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웹프로시딩 다운로드

사단법인 한국우주과학회
The Korean Space Science Society

차 례

<사단법인 한국우주과학회 입회 안내>

사단법인 한국우주과학회는 천문·우주과학 및 관련분야에 종사하는 여러분의 입회를 환영합니다. 우리 학회에 입회를 희망하시는 분은 입회원서 양식에 인적사항을 기재하시어 학회로 보내주시거나 홈페이지에서 가입하시고 입회비와 연회비는 학회 은행계좌로 송금하시기 바랍니다.

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▣ 회비납부안내

회원구분	입회비	연회비
학생회원(학부생)	10,000원	10,000원
정회원	10,000원	70,000원
회장, 부회장	-	150,000원
이사, 감사	-	150,000원

※ 회원의 구분은 정관 제6조에 의거하며, 변경된 연회비는 학회운영에 대한 규정 제2조에 의거한 사항입니다.

※ 뒷면의 입회원서를 복사하여 사용해 주십시오.

[표지사진 설명]
한국천문연구원은 우주항공청 수탁사업으로 우주물체감시 관측인프라의 관측 데이터 관리 및 공유체계 구축을 위해 우주위험대응 통합시스템을 2023~2027년까지 개발하고 있습니다.

입 회 원 서

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☐ 태양우주환경분과 ☐ 우주탐사분과 ☐ 우주관측기기분과
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<tr><td>경 력</td><td colspan="7"></td></tr>
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위 본인은 귀 학회의 설립 목적과 취지에 찬동하여 이에 회원 가입을 신청합니다.

년 월 일

신청인: (인)

위 사람을 귀 학회의 회원으로 추천합니다(참고: 정관 7조 1항에 따라 추천인은 우리 학회 정회원이면 누구나 가능합니다.).

추천인 : 직장 및 직위	성명	(인)
추천인 : 직장 및 직위	성명	(인)

사단법인 한국우주과학회 귀중

한국우주과학회
2025년 가을 학술대회

일　　시 : 2025. 10. 29.(수) ~ 11. 1.(토)

장　　소 : 제주 신화월드호텔&리조트

후　　원 :

KOFST
한국과학기술단체총연합회

대한민국육군
Republic of Korea Army

등록 및 안내

1. 등록

회원의 등록비는 300,000원이며, 정회원 중 석 · 박사과정(전일제) 학생은 200,000원, 학부생/군경은 150,000원입니다. 사전등록을 하신 회원은 학회보, 명찰을 수령하시기 바랍니다. 등록비 영수증과 참가확인증은 홈페이지에서 발행 가능합니다.

2. 발표자료 준비

구두발표: 발표자료는 파워포인트 파일로 준비하고, 발표 12분 + 질문 3분으로 준비해 주세요. 위촉된 심사위원이 우수 구두발표를 선정하여 폐회식 때 시상을 합니다.

포스터발표: 포스터발표는 A0 사이즈 1장(A0 사이즈 1장 내에 들어갈 분량, 예를 들면 A3 8장) 크기이며, 10월 29일(수) 14시까지 지정된 장소에 게시하고, 31일(금) 17시까지 수거해 주시기 바랍니다. 집중발표 시간에 발표자는 자신의 포스터 앞에서 회원들의 질문에 답할 수 있도록 준비해 주시기 바랍니다. 위촉된 심사위원이 우수 포스터발표를 선정하여 폐회식 때 시상을 합니다. 포스터를 부착하지 않거나 학회 종료 후 수거하지 않은 회원은 추후 학회발표가 제한될 수 있습니다.

3. 발표장

Landing Ballroom A	Landing Ballroom B	Landing Ballroom C
- Invited Talk (I), (II), (III) - 우주청 설명회 - 우주정책포럼 - 안보우주 (I), (II), (III), (Ⅳ) - SS: 달 탐사 국제 거버넌스 - SS: 국제 달 착륙선을 통한 과학 탐사 임무	- 우주탐사 (I), (II), (III), (Ⅳ) - SS: 달 착륙선 설계 · 개발 진행 현황 - SS: 소행성 탐사	- 태양 및 우주환경 (I), (II), (III), (Ⅳ) - SS: 도요샛 자료활용 - SS: 우주환경 국제협력
Halla Room	**Lobby**	**Olle Room**
- SS: GCR 측정 실험 및 측정 기술 - 우주감시 (I), (II), (III) - 우주인프라/우주산업 - SS: 우주망원경 - SS: 달 착륙선을 위한 월면 탐사 임무	- 전시부스 & 포스터 발표 - 우주천문 / 위성정보활용 / 우주정책(Baengnok Room) - SS: 우주교육유산(Yeongju Room)	- 아이돌봄사업 - 태양 및 우주환경(V)

4. 교통 안내

가. 주소: 제주특별자치도 서귀포시 안덕면 신화역사로 304번길 38 신화월드(Tel: 064-908-8888)

나. 버스 이용 시:

- 제주국제공항정류장(대정, 화순 방면)에서 151, 152번에 승차하여 신화월드리조트 정류장 하차
- 동광환승정류장에서 255, 771-1, 771-2, 784-1, 784-2번에 승차하여 신화월드리조트 정류장 하차

5. 구두발표 색인표

Ⅰ - 1 - 1

세션번호 발표장 발표순서

This work is supported by the 'Lottery Fund' of the 'Ministry of Strategy and Finance' and the 'Science and Technology Promotion Fund' of the 'Ministry of Science and ICT', contributing to the realization of social value and the development of national science and technology.

2025 KSSS FALL CONFERENCE PROGRAM

10. 29(수)

Time	Functions
09:00~	등록(Registration)
10:30~12:00	**다양성위원회 세션** Room: Landing Ballroom C **진행: 임조령 위원장** 주제: 회원간 연구 / 사업수행 멘토링 및 네트워킹
13:00~13:20	Opening Ceremony: Landing Ballroom A **개회사: 박종욱 회장** **축사 1: 방효충(국가우주위원회 부위원장) / 축사 2: 박장현(한국천문연구원장)**
13:20~13:50	**Invited Talk I** Room: Landing Ballroom A **Chair: 조경석(천문연)** Richard Cook (NASA/JPL) Dare Mighty Things
13:50~14:20	**Invited Talk II** Room: Landing Ballroom A **Chair: 박종욱(천문연)** Eun-Suk Seo (Unvi. of Maryland) Exploring Cosmic Rays from Space: Unexpected Findings and Emerging Questions
14:20~14:40	휴식(Coffee Break)
14:40~16:10	**우주정책 포럼** Room: Landing Ballroom A **진행: 권윤영(천문연)** 주제: 산 · 학 · 연 그리고 차세대를 잇는 다리: 공동 성장을 위한 글로벌 협력의 놀이터
16:10~16:20	휴식(Break Time)

Session Room	Landing Ballroom A		Landing Ballroom B		Landing Ballroom C		Halla Room	
Session I	**안보우주 I** 좌장: 송영범(천문연)		**우주탐사 I** 좌장: 김은혁(항우연)		**태양 및 우주환경 I** 좌장: 이경선(서울대)		**SS: GCR 측정 실험 및 측정기술** 좌장: 윤영수(표준연)	
16:20~16:35	I-1-1	김어진	I-2-1	백길호	I-3-1	김연한	I-4-1	김지현
16:35~16:50	I-1-2	김민기	I-2-2	정민섭	I-3-2	김도훈	I-4-2	탁동근
16:50~17:05	I-1-3	최승환	I-2-3	홍익선	I-3-3	한상철	I-4-3	윤석원
17:05~17:20	I-1-4	홍준석	I-2-4	안예선	I-3-4	장수정	I-4-4	Arul Bagga
17:20~17:35	I-1-5	박영일	I-2-5	Hess Marcel	I-3-5	오대현	I-4-5	이무현
17:35~17:50	I-1-6	오현웅	I-2-6	김상우	I-3-6	김정헌	I-4-6	강동화

10. 30(목)

Time	Functions
08:30~	등록(Registration)

Session Room	Landing Ballroom A		Landing Ballroom B		Landing Ballroom C		Halla Room	
Session II	**안보우주 II** 좌장: 최성환(한화시스템)		**우주탐사 II** 좌장: 정민섭(천문연)		**SS: 도요샛 자료활용** 좌장: 송호섭(천문연)		**우주감시 I** 좌장: 유지웅(천문연)	
09:00~09:15	II-1-1	이우석	II-2-1	문상만	II-3-1	이재진	II-4-1	신승후
09:15~09:30	II-1-2	송세찬1	II-2-2	정기철	II-3-2	송호섭	II-4-2	조중현1
09:30~09:45	II-1-3	정영진	II-2-3	김현준	II-3-3	양태용	II-4-3	유지웅1
09:45~10:00	II-1-4	김강우	II-2-4	최기혁	II-3-4	고영경	II-4-4	조중현2
10:00~10:15	II-1-5	정상순	II-2-5	이덕행	II-3-5	박재흥	II-4-5	감호식

10:15~10:25	휴식(Coffee Break)							
Session Ⅲ	**안보우주 Ⅲ** 좌장: 송세찬(육군)		**SS: 달 착륙선 설계 · 개발 진행현황** 좌장: 송영주(경희대)		**SS: 우주환경 국제협력 (영어 발표)** 좌장: 곽영실(천문연)		**우주감시 Ⅱ** 좌장: 성재동(항우연)	
10:25~10:40	Ⅲ-1-1	유승준	Ⅲ-2-1	박진혜	Ⅲ-3-1	이우경	Ⅲ-4-1	최진
10:40~10:55	Ⅲ-1-2	김동우	Ⅲ-2-2	박승수	Ⅲ-3-2	길효섭	Ⅲ-4-2	최은정
10:55~11:10	Ⅲ-1-3	신동빈	Ⅲ-2-3	윤형주	Ⅲ-3-3	김효민	Ⅲ-4-3	임홍서
11:10~11:25	Ⅲ-1-4	정해준	Ⅲ-2-4	전문진	Ⅲ-3-4	지건화	Ⅲ-4-4	노동구
11:25~11:40	Ⅲ-1-5	강승진	Ⅲ-2-5	홍승범	Ⅲ-3-5	Larry Paxton	Ⅲ-4-5	유지웅2
11:40~11:55	Ⅲ-1-6	최태연	Ⅲ-2-6	김동규			Ⅲ-4-6	김명진
11:55~12:10	Ⅲ-1-7	김주영	Ⅲ-2-7	정다운				
12:10~13:20	점심(Lunch)							
13:20~14:00	**우주청 설명회: "대한민국 우주탐사 로드맵"과 "화성탐사전략"** **Room: Landing Ballroom A** 우주항공청 강현우 우주과학탐사부문프로그램장							
14:00~14:10	휴식(Break Time)							
Session Ⅳ	**안보우주 Ⅳ** 좌장: 최호성(육군)		**우주탐사 Ⅲ** 좌장: 심채경(천문연)		**태양 및 우주환경 Ⅱ** 좌장:홍준석(천문연)		**우주감시 Ⅲ** 좌장:안재명(과기원)	
14:10~14:25	Ⅳ-1-1	송세찬2	Ⅳ-2-1	조은진	Ⅳ-3-1	김관혁	Ⅳ-4-1	이희재
14:25~14:40	Ⅳ-1-2	최성환	Ⅳ-2-2	이민경	Ⅳ-3-2	홍예원	Ⅳ-4-2	변용익
14:40~14:55	Ⅳ-1-3	이근희	Ⅳ-2-3	이석주	Ⅳ-3-3	조경석	Ⅳ-4-3	이서은
14:55~15:10	Ⅳ-1-4	이진용	Ⅳ-2-4	권동영	Ⅳ-3-4	양희수	Ⅳ-4-4	김재우
15:10~15:25	Ⅳ-1-5	양희인	Ⅳ-2-5	김명언	Ⅳ-3-5	송병권	우주감시 워크숍 발표 1: 황영은(우주청) 발표 2: 이기문(공군)	
15:25~15:40	Ⅳ-1-6	이종혁	Ⅳ-2-6	한승호	Ⅳ-3-6	Masaru Kogure		
15:40~15:50	휴식(Coffee Break)							
15:50~16:30	우주관측기기분과 총회		우주탐사분과 총회		태양우주환경분과 총회		우주감시분과 총회	
16:30~16:40	휴식(Break Time) (분과 총회 후 정기총회 반드시 참석)							
16:40~18:00	**제43차 정기총회** **Room: Landing Ballroom C** **제22대 회장선출, 감사선출**							
18:00~20:30	**만찬(Banquet)** **Room: Landing Ballroom A**							

10. 31(금)

Time	Functions							
08:30~	**등록(Registration)**							
09:00~09:30	**Invited Talk Ⅲ** **Room: Landing Ballroom A** **Chair: 곽영실(천문연)** Larry Paxton (JHU / APL) ExploringInternational Cooperation: ATHENA's GUVI + and the Far Ultraviolet							
09:30~09:40	휴식(Coffee Break)							
Session Room	**Landing Ballroom A**		**Landing Ballroom B**		**Landing Ballroom C**		**Halla Room**	
Session Ⅴ	**SS: 달 탐사 국제 거버넌스** 좌장: 정서영(항우연)		**우주탐사 Ⅳ** 좌장: 서행자(항우연)		**태양 및 우주환경 Ⅲ** 좌장: 이종길(충북대)		**우주인프라/우주산업** 좌장: 김일훈(에스엘랩)	
09:40~09:55	Ⅴ-1-1	정서영	Ⅴ-2-1	박재민	Ⅴ-3-1	지건화	Ⅴ-4-1	우창호
09:55~10:10	Ⅴ-1-2	김동규	Ⅴ-2-2	이호진	Ⅴ-3-2	길효섭	Ⅴ-4-2	박상원

10:10~10:25	V-1-3	정은정	V-2-3	최현정	V-3-3	안준모	V-4-3	오태석
10:25~10:40	V-1-4	김은혁	V-2-4	송상헌	V-3-4	손동희	V-4-4	김방엽
10:40~10:55	V-1-5	성재동	V-2-5	안범수	V-3-5	이진이		
10:55~11:10	V-1-6	송영주	V-2-6	김양호	V-3-6	유지현		
11:10~11:25	V-1-7	최남미	V-2-7	김민재	V-3-7	장서희		
11:25~13:00	점심(Lunch)							
13:00~16:00	**포스터 세션(Poster Session)** 13:00~14:30 태양우주환경, 우주탐사, 위성정보활용, 미소중력실험, 우주생물학, 우주감시, 안보우주 분야 집중발표 14:30~16:00 초소형위성, 우주산업, 우주인프라, 특별세션, 학부생세션 분야 집중발표							
16:00~16:10	휴식(Break Time)							
Session VI	**SS: 국제 달 착륙선을 통한 과학 탐사 임무** 좌장: 백슬민(천문연)		**SS: 소행성 탐사** 좌장: 이진성(과기원)		**태양 및 우주환경 IV** 좌장: 김효민(NJIT)		**SS: 우주망원경** 좌장: 문봉곤(천문연)	
16:10~16:25	VI-1-1	신재혁	VI-2-1	이준찬1	VI-3-1	이재욱	VI-4-1	문봉곤
16:25~16:40	VI-1-2	정종일	VI-2-2	이준찬2	VI-3-2	김지우		
16:40~16:55	VI-1-3	이은지	VI-2-3	이진성	VI-3-3	이종길	VI-4-2	고종완
16:55~17:10	VI-1-4	나고운	VI-2-4	정안영민	VI-3-4	손지현	VI-4-3	박성준
17:10~17:25	VI-1-5	김상화	VI-2-5	김푸름	VI-3-5	김대일	VI-4-4	백지혜
17:25~17:40	VI-1-6	정민섭	VI-2-6	이희재	VI-3-6	윤준무	VI-4-5	한정열
17:40~17:55					VI-3-7	전웅		
17:55~18:05					VI-3-8	박성홍		

11. 01(토)

Time	Functions							
08:30~	**등록(Registration)**							
Session Room	**Halla Room**		**Baengnok Room**		**Olle Room**		**Yeongju Room**	
Session VII	**SS: 달 착륙선을 위한 월면 탐사 임무** 좌장: 심채경(천문연)		**우주천문/위성정보활용/ 우주정책** 좌장: 정서영(항우연)		**태양 및 우주환경 V** 좌장: 안준모(천문연)		**SS: 우주교육유산** 좌장: 민병희(천문연)	
09:00~09:15	VII-1-1	한정열	VII-2-1	진경욱	VII-3-1	서정준	VII-4-1	강길구
09:15~09:30	VII-1-2	백슬민	VII-2-2	박선주	VII-3-2	안승우	VII-4-2	조아라
09:30~09:45	VII-1-3	김나연	VII-2-3	김하은	VII-3-3	김영재	VII-4-3	최홍순
09:45~10:00	VII-1-4	김경자	VII-2-4	조현아	VII-3-4	이해인	VII-4-4	함선영
10:00~10:15	VII-1-5	김선진	VII-2-5	김현준	VII-3-5	이승현	VII-4-5	김상혁
10:15~10:30	VII-1-6	조남석			VII-3-6	하지훈	VII-4-6	민병희
10:30~10:40	휴식(Break Time), 이동							
10:40:-11:00	**폐회식(Closing Ceremony), 시상식** Room : Halla Room							

Poster Session

10. 31. (Fri) 집중발표 13:00~14:30

Area	No	Author	Area	No	Author
태양 및 우주환경	P-1	유인상(항우연)	우주탐사	P-34	송재훈(항우연)
	P-2	이창은(항우연)		P-35	신동하(인하대)
	P-3	장재웅(항우연)		P-36	양정환(항우연)
	P-4	장경덕(항우연)		P-37	오민혁(경희대)
	P-5	신승헌(경희대)		P-38	우성현(항우연)
	P-6	최규철(에스이랩)		P-39	원영진(항우연)
	P-7	이영숙(충남대)		P-40	원주호(항우연)
	P-8	이원형(우주환경센터)		P-41	육영춘(항우연)
	P-9	김정헌(천문연)		P-42	이응석(지질연)
	P-10	김경수(연세대)		P-43	이주희(항우연)
	P-11	이재희(경희대)		P-44	이준현(천문연)
	P-12	이시백(경희대)		P-45	임현수(항우연)
	P-13	나현옥(경희대)		P-46	최지훈(항우연)
	P-14	Sumiaya Rahman(KHU)	위성정보활용	P-47	김구혁(항우연)
	P-15	김하나(UST)		P-48	김영선(항우연)
	P-16	이경선(서울대)		P-49	김준호(국가기상위성센터)
	P-17	양승주(충북대)		P-50	윤지연(항우연)
	P-18	최두영(충북대)		P-51	이명준(항우연)
	P-19	정종일(천문연)		P-52	이재열(항우연)
	P-20	이승현(UST)		P-53	임은숙(항우연)
우주탐사	P-21	김수연(지질연)		P-54	임지현(항우연)
	P-22	김의근(항우연)		P-55	전갑호(항우연)
	P-23	김주형(천문연)		P-56	정대준(항우연)
	P-24	김진형(항우연)		P-57	최준엽(국가기상위성센터)
	P-25	김희경(항우연)		P-58	허성식(항우연)
	P-26	민승용(항우연)	미소중력실험	P-59	김연규(항우연)
	P-27	박현후(경희대)	우주생물학	P-60	권경록(지질연)
	P-28	박희웅(항우연)	우주감시	P-61	김혜영(천문연)
	P-29	배종희(항우연)		P-62	이상현(천문연)
	P-30	백선기(항우연)		P-63	임덕원(항우연)
	P-31	서행자1(항우연)	안보우주	P-64	김형욱(항우연)
	P-32	서행자2(항우연)		P-65	신현규(항우연)
	P-33	손승희(항우연)			

Poster Session

10. 31. (Fri) 집중발표 14:30~16:00

Area	No	Author	Area	No	Author
초소형위성	P-66	강치호(항우연)	우주 인프라	P-102	강 철(항우연)
	P-67	나고운(경희대)		P-103	은희광(항우연)
	P-68	박상섭(항우연)		P-104	전종협(항우연)
	P-69	박성우(항우연)		P-105	김지석(항우연)
	P-70	신상윤(항우연)		P-106	방수완(항우연)
	P-71	신재민(항우연)		P-107	홍승모(항우연)
	P-72	이춘우(항우연)		P-108	김근식(항우연)
	P-73	천이진1(항우연)		P-109	서희준(항우연)
	P-74	김명길(스페이스케이)		P-110	이겨울(항우연)
우주산업	P-75	이덕규(항우연)		P-111	박재형(항우연)
	P-76	천이진2(항우연)		P-112	백현철1(항우연)
	P-77	한조영(항우연)		P-113	백현철2(항우연)
	P-78	김하은(LIG넥스원)		P-114	전정남(항우연)
	P-79	이상록(항우연)		P-115	김태현(LIG넥스원)
	P-80	김영윤(항우연)		P-116	이서윤(항우연)
	P-81	조승원(항우연)		P-117	복준영(항우연)
	P-82	정서윤(아이옵스)		P-118	신철수(항우연)
	P-83	연정흠(항우연)	SS: GCR 측정 실험 및 측정 기술	P-119	윤영수(표준연)
	P-84	이원범(항우연)	SS: 달 착륙선을 위한 월면 탐사 임무	P-120	이석주(Kentech)
	P-85	박홍원(항우연)		P-121	이나영(항우연)
	P-86	박종억(항우연)		P-122	심채경1(천문연)
	P-87	김경근(항우연)		P-123	심채경2(천문연)
	P-88	오규민(항우연)		P-124	이은지(천문연)
	P-89	김보성(KAI)	SS: 국제 달 착륙선을 통한 과학 탐사 임무	P-125	김성진(경희대)
	P-90	강은수(항우연)		P-126	이민경(천문연)
	P-91	박봉규(항우연)		P-127	송동욱(천문연)
	P-92	강우용(항우연)		P-128	김우진(천문연)
	P-93	서기훈(항우연)	학부생 세션	P-129	김도희(충남대)
	P-94	조창권(항우연)		P-130	김태준(천문연)
	P-95	안나균(항우연)		P-131	백유찬(천문연
	P-96	마진아(항우연)		P-132	이현수(충남대)
	P-97	김수현(항우연)		P-133	정수빈(충남대)
우주 인프라	P-98	박성욱(항우연)		P-134	진예얼(충남대)
	P-99	박수현(항우연)		P-135	김민규(충남대)
	P-100	김민준(항우연)		P-136	구의진(충남대)
	P-101	박선주(항우연)	우주탐사	P-137	이광호(항우연)
				P-138	최광호(항우연)

2025년 제7회 우주감시분과 워크숍

- **제목:** 민 · 군 우주감시 연구 발전 현황 공유 워크샵
- **일시:** 2025년 10월 30일(목) 15:00~16:30
- **장소:** 제주 신화월드 한라룸
- **모시는 글**

최근 지구 궤도상의 우주 환경이 점점 복잡해짐에 따라 우주 물체의 궤도상 충돌 위험과 지구 추락 위험 또한 지속적으로 증가하고 있고, 이러한 우주 위험에 대응하기 위한 노력 또한 중요해지고 있습니다.

이번 워크숍에서는 국내의 민간 및 국방 분야에서 이루어지고 있는 우주 감시 연구의 발전 현황을 공유하고, 협력 방안을 논의하고자 합니다. 워크샵 후 우주감시분과 총회를 열고 신임 분과장을 결정하는 자리가 이어집니다. 관심 있는 분들의 많은 참석을 기대합니다. 감사합니다.

- **프로그램**

시간	주제	발표
	민 · 군 우주감시 연구 발전 현황 공유 워크샵	
15:00~15:10	우주감시분과 워크숍 개회	안재명(KAIST)
15:10~16:00	[1] 우리나라 우주상황인식 및 우주교통관리 정책방향	황영은 주무관(우주항공청)
	[2] 공군 우주영역인식 발전 방향	이기문 중령(진)(공군)
16:00~16:30	우주감시분과 총회	안재명(KAIST)

- 우주감시분과장 안재명(KAIST), 간사 이동헌 (KAIST)
- 운영위원: 김명진(한국천문연구원), 김은희(세종대학교), 성재동(한국항공우주연구원), 최진(한국천문연구원), 김성우(텔레픽스)

워크숍 주제 발표 초록

[발표 1] 우리나라 우주상황인식 및 우주교통관리 정책 방향

발표자: 황영은 주무관 (우주항공청)

본 발표에서는 우주항공청의 우주상황인식(Space Situational Awareness, SSA) 및 우주교통관리(Space Traffic Management, STM) 관련 정책 방향과 관련 사업을 소개한다.

[발표 2] 공군 우주영역인식 발전 방향

이기문 중령(진) (대한민국 공군)

우주 안보를 위해 공군에서 수행 중인 우주영역인식(Space Domain Awareness, SDA) 활동을 소개하고 향후 발전을 위한 협력 방안에 대하여 논한다.

한국우주과학회 2025년 가을 학술대회 우주정책포럼

최근 우주항공청은 “제4차 우주개발진흥 기본계획 수정계획”을 발표함과 동시에 “대한민국 우주탐사 로드맵”을 통해 2045년까지 추진할 우리나라 우주탐사 비전과 중장기 전략을 공개하며, 대한민국의 새로운 우주시대로 나아가기 위해 박차를 가하고 있습니다. 국가의 우주개발 및 탐사의 계획은 개별 연구자, 또는 연구소, 대학, 산업체와 같이 작은 단위의 역량들이 자유롭게 발휘되고, 연합하며, 국가 차원에서 종합될 때 실현될 수 있습니다. 이에 우주과학회는 이러한 작은 씨앗들이 소중한 결실들로 이어질 수 있는 협력의 장이 되기 위해 노력해 왔습니다. 2024년 12월 미국 파사네나에서 한국우주과학회, 재미한인우주항공과학기술협회, JPL 공동 주최로 “KOR-US Joint Workshop on Space Science and Technology”를 개최하였으며 산 · 학 · 연 및 신진연구자들의 국제협력 강화와 기회 확대를 위한 장을 마련하였습니다. 그리고 올해는 이 행사를 “우주과학국제협력 워크숍(2025 International Collaboration Workshop on Space Science and Technology)”로 확대 개최하였습니다. 우주과학회는 여러분들 모두의 꿈을 언제까지나 지지하며 응원하는 곳이 되고자 합니다. 이에 2025년 가을학술대회 우주정책포럼에서는 우리 우주과학회가 앞으로 우주과학분야 글로벌 협력의 놀이터가 되기 위한 방안을 여러분들과 토론하고자 합니다. 미래 우리가 풀어야 할 과학 질문들을 도출하고, 이에 답을 하기 위한 구체적인 국내외 협력 방안 및 체계, 그리고 학회가 지원할 수 있는 방안을 여러분들과 논의 합니다.

- **제목: 산 · 학 · 연 그리고 차세대를 잇는 다리: 공동 성장을 위한 글로벌 협력의 놀이터, KSSS**
  (Bridging Research, Industry, Academia, and the Next Generation: KSSS as a Global Playground for Collective Growth)
- **일시/장소:** 2025년 10월 29일(수) / 제주 신화월드 Landing Ballroom A
- **좌장:** 권윤영 (한국천문연구원)

- **발제발표:**

Angelos Vourlidas (JHUAPL)
제목: The International Living with a Star Decadal: Bringing the World together to answer the Key Heliophysics Science Question

- **패널토론: (Modrator) 심채경 (한국천문연구원)**
  김효민 (교수, NJIT)
  방효충 (국가우주위원회 부위원장, 교수, KAIST)
  임명신 (교수, 서울대학교)
  Richard Cook (Associate Director for Strategic Integration, JPL)
  Larry J. Paxton (Chief scientist for geoscience, JHUAPL)
  Eun-Suk Seo (재미한인우주항공과학기술협회장, 교수, University of Maryland)
  Angelos Vourlidas (Astrophysicist, JHUAPL)

다양성위원회 회원간 멘토링과 네트워킹 특별 세션

■ **세션개요**

- **주최:** 한국우주과학회(다양성위원회)
- **목적:** 한국우주과학회 회원들의 멘토링 & 네트워킹
- **일시:** 2025년 10월 29일(수) 오전 10시 30분~오후 12시 00분
- **장소:** 신화월드 랜딩볼룸 C

■ **세부일정**

일정	내용
10:30~10:35	개회 및 세션소개 & 환영사
10:35~11:20	패널 발표 및 토론: 연구/사업 수행 • 산학연 및 다양한 회원 구성원의 발표 - 대학원생/신진 회원 - 중견/산업계/시니어 회원 - 은퇴 회원 등
	• 자유토론 및 질의 응답
11:20~12:00	멘토링 & 네트워킹 세션

■ **참석대상: 한국우주과학회 회원**

회원들을 위한 멘토링 & 네트워킹 교류 세션입니다. 연구와 사업 수행 경험, 다양한 연구 주제를 서로 나누며 자연스럽게 인적 네트워크를 넓히고, 새로운 협력 연구의 기회도 찾아볼 수 있습니다. 부담 없이 오셔서 따뜻하게 교류하시고, 뜻깊은 시간 함께 만들어가시길 기대합니다.

■ **세션 문의**

조은진 박사 (다양성위원회 총무, jonjin4368@kasi.re.kr)
임조령 박사 (다양성위원회 위원장, jryim@kari.re.kr)

구두발표 논문 제목 및 시간표

10월 29일(수)

Landing Ballroom A

13:20 [IS-1]

Dare Mighty Things

Richard Cook

NASA/JPL

13:50 [IS-2]

Exploring Cosmic Rays from Space: Unexpected Findings and Emerging Questions

Eun-Suk Seo

University of Maryland

Landing Ballroom A

16:20 [I-1-1]

Numerical Analysis of Propagation of Laser Beams Through the Atmosphere: Modeling and Analysis

Eojin Kim[1], Gwibong Kang[1], Ki-Pyung Sung[1], Sung-Yeol Yu[1], Jinhyeok Choi[2], Eunyeong Kim[2], Jongwon Yu[2], Jaemin Kim[2], Yun Gon Lee[2]

[1]*KASI*

[2]*Chungnam National University*

16:35 [I-1-2]

Conceptual Design and Prototype Tests of Disposable Deorbiter for Active Debris Removal

Min-Ki Kim

Korea Aerospace Research Institute

16:50 [I-1-3]

SPACEMAP Capability for K-SDA/STM: Algorithms, Services, and SpaceTube

Shawn Choi[1], Hyeonoh Hur[1], Alina Shymanska[2], Peter Ryu[1,3], Douglas Kim[1,3]

[1]*SpaceMap Inc.*

[2]*Hankuk University of Foreign Studies*

[3]*School of Mechanical Engineering, Hanyang University*

17:05 [I-1-4]

Severe GNSS Signal Disturbances over Korean Peninsula during Geomagnetic Storm

Junseok Hong[1], Byung-Kyu Choi[1], Jong-Kyun Chung[1], Woo Kyoung Lee[1], Hyosub Kil[1,2], Hyuck-Jin Kwon[3]

[1]*Korea Astronomy and Space Science Institute*

[2]*Johns Hopkins University Applied Physics Laboratory*

[3]*Korea Polar Research Institute*

17:20 [I-1-5]

INNOSPACE's HANBIT: A Small Satellite Launch Solution

Young-Il Park, Tae Seung-Kuk, Kyoungjin Woo, Hun Jung, Soojong Kim

INNOSPACE Co., Ltd.

17:35 [I-1-6]

Development of DaejeonSat-1: A City-Participatory Optical Earth Observation Mission for Daejeon Metropolitan City

Hyun-Ung Oh[1,2], Tae-Yong Park[1], Bong-Geon Chae[1], Chi-Hwa Song[3]

[1]*STEP Lab. Ltd.*

[2]*Korea Aerospace University*

[3]*Daejeon Technopark*

Landing Ballroom B

16:20 [I-2-1]

Key Calibration Outcomes and Preliminary Global Maps of the Moon from Danuri/PolCam

Kilho Baek[1], Sungsoo S. Kim[1], Minsup Jeong[2]

[1]*Kyung Hee University*

[2]*Korea Astronomy and Space Science Institute*

16:35 [I-2-2]

Lunar Swirl Studies with Danuri/PolCam: Polarimetric Analysis of Reiner Gamma Swirl

Minsup Jeong[1], Kilho Baek[2], Sungsoo S. Kim[2], Young-Jun Choi[1,3]

[1]*Korea Astronomy and Space Science Institute*
[2]*Kyung Hee University*
[3]*University of Science and Technology*

16:50 [I-2-3]

Time-Series Data Correction of Korea Pathfinder Lunar Orbiter (KPLO) Gama-Ray Spectrometer (KGRS)

Ik-Seon Hong[1], Suyeon Kim[1], Kyeong Ja Kim[1,2]

[1]*Korea Institute of Geoscience and Mineral Resources*
[2]*Korea National University of Science and Technology*

17:05 [I-2-4]

Initial Results of In-Orbit Temperature Calibration of the KPLO Magnetometer

Yesun Ahn[1], Ho Jin[1], Hyeonhu Park[1], Yunho Jang[1], Khan-Hyuk Kim[1], Ian Garrick-Bethell[2]

[1]*Kyung Hee University*
[2]*University of California, Santa Cruz*

17:20 [I-2-5]

Space Weathering at the Reiner Gamma Swirl: Insights from Unmixing

Marcel Hess, Eung-Seok Yi, Jae-Soo Lim, Kyeong-Ja Kim

Korea Institute of Geoscience and Mineral Resources

17:35 [I-2-6]

From the Moon to Mars and Beyond: Neutron Insights into Subsurface Water for Exploration Missions

Sang Woo Kim, Kyeong Ja Kim

Korea Institute of Geoscience and Mineral Resources

Landing Ballroom C

16:20 [I-3-1]

Progress Report of the CODEX Mission

Yeon-Han Kim[1], Su-Chan Bong[1], Seonghwan Choi[1], Kyungsuk Cho[1,2], Jeffrey Newmark[3], Nicholeen Viall[3], KASI-NASA Coronagraph Team

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*NASA Goddard Space Flight Center, USA*

16:35 [I-3-2]

Optical Design of Space Coronagraph based on Off-Axis Refelctive System

Dohoon Kim[1], Seunghyuk Chang[2], Changgon Kim[1,3], Nayeon Kim[1], Hojae Ahn[1], Hyukmo Kang[3], Daewook Kim[3], Kyohoon Ahn[4], Kyung-Suk Cho[4], Seong-Hwan Choi[4], Uk-Won Nam[4,] Soojong Pak[1]

[1]*Kyung Hee University*
[2]*Center for Integrated Smart Sensors*
[3]*University of Arizona*
[4]*Korea Astronomy and Space Science Institute*

16:50 [I-3-3]

Jeju Volcanic Island Geomagnetic Observatory: Studying Magnetic Field Variations through Ground-Based Measurements

Sang Cheol Han, Jae-Hyung Lee, Jaehun Kim, Ji-Hoon Ha, Soojeong Jang, Wonhyeong Yi

Korea Space Weather Center, Korea AeroSpace Administration

17:05 [I-3-4]

Current Status and Prospects of the Radio Blackouts (R) Forecast at Korea Space Weather Center

Soojeong Jang, Jae-Hyung Lee, Jaehun Kim, Ji-Hoon Ha, Sang Cheol Han, Wonhyeong Yi

Korea Space Weather Center, Korea AeroSpace Administration

17:20 [I-3-5]

Five-Year Review of Space Weather Observations from GK2A KSEM (2020-2024)

Daehyeon Oh, Eun-Jeong Cha, Hanbyul Lee, Euidong Hwang

National Meteorological Satellite Center, Korea Meteorological Administration

17:35 [I-3-6]

Performance Evaluation of Thermospheric Density Models under Quiet and Disturbed Space

Weather Conditions

Jeong-Heon Kim[1], Young-Sil Kwak[1,2], Yongha Kim[3], GeonHwa Jee[2,4], In-sun Song[5], Woo-Kyoung Lee[1], Tae-Yong Yang[1], Eun Jeong Cha[6], Guk-hyeon Oh[6]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Chungnam National University*
[4]*Korea Polar Research Institute*
[5]*Yonsei University*
[6]*National Meteorological Satellite Center, Korea Meteorological Administration*

Halla Room

16:20 [I-4-1]

Detection Techniques and Instrumentation in the Telescope Array for Ultra-High-Energy Cosmic Rays

Jihyun Kim, for the Telescope Array Collaboration

Graduate School of Science, Osaka Metropolitan University, Japan

16:35 [I-4-2]

Explore the Universe with the Fermi Gamma-Ray Space Telescope

Donggeun Tak

Seoul National University

16:50 [I-4-3]

Measurement of Heavy Ion Beams Using the Silicon-Based Particle Dosimeter and Spectrometer for the GCR Charged Particle Environment

Sukwon Youn[1], Uk-won Nam[2], Sunghwan Kim[3], Jongdae Sohn[2], Woo-Hyeong Seol[2], Bobae Kim[4], Hongjoo Kim[5], Hwanbae Park[5], Won-Kee Park[2], Dahye Ahn[1], Eunji Yi[2], Chae Kyung Sim[2], Dukhang Lee[2], Seul-Min Baek[2], Jehyuck Shin[2], Young-Jun Choi[2], Insoo Jun[6], Sung-Joon Ye[1]

[1]*Seoul National University*
[2]*Korea Astronomy and Space Science Institute*
[3]*Cheongju University*
[4]*Argonne National Laboratory*
[5]*Kyungpook National University*
[6]*Jet Propulsion Laboratory*

17:05 [I-4-4]

Isotropic Helium Monte Carlo Simulations for the ISS-CREAM Instrument

A. Bagga[1], S. Pandey[2], G. H. Choi[1], M. H. Lee[2], M. J. Lee[1], S. C. Kang[3], E. S. Seo[2,4], Y. S. Yoon[2,4], on behalf the ISS-CREAM Collaboration

[1]*Department of Physics, Sungkyunkwan University*
[2]*Institute for Physical Science and Technology, University of Maryland, College Park, USA*
[3]*Department of Physics, Kyungpook National University*
[4]*Department of Physics, University of Maryland, College Park, USA*

17:20 [I-4-5]

High Energy Cosmic Ray Experiment Instruments, CREAM and ISSCREAM

Moo Hyun Lee[1,2] on behalf of the CREAM and ISSCREAM collaborations

[1]*Institute for Basic Science (IBS), Center for Underground Physics*
[2]*IBS School, University of Science and Technology (UST)*

17:35 [I-4-6]

Detection of Cosmic Rays in the PeV to EeV Energy Range

Donghwa Kang

Karlsruhe Institute of Technology

10월 30일(목)

Landing Ballroom A

09:00 [II-1-1]

Proposed Framework for Military Integration of Commercial Satellite Imagery

Woo-Seok Lee, Hyun-Ki Moon

Policy Office, ROKA HQ

09:15 [II-1-2]

Leveraging Commercial Satellites to Enhance ROK Army Combat Power: Focusing on the Operational Application of the U.S. Space Force TacSRT Model

Sechan Song

ROK Strategic Command Space Operation Center

09:30 [II-1-3]

Legal and Regulatory Frameworks for the Establishment and Operation of a National Defense Space Launch Site

Young-Jin Jeong, Ho-Jun Lee, Kyu-Min Lee, Hae-Jun Jeong

Korea National Defense University

09:45 [II-1-4]

Suggestion for the Use of Commercial Surveillance and Reconnaissance Satellites to Support Rear Area Operations

Kangwoo Kim[1], Hosung Choi[2]

[1]*2nd Operation Command, ROK Army*
[2]*ROK Army Head Quarter*

10:00 [II-1-5]

Tactical ISR Based on Low Earth Orbit (LEO) Small Satellites and the Republic of Korea Army's Space Strategy: Comparative Analysis of the Ukraine and Israel Cases with U.S. and NATO Strategies

Sang-soon Jung

Republic of Korea Army

Landing Ballroom B

09:00 [II-2-1]

Conceptual Design Study for Lunar Surface Localization and Lunar PNT Improvement to Determine the Position of a Lunar Surface Vehicle

Sangman Moon[1], Inkyu Kim[1], Jaehoon Song[1], Yoon-Jeong Jang[1], Huiung Park[1], Jong-Myung Woo[2]

[1]*Korea Aerospace Research Institute*
[2]*Chungnam National University*

09:15 [II-2-2]

A Case Study on Path Planning and Tracking Strategies for Planetary Exploration Rovers Based on Limited Field-of-View Camera Vision

Kicheol Jeong, Hyomin Jin

Korea Automotive Technology Institute

09:30 [II-2-3]

Reconstruction of Atmospheric Entry of the Pioneer Venus Mission

Hyeonjun Kim[1], Yeon Joo Lee[2]

[1]*Korea Aerospace Research Institute*
[2]*Planetary Atmospheres Group (PAG), Institute for Basic Science (IBS)*

09:45 [II-2-4]

Design Study for the Mars Atmosphere Entry Mission (EDL)

Gi-Hyuk Choi[1], Jae-Ik Park[1], Yeong-Sil Kwak[2], Dae Yeong Kim[1]

[1]*Korea Aerospace Research Institute*
[2]*Korea Astronomy & Space Science Institute*

10:00 [II-2-5]

Concept of a Micro-Satellite Mission for Mars Orbital Science in the International Cooperation Framework

Dukhang Lee[1,2], Minsup Jeong[1], Youngbum Song[1], Sung-Joon Park[1], Jehyuck Shin[1], Chae Kyung Sim[1,2], Hong-Kyu Moon[1], Pureum Kim[3], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*
[3]*Yonsei University*

Landing Ballroom C

09:00 [II-3-1]

***In-Situ* Observations of Energetic Electron Loss in the Inner Radiation Belt**

Jaejin Lee, Jaeheung Park, Tae-Yong Yang, Jongdae Sohn, Hosub Song

Korea Astronomy and Space ScienceInstitute

09:15 [II-3-2]

Ionospheric Responses to the May 2024 Superstorm: Combined Ground-Based and LEO Observations

Hosub Song[1], Jaeheung Park[1,2], Jaejin Lee[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Department of Astronomy and Space Science, University of Science and Technology (UST)*

09:30 [II-3-3]

Multi-Satellite Observations of Morning Overshoot During the Recovery Phase of the October 2024 Superstorm

Tae-Yong Yang[1], Hosub Song[1], Jaeheung Park[1,2], Jae-Jin Lee[1], Jongdae Sohn[1], Youngbum Song[1], Ki Hwan Keum[1], Young-Sil Kwak[1,2], Seungjun Yoo[3], Ochang Kwon[1,2]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*
[3]*Republic of Korea Army (ROKA)*

09:45 [II-3-4]

High-Energy Electron Injection into the Inner Plasmasphere during the May 2024 Super Storm Observed by SNIPE

Young Gyung Ko[1], Ensang Lee[1], Jaejin Lee[2]

[1]*School of Space Research, Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*

10:00 [II-3-5]

SNIPE-2 for Monitoring Very-Low-Earth-Orbit (VLEO) Space Environment

Jaeheung Park[1], Jae-Jin Lee[1], Jongdae Sohn[1], Tae-Yong Yang[1], Hosub Song[1], Youngbum Song[1], Ki Hwan Keum[1], Seungjoon Yoo[1,2], Ochang Kwon[1,2], Jeong-Heon Kim[1], Young-Sil Kwak[1], Won-Kee Park[1], Wook-Won Nam[1], Dae-Hee Lee[1]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*Republic of Korea Army (ROKA)*

Halla Room

09:00 [II-4-1]

The Policy Evolution of Korea's National Space Hazard Response Framework and Its Institutional Implications

Seung-Hoo Shin, Sungki Cho

Korea Astronomy and Space Science Institute

09:15 [II-4-2]

Evolution of the Development Roadmap of the Center for Space Situational Awareness

Jung Hyun Jo

Korea Astronomy and Space Science Institute

09:30 [II-4-3]

Research Activities Supporting the National Space Situational Awareness Organization's Mission

Jiwoong Yu[1], Jaemann Kyeong[1], Hee-Jae Lee[1], Yun Hak Kim[1], Hosik Kam[1], Hong-Suh Yim[1], Jin Choi[1], Eun Jung Choi[1,2], Jung Hyun Jo[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea National University of Science and Technology*

09:45 [II-4-4]

Development of an Integrated Space Risk Response System

Jung Hyun Jo

Korea Astronomy and Space Science Institute

10:00 [II-4-5]

Design of a Space Surveillance Integrated Data System 'SpaceBook' for Space Hazard Response in the Republic of Korea

Hosik Kam[1], Eun Jung Choi[1,2], Jung Hyun Jo[1], Ki Pyoung Sung[1], Jin Choi[1], Jaemann Kyeong[1], Myung-Jin Kim[1], Dong-Goo Roh[1], Jiwoong Yu[1], Hong-Suh Yim[1], Hye-Young Kim[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea National University of Science and Technology*

Landing Ballroom A

10:25 [III-1-1]

A Strategy for Securing Tactical Communication and ISR Capabilities for the ROK Army Using CubeSat Constellations

SenugJun Yoo[1,2], Hosub Song[2], OhChang Kwon[1,2], KiHwan Keum[2], Ho-sung Choi[1]

[1]*Republic of Korea Army*

[2]*Korea Astronomy and Space Science Institute*

10:40 [III-1-2]

The Role of Mobile Ground-Based Anti-Satellite Laser Systems in the Space Battlefield

Dong-Woo Kim[1,2]

[1]*Republic of Korea Army (ROKA)*
[2]*Korea Astronomy and Space Science Institute (KASI)*

10:55 [III-1-3]

A Methodology for Developing Military-Customized AI Models with KOMPSAT Satellite Imagery and Open-Source LMM

Dong-Bin Shin[1,2,3], Ju-Young Kim[1,2,3], Hyun-Woo Seo[2,3,4], Dae-Won Chung[2,3], Han Oh[2,3]

[1]*Republic of Korea Army*
[2]*Korea Aerospace Research Institute*
[3]*University of Science and Technology (UST)*
[4]*Republic of Korea Air Force*

11:10 [III-1-4]

Japan's Decision to Develop QZSS: Focusing on Threat Perception and Alliance Trust

Hae-Jun Jeong

Korea National Defense University

11:25 [III-1-5]

Attitude Control of Reusable Launch Vehicle Using Finite Time Control Theory

Seung-Jin Kang, Chang-Hun Lee, Ki-Wook Jeong

Korea Advanced Institute of Science and Technology

11:40 [III-1-6]

Reinforcement Learning-Based Evasive Guidance in J2 Perturbed Elliptic Orbital Pursuit-Evasion Game

Taeyeon Choe[1,2], Hyeongjun Park[3]

[1]*Republic of Korea Army*
[2]*Department of Aerospace Engineering, Seoul National University*
[3]*Institute of Advanced Aerospace Technology, Seoul National University*

11:55 [III-1-7]

A Study on Space Traffic Management Systems for Space Security and International Cooperation

Jooyoung Kim

Korea Aerospace University, ROK Army College

Landing Ballroom B

10:25 [III-2-1]

Strategic Vision and Scientific Impact of South Korea's Lunar Lander Mission

Jinhye Park

KASA

10:40 [III-2-2]

달 표면 탐사를 위한 착륙 후보지역 검토

Seungsoo Park

Korea AeroSpace Administration, Lunar Lander Program

10:55 [III-2-3]

Introduction to the Korea Pathfinder Lunar Lander (KPLL) Program

Hyungjoo Yoon

Korea Aerospace Research Institute

11:10 [III-2-4]

System Design and Payload Accommodation Plan for Korea Pathfinder Lunar Lander

Moon-Jin Jeon, Hyungjoo Yoon

Korea Aerospace Research Institute

11:25 [III-2-5]

Preliminary Mission Design Status for the Korea Pathfinder Lunar Lander

SeungBum Hong, Jun Bang, Jonghee Bae, Kiduck Kim, Moon-Jin Jeon

Korea Aerospace Research Institute

11:40 [III-2-6]

Design and Development Concepts of the Korea Pathfinder Lunar Lander (KPLL) Ground System

Dong-Gyu Kim

Korea Aerospace Research Institute

11:55 [III-2-7]

Testing Lunar Lander Visual Navigation with Robots

Dawoon Jung, Kwangyul Baek, Jae Wook Kwon, Ju-Hyun Kim

Korea Aerospace Research Institute

Landing Ballroom C

10:25 [III-3-1]

ROKITS and ATHENA: Imaging the Aurora and Airglow from Space

Woo Kyoung Lee[1,2], Hyosub Kil1[1,3], Larry J. Paxton[3], Young-Sil Kwak[1,2], ROKITS Team[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Johns Hopkins University Applied Physics Laboratory*

10:40 [III-3-2]

Earth's Upper Atmosphere Exploration from Space Using a Visible and Infrared Imager

Hyosub Kil[1], Serin Jeon[2], Woo Kyoung Lee[1], Young-sil Kwak[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungnam National University*

10:55 [III-3-3]

Development of Ground-Based Geospace Instruments for Coordinated Space Weather Monitoring

Hyomin Kim[1], Gareth Perry[1], Alex Chartier[2], Geonhwa Jee[3], Hyuck-jin Kwon[3], Changsup Lee[3], Nathaniel Frissell[4], Anton Kashcheyev[5]

[1]*New Jersey Institute of Technology, USA*
[2]*Applied Physics Laboratory, Johns Hopkins University, USA*
[3]*Korea Polar Research Institute*
[4]*University of Scranton, USA*
[5]*University of New Brunswick, Canada*

11:10 [III-3-4]

Ground-Based Observations of the Polar Upper Atmosphere

Geonhwa Jee

Korea Polar Research Institute (KOPRI)

11:25 [III-3-5]

Exploring ATHENA GUVI+: An Example of International Cooperation in Space Weather

Larry Paxton

Johns Hopkins University Applied Physics Laboratory

Halla Room

10:25 [III-4-1]

Development of a BRAHE Telescope System: Progress Report

Jin Choi[1], Jung Hyun Jo[1], Hong-Suh Yim[1], Dong-Goo Roh[1], Myung-Jin Kim[1], Yunhak Kim[1], Ki-Pyoung Sung[1], Jang-Hyun Park[1], Jaemann Kyeong[1], Sungki Cho[1], Eun-Jung Choi[1,2], Jiwoong Yu[1], Seong-Yeol Yu[1], Youn Kil Jung[1,2], Wookyung Lee[1], Hong-Kyu Moon[1], Min-Jung Kim[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

10:40 [III-4-2]

Toward Space-based Space Situational Awareness Systems: Development Challenges and Strategic Implications

Eun Jung Choi[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea National University of Science and Technology*

10:55 [III-4-3]

A Decade of the OWL-Net (Optical Wide-Field Patrol Network) and Beyond

Hong-Suh Yim[1], Myung-Jin Kim[1], Dong-Goo Roh[1], Jin Choi[1], Jung Hyun Jo[1], Hong-Kyu Moon[1], Jaemann Kyeong[1], Young-Sik Park[1], Yoon-Ho Park[1], Jiwoong Yu[1], Youn Kil Jung[1,2], Eun-Jung Choi[1,2], Sungki Cho[1], Young-Jun Choi[1], Jang-Hyun Park[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

11:10 [III-4-4]

Korea Meteor Monitoring and Observation

Network(MONET): Overall System Introduction with Statistical Results during Test Operation

Dong-Goo Roh[1], Yun Hak Kim[1], Sungki Cho[1], Eun-Jung Choi[1,2], Jang-Hyun Park[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

11:25 [III-4-5]

Development Progress of KOSPAW (Korea Space Surveillance Active Phased Array Radar Window)-Testbed: A Phased Array Radar for Space Surveillance

Jiwoong Yu[1], Eun Jung Choi[1,2], Sungki Cho[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea National University of Science and Technology*

11:40 [III-4-6]

NSOS-α: The First Korean Asteroid Survey Telescope

Myung-Jin Kim[1], Hong-Suh Yim[1], Jaemann Kyeong[1], Youngmin JeongAhn[1], Hee-Jae Lee[1], Hong-Kyu Moon[1], Dong-Goo Roh[1], Jung Hyun Jo[1], Jang-Hyun Park[1], Youn Kil Jung[1,2], Sungki Cho[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

Landing Ballroom A

14:10 [IV-1-1]

AI-Driven Space Power Innovation for Victory in Future Ground Warfare: Focusing on the Reformation of the Defense Acquisition System and the Establishment of Collaborative Governance

Sechan Song

ROK Strategic Command Space Operation Center

14:25 [IV-1-2]

Integrating Commercial Space into National Security: Opportunities and Challenges

Seonghwan Choi

Hanwha Systems

14:40 [IV-1-3]

Satellite as a Service: New Era of Satellite Data Industry

KeunHui Lee

SI Imaging Services

14:55 [IV-1-4]

Where It Is Today: Space-Borne SAR Technology and Its Applications

Jin-Yong Lee

ICEYE

15:10 [IV-1-5]

Advanding Synthetic Aperture Radar-based Change Detection for Surveillance: From High-Resolution Coregistration to Strategic Monitoring Applications

Heein Yang, Mirza Muhammad Waqar, Muhammd Umer Kakli, Joo-hyung Kang

Division on Satellite Mission S/W, CONTEC

15:25 [IV-1-6]

Time-Series Satellite SAR for infrastructure Stability Monitoring

Jonghyuk Yi[1], Minha Choi[2], Yangwon Lee[3]

[1]*SELab, Inc.*
[2]*Sungkyunkwan University*
[3]*Pukyong National University*

Landing Ballroom B

14:10 [IV-2-1]

Spectral and Polarimetric Properties of Reduced Lunar Simulants

Eunjin Cho[1], Seungju Han[2,3], Minsup Jeong[1], Serin Kim[1,3], Young-Jae Kim[2], Chae Kyung Sim[1,3], Eunji Yi[1,3], Mingyeong Lee[1], Keewook Yi[4]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*Korea Institute of Civil Engineering and Building Technology (KICT)*
[3]*University of Science and Technology (UST)*
[4]*Korea Basic Science Institute (KBSI)*

14:25 [Ⅳ-2-2]

Photometric Properties of High Porosity Lunar Regolith Simulants Fabricated by 3D Printing

Mingyeong Lee[1], Minsup Jeong[1], Gorden Videen[2], Matthew J. Berg[3], Dong Lin[4], Chae Kyung Sim[1,2], Antti Penttila[5], Karri Muinonen[5], Sungsoo S. Kim[6], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Space Science Institute*
[3]*Kansas State University*
[4]*Oregon State University*
[5]*University of Helsinki*
[6]*Kyung Hee University*

14:40 [Ⅳ-2-3]

Lunar Neural Elevation Model: Multi-View 3D Reconstruction with Shadow-Aware Irradiance Modeling

Suwan Lee, Seokju Lee

Korea Institute of Energy Technology

14:55 [Ⅳ-2-4]

Application of DC and Electrical Integration Tests during the Development of a Lunar Rover

Dongyoung Kwon[1], Kyudong Kim[1], Sunwook Kim[1], Mangyu Lee[2], Jaeseon Yu[2], Hyoungsic Park[2], Youngseok Lee[1], Kihan Noh[1], Changseop Ahn[2]

[1]*Korea Automotive Technology Institute*
[2]*Hyundai Motor Company*

15:10 [Ⅳ-2-5]

Deep Learning-Based Real-Time 3D Terrain Generation for Lunar Exploration

Myeung Un Kim[1], Dae-Kwan Kim[1], Dong-Geol Choi[2], Seokbok Lee[3]

[1]*Korea Aerospace Research Institute*
[2]*Hanbat National University*
[3]*ANTLAB Corp.*

15:25 [Ⅳ-2-6]

Developing the Tool Influence Function Prediction Model Using Artificial Intelligence

Seung Ho Han[1,2], Jeong-Yeol Han[1,2], Jiwoo Lee[1,2], Eunsu Park[2], Seonghwan Choi[2]

[1]*University of Science and Technology*
[2]*Korea Astronomy and Space Science Institute*

Landing Ballroom C

14:10 [Ⅳ-3-1]

Multispacecraft Observations of Upstream Waves Near the Moon in the Solar Wind

Khan-Hyuk Kim[1], Junhyun Lee[2], Ho Jin[1], Seul-Min Baek[2], Jungjoon Seough[2]

[1]*Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*

14:25 [Ⅳ-3-2]

Conditions for Solar Wind Ion Reflection over Lunar Magnetic Anomalies Observed by Kaguya

Yewon Hong[1], Khan-Hyuk Kim[1], Jaehee Lee[1], Seul-Min Baek[2], Ho Jin[1], Yoshifumi Saito[3], Masaki N. Nishino[3], Shoichiro Yokota[4]

[1]*School of Space Research, Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*
[3]*Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, Sagamihara, Japan*
[4]*Osaka University, Toyanaka, Japan*

14:40 [Ⅳ-3-3]

Frequency-Dependent Evolution of Propagating Intensity Disturbances in Polar Plumes

Kyung-Suk Cho[1], D. Y. Kolotkov[2], Il-Hyun Cho[3], V. M. Nakariakov[2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Warwick*
[3]*Kyung Hee University*

14:55 [Ⅳ-3-4]

Spectroscopic Observation of a Solar Anemone Jet

Heesu Yang

Korea Astronomy and Space Science Institute

15:10 [Ⅳ-3-5]

Winds and Gravity Waves in the Antarctic Mesosphere-Lower Thermosphere from 18 Years of Meteor Radar Observations and Comparison with SD-WACCM-X

Byeong-Gwon Song[1], In-Sun Song[1], Nicholas M. Pedatella[2,3]

[1]*Department of Atmospheric Sciences, Yonsei University*

[2]*NSF National Center for Atmospheric Research, High Altitude Observatory*
[3]*COSMIC Program Office, University Center for Atmospheric Research*

15:25 [Ⅳ-3-6]

Medium-Scale Travering Ionospheric Disturbances Induced by Secondary Gravity Waves During the 2021 August Breaking-record Heavy Rainfall over Kyushu, Japan

Masaru Kogure[1], In-Sun Song[1], Byeong-Gwon Song[1], Huixin Liu[2], Michi Nishioka[3], Septi Perwitasari[3], Hosik Kam[4], Junseok Hong[4]

[1]*Yonsei University*
[2]*Kyushu University, Japan*
[3]*National Institute of Information and Communications Technology*
[4]*Korea Astronomy and Space Science Institute*

Halla Room

14:10 [Ⅳ-4-1]

Preliminary Assessment of Earth Impact Probabilities for Near-Earth Asteroids

Hee-Jae Lee[1], Myung-Jin Kim[1], Youngmin JeongAhn[1], Dong-Goo Roh[1], Jin Choi[1], Eun-Jung Choi[1,2], Sungki Cho[1], Jung Hyun Jo[1], Hong-Suh Yim[1], Jaemann Kyeong[1], Jiwoong Yu[1], Yun Hak Kim[1], Hosik Kam[1], Hye-Young Kim[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

14:25 [Ⅳ-4-2]

Ultra-Wide FoV Video Observations at Jang Bogo and YoungYang Stations for Space Situational Awareness

Yong-Ik Byun[1], Seo-Eun Lee[1], Daewon Kim[2], Hoyoung Hwang[3], Hyuck-Jin Kwon[4], Changsup Lee[4]

[1]*Department of Astronomy, Yonsei University*
[2]*ETRI*
[3]*YSPACE, Co. Ltd.*
[4]*Korea Polar Research Institute*

14:40 [Ⅳ-4-3]

Association and Orbit Determination for Space Situational Awareness Using Ultra-Wide-Field Optical Observations: Pipeline and Case Studies

Seo-Eun Lee[1], Yong-Ik Byun[1], Daewon Kim[2], Hoyoung Hwang[3]

[1]*Department of Astronomy, Yonsei University*
[2]*Electronics and Telecommunications Research Institute (Etri)*
[3]*YSPACE , Co. Ltd.*

14:55 [Ⅳ-4-4]

Survey of Risk Indices for Space Objects and Implications

Jaewoo Kim[1], Eun Jung Choi[2,3], Jin Choi[2,3], Jiwoong Yu[2], Junghyun Jo[2], Hosik Kam[2], Jaemyung Ahn[1]

[1]*Korea Advanced Institute of Science and Technology*
[2]*Korea Astronomy and Space Science Institute*
[3]*University of Science and Technology*

10월 31일(금)

Landing Ballroom A

09:00 [IS-3]

Exploring International Cooperation: ATHENA's GUVI+ and the Far Ultraviolet

Larry Paxton

Johns Hopkins University Applied Physics Laboratory

Landing Ballroom A

09:40 [Ⅴ-1-1]

The First Step Toward Safe and Sustainable Lunar Exploration: Space Object Registration and Mission Information Sharing

Soyoung Chung

Korea Aerospace Research Institute

09:55 [Ⅴ-1-2]

Potential Impacts of Lunar Landing Activities on PSR Volatile Science

Dong-Gyu Kim
Korea Aerospace Research Institute

10:10 [V-1-3]
Listening to the Early Universe: Protecting Lunar Radio Astronomy

Eun Jung Chung
Korea Astronomy and Space Science Institute

10:25 [V-1-4]
Sharing the Lunar Science Data: Limitation, Challenges & How to Overcome

Eunhyeuk Kim, Seoyoung Chung
Korea Aerospace Research Institute

10:40 [V-1-5]
Current Status and Development of IADC Guidelines for Space Debris Mitigation in Lunar Orbit

Jaedong Seong, Youeyun Jung, Saehan Song, Okchul Jung
Korea Aerospace Research Institute

10:55 [V-1-6]
Concept Proposal for Safe and Sustainable Lunar Exploration: The LANTERN (Lunar Activity Notice, Traffic, and Environmental Risk Network) Platform

Young-Joo Song[1], Soyoung Chung[2], Moon-Jin Jeon[2], Chaerin Jeong[1]
[1]*Kyung Hee University*
[2]*Korea Aerospace Research Institute*

11:10 [V-1-7]
Current Status and Implications of International Discussions on the Interoperability of Systems and Infrastructure for Lunar Activities

Nammi Choe
Korea Aerospace Research Institute

Landing Ballroom B

09:40 [V-2-1]
Sensitivity Analysis on Multi-Revolution Orbit Transfer Trajectory Optimizations with Low/Continuous Thrust

Jaemin Park, Jinah Lee, Chandeok Park
Department of Astronomy, Yonsei University

09:55 [V-2-2]
Initial Design of Cryogenic System for Ground and Deep Space Optic Communication

Hojin Lee[1,2], Seonghwan Choi[1], Sanghun Song[1], ByeongChae Bang[3]
[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*AntBridge, Inc*

10:10 [V-2-3]
Feasibility Study of DSOC for L4

Hyun-Jeong Choi[1], Yong-Jae Moon[1], Seonghwan Choi[2]
[1]*School of Space Research, Kyung Hee University*
[2]*Center for Heliophysics Observations and Technology, KASI*

10:25 [V-2-4]
Simulink-Based Modeling and Design for DSOC (Deep Space Optical Communication)

Sanghun Song[1], ByeongChae Bang[2], Seonghwan Choi[1], Hojin Lee[1,3]
[1]*Korea Astronomy and Space Science Institute*
[2]*AntBridge, Inc*
[3]*University of Science and Technology*

10:40 [V-2-5]
Radiation Shielding Evaluation for Quantum Key Distribution Payload in Low Earth Orbit

Beom-Su An[1], Sung-Jin Kim[1], Jongho Seon[1], Jun-Bum Park[2], Jeong-Woon Choi[2], Hyung-Chul Lim[3], Chun-Ju Youn[4], Minchul Kim[4], Min-Hyeong Gil[5]
[1]*School of Space Research, Kyung Hee University*
[2]*SK Telecom*
[3]*Korea Astronomy and Space Science Institute*

[4]*Electronics and Telecommunications Research Institute*
[5]*Korea Testing Laboratory*

10:55 [V-2-6]

Development of a Cross-Contamination Control System to Improve the Reliability of the ASTM E595 Outgassing Test Method

Yangho Kim, Minsung Kim, Chulwoo Park

Vacuumex Inc.

11:10 [V-2-7]

Space ASIC Devices for Space Science Payload Instruments

Minjae Kim[1], Ho Jin[1], Yunho Jang[1], Ik Joon Chang[2], Ickhyun Song[3], Yonghwan Kwon[4], Taeyeong Kim[5], Khan-Hyuk Kim[1]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Electronic Engineering, Kyung Hee University*
[3]*Department of Electronic Engineering, Hanyang University*
[4]*Department of Semiconductor Enginnering, Kyung Hee University*
[5]*Department of Artificial Intelligence Semiconductor Engineering, Hanyang University*

Landing Ballroom C

09:40 [V-3-1]

Climatology of Thermospheric Winds in the Southern Polar Cap: Long-Term Ground-Based Observations from JBS-FPI

Eunsol Kim[1], Changsup Lee[1,2], Young-Bae Ham[1,2], Geonhwa Jee[1,2]

[1]*Korea Polar Research Institute*
[2]*University of Science and Technology*

09:55 [V-3-2]

Origin of Intense Plasma Depletions After Midnight over the Korean Peninsula during the Geomagnetic Storm on 11 May 2024

Hyosub Kil, Se-Heon Jeong, Woo Kyoung Lee, Junseok Hong

Korea Astronomy and Space Science Institute

10:10 [V-3-3]

Coronal Magnetic Field Modeling Improved by Incorporation of 3-D Density Structures

Junmo An, Ryun-Young Kwon

Korea Astronomy and Space Science Institute

10:25 [V-3-4]

Development of an Anisotropic Visco-Resistive MHD Code with Thermal Conduction for Solar Atmospheric Simulations

Donghui Son[1], Tetsuya Magara[1,2]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Astronomy and Space Science, Kyung Hee University*

10:40 [V-3-5]

Solar Wind Charge State Evolution from the Corona to 1 AU with Nonthermal Electrons

Jin-Yi Lee[1], Junmo An[2], John C. Raymond[3], Chengcai Shen[3]

[1]*Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*
[3]*The Center for Astrophysics | Harvard & Smithsonian*

10:55 [V-3-6]

Investigating Differences and Causes of Two Energy Spectrum Types of Solar Proton Events

Ji-Hyeon Yoo[1,2], Ryun-Young Kwon[1], Dae-Young Lee[2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*

11:10 [V-3-7]

Investigating the Characteristics and Solar Origin of High-latitude Geomagnetic Disturbances During a Deep Solar Minimum

Seohee Jang[1,2], Sung-Hong Park[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*

Halla Room

09:40 [V-4-1]

A Study on Requirements for Developing Core Technologies of Microwave Sounder

Changho Woo, Jin-Ho Lee, Sinmu Park, Hyunsuk Lee, Byong-Suk Suk, Sang-Soon Yong

Korea Aerospace Research Institute

09:55 [V-4-2]

100 Gbps Laser Communication Experiment under Atmospheric Turbulence Channel

Sang-Won Park[1,2], Hyung-Chul Lim[1], Ki-Pyung Sung[1], Sung-Yeol Yu[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*

10:10 [V-4-3]

Maintenance of Large Vertical Vibration Shaker System

Tae Seok Oh, Jong-Min Im, Hee-Kwang Eun, Jong-Hyub Jun, Seon-Je Jo, Jin Park, Nam-Jin Moon, Chang-Rae Cho

Korea Aerospace Research Institute

10:25 [V-4-4]

A Study on the Optimization of the Mission Orbit Entry of an Inclined Geosynchronous Orbit Satellite Using a Numerical Optimization Method

Bangyeop Kim

Korea Aerospace Research Institute

Landing Ballroom A

16:10 [VI-1-1]

Development and Delivery of K-RadCube: A 12U CubeSat for Space Radiation Measurement to be Deployed from Artemis II Mission

Jehyuck Shin[1], Dukhang Lee[1,2], Young-Jun Choi[1], Uk-Won Nam[1], Donguk Song[1], Woo-Hyeong Seol[1], Won-kee Park[1], Seul-Min Baek[1], Chae Kyung Sim[1,2], Hyojeong Lee[3], Seongwhan Lee[3], Taewan Kim[4], Hyeonggu Kim[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Nara Space Technology Inc.*
[4]*KT SAT*

16:25 [VI-1-2]

Space Radiation Research Using LEO-DOS Data from NEXTsat-2

Jongil Jung[1], Young-Sil Kwak[1,2], Uk-Won Nam[1], Won-Kee Park[1], Jongdae Sohn[1], Sukwon Youn[3], Sunghwan Kim[4], Hongjoo Kim[5]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Seoul National University*
[4]*Cheongju University*
[5]*Kyoungpook National University*

16:40 [VI-1-3]

Science Applications of the LVRAD Neutron Spectrometers for Lunar Lander Missions

Eunji Yi[1,2], Uk-won Nam[1], Sukwon Youn[3], Dahye Ahn[3], Sunghwan Kim[4], Hongjoo Kim[5], Woo-Hyeong Seol[1], Won-kee Park[1], Jongdae Sohn[1], Chae Kyung Sim[1,2], Dukhang Lee[1], Seul-Min Baek[1], Jehyuck Shin[1], Young-Jun Choi[1], Insoo Jun[6], Sung-Joon Ye[3]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*
[3]*Seoul National University*
[4]*Cheongju University*
[5]*Kyungpook National University*
[6]*NASA Jet Propulsion Laboratory*

16:55 [VI-1-4]

LUSEM for Artemis CLPS Mission: Instrument Overview, Pre-Launch Testing, and Science Objectives

Go Woon Na[1], Jongho Seon[1], Sung-Jin Kim[1], Minhyuk Oh[1], Beom-Su An[1], Young-Jun Choi[2,3], Dukhang Lee[2], Chae Kyung Sim[2], Seul-Min Baek[2], Woo-Hyeong Seol[2], Jehyuck Shin[2], Young Jin Jun[4], Sinhyeong Cho[4]

[1]*Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*
[3]*University of Science and Technology*
[4]*Satrec Initiative Co., Ltd.*

17:10 [VI-1-5]

Analysis of Apollo 16 Lunar Surface Magnetometer Data: Implications for the Operations of the Lunar Surface MAGnetometer (LSMAG)

Sanghwa Kim[1], Hyeonhu Park[1], Ho Jin[1], Khan-Hyuk Kim[1], Seul-Min Baek[2], Peter J. Chi[3]

[1]*School of Space Research, Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*
[3]*University of California, Los Angeles*

17:25 [VI-1-6]

GrainCams (CLPS): *In Situ* 3D Regolith Imaging and Levitated Dust Detection, FM Development Status

Minsup Jeong[1], Young-Jun Choi[1,2], Chae Kyung Sim[1,2], Dukhang Lee[1,2], Bongkon Moon[1], Sungsoo S. Kim[3], Woojin Kim[2], Dae-Hee Lee[1], Seonghwan Choi[1], Jihun Kim[1], Yoonjong Kim[1], Mingyeong Lee[1,3], Seul-Min Baek[1], Jehyuck Shin[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Kyung Hee University*

Landing Ballroom B

16:10 [VI-2-1]

Construct Korean Asteroid Exploration Mission Roadmap

Junchan Lee[1], Jinsung Lee[1], HyeonKyu Jeon[1], Eunjin Jang[2], YoungJae Choo[1], Jisoo Kim[1], KyoungWook Min[3], Dainel J. Scheeres[4,5], Jaeheung Han[1,2,4,5]

[1]*Satellite Technology Research Center (SaTRec), Korea Advanced Institute of Science and Technology*
[2]*Aerospace Engineering, Korea Advanced Institute of Science and Technology*
[3]*Physics Department, Korea Advanced Institute of Science and Technology*
[4]*Aerospace Engineering Science, University of Colorado Boulder*
[5]*Space Institute, Korea Advanced Institute of Science and Technology*

16:25 [VI-2-2]

Requirement Analysis of Asteroid Exploration Mission for Technology Demonstration and Planetary Defense

Junchan Lee[1], Jinsung Lee[1], HyeonKyu Jeon[1], Eunjin Jang[2], YoungJae Choo[1], Jisoo Kim[1], KyoungWook Min[3], Dainel J. Scheeres[4,5], Jaeheung Han[1,2,4,5]

[1]*Satellite Technology Research Center (SaTRec), Korea Advanced Institute of Science and Technology*
[2]*Aerospace Engineering, Korea Advanced Institute of Science and Technology*
[3]*Physics Department, Korea Advanced Institute of Science and Technology*
[4]*Aerospace Engineering Science, University of Colorado Boulder*
[5]*Space Institute, Korea Advanced Institute of Science and Technology*

16:40 [VI-2-3]

Trajectory Design of Dual Near-Earth-Asteroid Reconnaissance and Impact Mission

Jinsung Lee

KAIST Satellite Technology Research Center

16:55 [VI-2-4]

Flyby and Impact of NEAs for Assessment: pLanetary Defense, Evolution and Internal Structure (FINALEI)

Youngmin JeongAhn[1], Myung-Jin Kim[1], Hee-Jae Lee[1], Pureum Kim[2], Hong-Kyu Moon[2], Chae Kyung Sim[1,3], Eun-Jung Choi[1,3], Youngbum Song[1], Bongkon Moon[1,3], Sung-Joon Park[1], Dukhang Lee[1,3], Minsup Jeong[1], Dong-Goo Roh[1], Jiwoong Yu[1], Jin Choi[1], Sang-Young Park[2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Yonsei University*
[3]*University of Science and Technology*

17:10 [VI-2-5]

Flyby Trajectory Design for Near-Earth Asteroids Using a Lunar Swing-By

Pureum Kim, Sang-Young Park

Yonsei University

17:25 [VI-2-6]

Ground-Based Observational Support for the FINALEI Mission

Hee-Jae Lee[1], Myung-Jin Kim[1], Youngmin JeongAhn[1], Hong-Kyu Moon[1], Haeun Kim[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*

Landing Ballroom C

16:10 [VI-3-1]

Altitude-Dependent Contributions of Zonal and Meridional Winds to Sporadic E Layers

Jaewook Lee[1], Young-Sil Kwak[1,2], Hyosub Kil[1,3], Tae-Yong Yang[1], Jong-Yeon Yun[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA*
[4]*Korea Aero Space Administration*

16:25 [VI-3-2]

Comparative Evaluation of High-Latitude Electrostatic Potential Models in SD WACCM-X

Jiwoo Kim[1], In-Sun Song[1], Wonseok Lee[2,3], Ja Soon Shim[2,4], Nicholas M. Pedatella[5,6]

[1]*Department of Atmospheric Sciences, Yonsei University*
[2]*NASA Goddard Space Flight Center, Greenbelt, USA*
[3]*Department of Physics, Catholic University of America, Washington, USA*
[4]*Science and Technology Institute, Universities Space Research Association, Huntsville, USA*
[5]*NSF National Center for Atmospheric Research, High Altitude Observatory, Boulder, USA*
[6]*COSMIC Program Office, University Center for Atmospheric Research, Boulder, USA*

16:40 [VI-3-3]

Automatic CME Detection Using Historical Trends in SOHO LASCO Solar Images

Jonglil Lee[1], Daeyoung Lee[1], Ryunyoung Kwon[2]

[1]*Chungbuk National University*
[2]*Korea Astronomy&Space Science Institute*

16:55 [VI-3-4]

Prediction of Hp30 Geomagnetic Index Associated with CME Events Using Deep Learning

Jihyeon Son[1], Jeong-Heon Kim[1], Young-Sil Kwak[1,2], Seon-Young Kim[3], Gi-Jeong Kim[4], Seungheon Shin[4], Se-Heon Jeong[1], Woong Jeon[1,4], Rok-Soon Kim[1], Sung-Hong Park[1,2], Jungjoon Seough[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Ewha Womans University*
[4]*Kyung Hee University*

17:10 [VI-3-5]

Denoising SDO/AIA Images Using Self-Supervised Deep Learning Method

Daeil Kim[1], Yong-jae Moon[1,2]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Astronomy and Space Science, Kyung Hee University*

17:25 [VI-3-6]

Preliminary Results of Stereoscopic DEMs for L4 and L5 missions

Junmu Youn[1], Jeongwoo Lee[2], Hyun-Jin Jeong[1,3], Yong-Jae Moon[1], Daeil Kim[1], Mingyu Jeon[1]

[1]*Kyung Hee University*
[2]*New Jersey Institute of Technology*
[3]*KU Leuven*

17:40 [VI-3-7]

Validation of IGS GIMs Over Oceanic Regions Using Altimeter-Derived TEC

Woong Jeon[1,2], Woo Kyoung Lee[1,3], Yong-Jae Moon[2,4]

[1]*Korea Astronomy and Space Science Institute*
[2]*School of Space Research, Kyung Hee University*
[3]*University of Science and Technology*
[4]*Department of Astronomy and Space Science, Kyung Hee University*

17:55 [VI-3-8]

A Simple but Effective Way of Characterizing Coronal Mass Ejection Events for Space Weather Applications

Sung-Hong Park[1,2]

[1]*Korea Astronomy and Space Science Institute*

[2]*University of Science and Technology*

Halla Room

16:10 [VI-4-1]

Formulating Korea's Roadmap for Space Telescopes

Bongkon Moon[1,2], Woong-Seob Jeong[1,2], Sung-Joon Park[1], Jongwan Ko[1,2], Ji Hye Baek[1], Dae-Hee Lee[1,2], Chae Kyung Sim[1,2], Jeong-Yeol Han[1,2], Chung-Uk Lee[1], Eun-Jeong Hwang[1], Kyoung Suk Lee[1], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*

16:40 [VI-4-2]

Beyond Ground-Based LSB Observations: Space-Based K-DRIFT

Jongwan Ko[1,2], K-DRIFT Team

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*

16:55 [VI-4-3]

Development Strategies of Spectrographs Onboard the Korea-Led Space Telescope in Future

Sung-Joon Park[1], Jae Joon Lee[1], Sungho Lee[1], Woong-Seob Jeong[1,2], Yujin Yang[1], Bongkon Moon[1,2], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*

17:10 [VI-4-4]

High Contrast Imaging Technology

Ji-Hye Baek, Seonghwan Choi, Kyohoon Ahn, Yunjon Kim, Jihun Kim, Jongyeob Park, Sanghun Song

Korea Astronomy and Space Science Institute (KASI)

17:25 [VI-4-5]

Trade Space of Primary-Secondary Fore-Optics for a Korean Space Telescope

Jeong-Yeol Han[1], Bongkon Moon[1,2], Eunjung Hwang[1], Young-Jun Choi[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*

11월 1일(토)

Halla Room

09:00 [VII-1-1]

Concept Study of Lunar Vision: Multiband Polarimetric Imaging for Space Weathering and Regolith, Mineralogy, and Plume-Effect Characterization

Jeong-Yeol Han[1,2], Chae Kyung Sim[1,2], Minsup Jeong[1], Dukhang Lee[1,2], Hyoung Kwon Lee[3], Jaehyeon Kyeong[3], Jiwoo Lee[1,2], Seungkyun Ryu[4], Nikolay Vedenkin[5]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*LeO SPACE Inc.*
[4]*IM Technology Inc.*
[5]*KAIROSPACE Co., Ltd.*

09:15 [VII-1-2]

Scientific Payload Concept for Lunar Surface Space Environment Observations: CLUSER

Seul-Min Baek, and CLUSER Team

Korea Astronomy and Space Science Institute

09:30 [VII-1-3]

3D Topographic and Microscopic Hybrid Camera System for *In-Situ* Lunar Surface Exploration

Nayeon Kim[1], Sunwoo Lee[1,2], Seunghyuk Chang[3], I Jong Kim[2], Changgon Kim[1], Dohoon Kim[1], Jae Hyuk Lim[4], Ah-Jeong Seong[4], Jaesang Hyun[5], Geunhee Jo[5], Daewook Kim[6], Soojong Pak[1]

[1]*School of Space Research, Kyung Hee University*
[2]*Korea Basic Science Institute*
[3]*Center for Integrated Smart Sensors*
[4]*Department of Mechanical Engineering, Kyung Hee University*
[5]*Department of Mechanical Engineering, Yonsei University*
[6]*James C. Wyant College of Optical Sciences, The University of Arizona*

09:45 [Ⅶ-1-4]

Introduction to Mission Objectives for Lunar Surface Geology and Resource Exploration

Kyeong Ja Kim

Korea Institute of Geoscience and Mineral Resources

10:00 [Ⅶ-1-5]

Preliminary Design of Radioisotope Power Systems for Lunar Science and Technology Missions

Sunjin Kim, Jong-Bum Kim, Jin-Joo Kim, Gilyoung Ko, Da-Hye Kim, Jintae Hong

Korea Atomic Energy Research Institute

10:15 [Ⅶ-1-6]

lunar Surface Mission with Micro-Rover

Namsuk Cho, Junseok Lee, Jungwoo Shin, Jaeho Lee

Unmanned Exploration Laboratory

Baengnok Room

09:00 [Ⅶ-2-1]

Radiometric Cross-Calibration of Optical Payloads on KOMPSAT and CAS500-1 Satellites

Kyoung-Wook Jin[1], Jin-Hyeok Choi[2], Yungon Lee[2]

[1]*Korea Aerospace Research Institute Cal/Val & Image Quality Research Team*
[2]*Department of Atmospheric Sciences, Chungnam National University*

09:15 [Ⅶ-2-2]

A Study on Intelligent Fault Detection Modeling Using Satellite Telemetry Data

Sunju Park[1], Jaehyung Park[1], Hyunchang Lee[1], JeongSik Choi[1], Jingi Ju[2], Mincheol Shin[2], Jiseung Ahn[2]

[1]*Korea Aerospace Reserach Institute*
[2]*IOPS*

09:30 [Ⅶ-2-3]

Time-Series Photometry of Main-Belt Binary Asteroids: A Case Study of (7344) Summerfield

Haeun Kim[1,2], Myung-Jin Kim[2], Hee-Jae Lee[2], Youngmin Jeongahn[2], Hong-Kyu Moon[2], Young-Jun Choi[2], Yonggi Kim[1]

[1]*Chungbuk National University*
[2]*Korea Astronomy and Space Science Institute*

09:45 [Ⅶ-2-4]

Risk of Space Tourism through Black Swan Theory: Applying Risk Management

Hyeona Jo[1], Yunkyoung Jo[1], Jinhye Park[2], James F. Petrick[3], Michael Hall[4], Myung Ja Kim[5]

[1]*Kyunghee University*
[2]*Korea AeroSpace Administration*
[3]*Texas A & M University*
[4]*Massey university*
[5]*Sejong University*

10:00 [Ⅶ-2-5]

The Reality of In-Space Pharmaceutical Manufacturing Industry

Hyeonjun Kim

Korea Aerospace Research Institute

Olle Room

09:00 [Ⅶ-3-1]

Prediction of Heavy Ion Charge State Ratios and Elemental Composition of Solar Wind Using Deep Learning

Jungjoon Seough[1], Jihyeon Son[1], Hyun-Su Lee[2], Ji-Yeong Kim[2], Kyoung-Sun Lee[3]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungnam National University*
[3]*Seoul National University*

09:15 [Ⅶ-3-2]

Deriving an Interpretable Model for Solar Wind Speed Prediction via Symbolic Regression

Seungwoo Ahn[1], Youngjae Kim[1], Mingyu Jeon[1], Daeil Kim[1], Junmu Youn[1], Yong-Jae Moon[1,2]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Astronomy and Space Science, Kyung Hee University*

09:30 [Ⅶ-3-3]

Interpretable Data-Driven Models for Solar Flare Forecasting through Deep Learning and Symbolic Regression

Youngjae Kim[1], Yong-jae Moon[1], Hyun-Jin Jeong[1,2], Gwangson Choe[1], Jihyeon Son[3], Mingyu Jeon[1]

[1]*Kyunghee University*
[2]*KU Leuven, Belgium*
[3]*Korea Astronomy and Space Science Institute*

09:45 [Ⅶ-3-4]

Statistical Analysis of Solar Proton Events and Their Correlation with Solar Energetic Phenomena: Implications for Forecasting of Solar Radiation Storm

Haein Lee[1,2], Ryun Young Kwon[1], Dae-Young Lee[2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk Naional University*

10:00 [Ⅶ-3-5]

Development of a Deep Learning Model for Predicting Earth-Directed Solar Energetic Particle Events

Seunghyeon Lee[1,2], Sung-Hong Park[1,2], Youngwoo Cho[3], Wonkeun Jo[4], Mingyu Jeon[5], Seohee Jang[1,2], Junmu Youn[5], Daeil Kim[5], Seungwoo Ahn[5], Juheon Kwak[6], Seungye Lee[6], Soomin Lee[7], Yeseul Choi[6], Ik Hyun Lee[8], Joongsun You[9]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*
[3]*Kim Jaechul Graduate School of AI, Korea Advanced Institute of Science and Technology (KAIST)*
[4]*Asan Institute for Life Sciences, Asan Medical Center*
[5]*School of Space Research, Kyung Hee University (KHU)*
[6]*Division of Artificial Intelligence and Software, Ewha Womans University (EWU)*
[7]*Computer Science and Engineering, Chungnam National University (CNU)*
[8]*Department of Mechatronics Engineering, Tech University of Korea (TUKOREA)*
[9]*School of Aerospace Engineering, Gyeongsang National University (GNU)*

10:15 [Ⅶ-3-6]

Toward a Forecast Model and Operational Alert Service for 2 MeV Relativistic Electrons in Geosynchronous Orbit

Ji-Hoon Ha, Jae-Hyung Lee, Jaehun Kim, Sang Cheol Han, Soojeong Jang, Wonhyeong Yi

Korea Space Weather Center, Korea AeroSpace Administration

Yeongju Room

09:00 [Ⅶ-4-1]

AcuDA: Development and Validation of a Curriculum-Aligned Diagnostic Assessment of Astronomy Concepts

Gilgu Kang[1], Ahra Cho[1], Jiwon Park[1,2], Yonggi Kim[1,2]

[1]*Chungbuk National University*
[2]*Chungbuk Pro Maker Center*

09:15 [Ⅶ-4-2]

Effectiveness of an HTE-STEAM Astronomy and Space Science Education Program: Focusing on Attitude Change toward Astronomy and Conceptual Restructuring across Major Learning Areas

Ahra Cho[1], Gilgu Kang[1], Jiwon Park[1,2], Yonggi Kim[1,2]

[1]*Chungbuk National University*
[2]*Chungbuk Pro Maker Center*

09:30 [Ⅶ-4-3]

Realization of the Heomsi-ui Operating Mechanism

Hong Soon Choi[1,2], Sang Hyuk Kim[1], Byeong-Hee Mihn[1,2,3], Kyoung-uk Nam[4], Kyeong-han Yoo[2,5], Yonggi Kim[2,5]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*
[3]*Korea University of Science and Technology*
[4]*Gwacheon National Science Museum*
[5]*Chungbuk Pro Maker Center*

09:45 [Ⅶ-4-4]

The Celestial Cartography of Hong Dea-Yong's Honsang-ui (渾象儀)

Seon Young Ham[1,2], Byeong-Hee Mihn[2,3,4], Sang Hyuk Kim[3], Yong-Hyun Yun[5], Go-Eun Choi[1],

Hongkeun Park[1], Eunyoung Choi[1]

[1]*National Science Museum Republic of Korea*
[2]*Chungbuk National University*
[3]*Korea Astronomy and Space Science Institute*
[4]*Korea University of Science and Technology*
[5]*Scientific and Cultural Heritage Research Institute*

10:00 [Ⅶ-4-5]

A Study on the Characteristics of Southern Hemisphere Horizontal Sundials: With a Focus on the Dunedin Botanic Garden Sundial

Sang Hyuk Kim[1], Byeong-Hee Mihn[1,2,3], Kyung Ha Lee[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*
[3]*Chungbuk National University*
[4]*Kongju National University*

10:15 [Ⅶ-4-6]

The Launch of the KAPPA Web Service: An Online Database of Korean Historical Astronomical Records

Byeong-Hee Mihn[1,2,3], Sang Hyuk Kim[1], Ki-Won Lee[4], Young-Sook Ahn[1], Do-Gyun Kim[5]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*
[3]*Korea University of Science and Technology*
[4]*Daegu Catholic University*
[5]*Wecean Inc.*

포스터발표 논문 제목

10월 31일(금) 13:00~14:30

▶ 태양 및 우주환경

[P-1] Test Equipment and Methods for Transient Voltage Evaluation of DC Power Systems in Satellite Electromagnetic Compatibility (EMC) Tests

In-Sang Yu, Chang-Eun Lee, Jae-Woong Jang, Kyung-Duk Jang, Tae-Youn Kim, Sang-Rok Lee

Korea Aerospace Research Institute

[P-2] Impact of Temperature on Measurement Accuracy of EMI Receivers in Satellite Radiated Emission Testing

Chang-Eun Lee, Jae-Woong Jang, Kyung-Duk Jang, Tae-Youn Kim, Sang-Rok Lee, In-Sang Yu

Korea Aerospace Research Institute

[P-3] Research for Analysis Method of Launch Vehicle RF Compatibility

Jae-Woong Jang, Tae-Youn Kim, Kyung-Duk Jang, Sang-rok Lee, Chang-Eun Lee, In-Sang Yu

Korea Aerospace Research Institute

[P-4] Study on the Testing Methods to Reduce ESD Threat in Satellites

Kyung-Duk Jang, Tae-Youn Kim, Jae-Woong Jang, Sang-Rok Lee, Chang-Eun Lee, In-Sang Yu

Korea Aerospace Research Institute

[P-5] GPT for Space Weather

Seungheon Shin[1], Yong-Jae Moon[1,2], Jihyeon Son[3], Ji-Hoon Ha[4]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Astronomy and Space Science, Kyung Hee University*
[3]*Center for Heliophysics Research, Korea Astronomy and Space Science Institute*
[4]*Korea Space Weather Center, Korea AeroSpace Administration*

[P-6] Seasonality Bias and Class Imbalance Mitigation of Machine Learning based Sporadic E Layer Prediction Model

Kyu-Cheol Choi, Dae-Kyu Shin, Seung-Jun Oh, Yong-Ha Kim

SELab. Inc,.

[P-7] Substorm Effects on Polar Mesospheric Summer Echoes during High-Speed Solar Wind Streams

Young-Sook Lee[1], Geonwha Jee[2,3], Young-Sil Kwak[3,4]

[1]*Chungnam National University*
[2]*Korea Polar Research Institute*
[3]*University of Science and Technology*
[4]*Korea Astronomy and Space Science Institute*

[P-8] Characteristics of Ionospheric Parameters Observed by Digisonde at Icheon and Jeju, South Korea

Wonhyeong Yi, Jae-Hyung Lee, JaeHun Kim, Ji-Hoon Ha, Sang Cheol Han, Soojeong Jang

Korea Space Weather Center, Korea AeroSpace Administration

[P-9] Comparative Study of MHD- and WEIMER-Derived Cross Polar Cap Potential (CPCP) as Inputs to Thermosphere-Ionosphere Model

Jeong-Heon Kim[1], Kyungsun Park[2], Jihyeon Son[1], Young-Sil Kwak[1,3]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*
[3]*University of Science and Technology*

[P-10] Influence of Tropospheric Variability on Migrating Semidiurnal Tide in the Mesosphere and Thermosphere

Kyeongsoo Kim, In-Sun Song

Department of Atmospheric Sciences, Yonsei University

[P-11] Moon-Originating Ions Observed Over a Broad Range of Latitudes on the Lunar Far Side

Jaehee Lee[1], Khan-Hyuk Kim[1], Yewon Hong[1], Seul-Min Baek[2], Ho Jin[1], Junhyun Lee[2]

[1]*Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*

[P-12] Effects of Radial Nonuniformity in Global Reconstruction of Coronal Magnetic Fields

Sibaek Yi, Gwangson Choe

Department of Astronomy and Space Science, Kyung Hee University

[P-13] Determination of CME Three-Dimensional Parameters Using Deep Learning

Hyeonock Na[1], Yong-Jae Moon[1,2]

[1]*Department of Astronomy and Space Science, Kyung Hee University*
[2]*School of Space Science, Kyung Hee University*

[P-14] AI-Based Improvement of Spatial and Temporal Resolution of SUVI/EUV Data Using SDO/AIA

Sumiaya Rahman[1], Bendict Lawrance[2], Ashraf Siddique[3], Hyun-Jin Jeong[1,4], Yong-Jae Moon[1]

[1]*Department of Astronomy and Space Science, Kyung Hee University*
[2]*Department of AI-based Big Data Management, Gangseo University*
[3]*Department of Computer Science Engineering, Kyung Hee University*
[4]*Center for mathematical Plasma Astrophysics, Department of Mathematics, KU Leuven, Belgium*

[P-15] Spectral Analysis of Jet-Like Features Observed at 8542-0.4 Å in FISS

Hana Kim[1,2], Heesu Yang[2], Maria S. Madjarska[2,3,4]

[1]*University of Science and Technology*
[2]*Korea Astronomy and Space Science Institute*
[3]*Max Planck Institute for Solar System Research*
[4]*Space Research and Technology Institute*

[P-16] A Multi-Layer Constant Gradient Approach to Alfvén Wave Transmission in the Solar Atmosphere: Application to FALC and FALP

Kyoung-Sun Lee, Jongchul Chae

Seoul National University

[P-17] Backward Tracing of Solar Energetic Particles with MHD Simulations (WSA-ENLIL model): Implications for Space Weather Prediction

Seung-Ju Yang[1], Dae-Young Lee[1], Ryun-Young Kwon[2], Kyung-Chan Kim[1], Ji-Hyeon Yoo[1,2]

[1]*Department of Astronomy and Space Science, Chungbuk National University*
[2]*Korea Astronomy and Space Science Institute*

[P-18] Determination of Small-Scale Current Sheets Embedded within the Large-Scale Heliospheric Current Sheets as Observed by Parker Solar Probe

Dooyoung Choi, Dae-Young Lee

Chungbuk National University

[P-19] Statistical Study of Solar Energetic Particle Events and Their Relation to Ground Level Enhancements Using ACE/SIS Data (1997-2023)

Jongil Jung[1], Suyeon Oh[2], Young-Sil Kwak[1,3], Yu Yi[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chonnam National University*
[3]*University of Science and Technology*
[4]*Chungnam National University*

[P-20] A Statistical Study of Solar Energetic Particle Events Observed by Geostationary Operational Environmental Satellites

Seunghyeon Lee[1,2], Uijin Gu[3], Sung-Hong Park[1,2]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*
[3]*Department of Astronomy and Space Science, Chungnam National University (CNU)*

▶ 우주탐사

[P-21] The Basic Data Processing for KPLO Gamma-Ray Spectrometer (KGRS)

Suyeon Kim[1], Kyeong Ja Kim[1,2], Ik-Seon Hong[1]

[1]*Korea Institute of Geoscience and Mineral Resources*
[2]*University of Science and Technology*

[P-22] Cable-Driven Parallel Robot Requirements for Lunar Lander GNC Sensor Navigation Tests

Eui-Keun Kim, Seung-Yong Min

Korea Aerospace Research institute

[P-23] Onboard AI for Space Exploration: Extending Raspberry Pi Validation toward Mission Scenario Applications

Juhyeong Kim[1,2], Dae-Hee Lee[1,2,3], Chae Kyung Sim[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Department of Aerospace Engineering, KAIST*

[P-24] Rapid, Lightweight Attitude Screening for Early Mission Design of LAE Burns in GTO/IGSO Transfers

Jin-Hyung Kim

Korea Aerospace Research Institute

[P-25] Thermal Environmental Conditions of Thermal Analysis for Planetary Explanation Mission

Hui-Kyung Kim[1,2]

[1]*Korea Aerospace Research Institute*
[2]*University of Science and Technology*

[P-26] Overview on STM and LSTM of Lunar Lander

Seung Yong Min, Eui-Keun Kim

Korea Aerospace Research Institute

[P-27] New Insights into Magnetic Anomalies Associated with the Moon's Oldest Geologic Features: South Pole-Aitken and Dirichlet-Jackson Basins

Hyeonhu Park[1], Ian Garrick-Bethell[2], Ho Jin[1]

[1]*Kyung Hee University*
[2]*University of California, Santa Cruz*

[P-28] Lessons from Lunar Node-1: Considerations for Developing a PNT Payload on Lunar Landers

Huiung Park[1], Sangman Moon[1], Inkyu Kim[1], Jaehoon Song[1], Yoon-jeong Jang[1], Jong-Myung Woo[2]

[1]*Korea Aerospace Research Institute*
[2]*Chungnam National University*

[P-29] Analysis of Landing Conditions Including Mission Duration at International Lunar Lander Sites

Jonghee Bae, SeungBum Hong, Jun Bang, Kiduck Kim

Korea Aerospace Research Institute

[P-30] Proof Load Test Results of Lifting System and Approach Fixture for a Large Thermal Vacuum Chamber

SunKi Baek, Sung-Wook Park, KeunShik Kim, Hee-Jun Seo, Ji-Seok Kim, Ji-Hoon Choi, KyuMin Oh

Korea Aerospace Research Institute

[P-31] Topographic Features of the Lunar Surface with Water-Ice on the Sub-Surface

Haingja Seo, Jin Bae

Korea Aerospace Research Institute

[P-32] Study of the Lunar Environment Affecting the Lunar PNT Signal

Haingja Seo, Hyewon Park, Jin Bae

Korea Aerospace Research Institute

[P-33] Instrument Kernel Update for the KPLO LUTI Camera: Methodology and Product-Level Improvements

Seunghee Son

Korea Aerospace Research Institute

[P-34] Preparations of the On-Orbit Servicing System Specification Document

Jae-Hoon Song, Jae-Wook Kwon

Korea Aerospace Research Institute

[P-35] Toward Korean Space Exploration Raman Spectrometer

Dongha Shin[1,2]

[1]*Department of Chemistry, Inha University*
[2]*Program in Biomedical Science and Engineering, Inha University*

[P-36] Differential Amplifier Based Inner Controller for the Dual-Loop Control of DC-DC

Converters

Jeong-Hwan Yang

Korea Aerospace Research Institute

[P-37] Strategies for Efficient Signal Processing in Next-Generation Space Particle Detectors

Minhyuk Oh, Sungjin Kim, Go Woon Na, Jongho Seon, Beomsu An

School of Space Research, Kyung Hee University

[P-38] Roll-Out Solar Array Development for Scalable and Reusable Autonomous Spacecraft

Sung-Hyun Woo, Dae Yeong Kim, Dae Jun Jung

Korea Aerospace Research Institute

[P-39] Electrical Interface Test for the Electric Propulsion System of Geostationary Communication Satellite

Young-Jin Won

Korea Aerospace Research Institute

[P-40] Design of Test Scheme using Flight model for On Board Computer of GEO satellite

Joo Ho Won

Korea Aerospace Research Institute

[P-41] MTF Characteristics Analysis and Performance Evaluation for High-Resolution Imaging Systems

Youngchun Youk, Shinwook Kim

Korea Aerospace Research Institute

[P-42] 코페르니쿠스 충돌구 분출물과 그 주변 지역의 광물 분포 조사

이응석, 헤스 마셀, 김경자, 임재수

한국지질자원연구원

[P-43] Analysis of the Emergency Response of Air Management System from the Perspective of Life Support System

Joo-Hee Lee, Youn-Kyu Kim

Korea Aerospace Research Institute

[P-44] Survey of the Lunar Surface Environment Related to Orbital Missions

Young-Jun Choi[1], Junhyun Lee[1], Seul-Min Baek[1], Woo-Hyeong Seol[1], Khan-Hyuk Kim[2], Ho Jin[2], Jongho Seon[2], Minsup Jung[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Kyung Hee University*

[P-45] Concept Study of a VLEO Satellite for High-Resolution Earth Observation

Hyunsu Lim

Korea Aerospace Research Institute

[P-46] Seasonal Particle and Molecular Contamination Measurement for Precise Space Experiments

Ji-Hoon Choi, Seon-gi Baek, Geun-sik Kim, Gyu-min Oh, Seung-mo Hong

Korea Aerospace Research Institute

▶ 위성정보활용

[P-47] Improvement of Process Monitoring Functions for Neonsat Monitoring

Guhyeok Kim, Min-A Kim

Korea Aerospace Research Institute

[P-48] Super-Resolution Image Reconstruction Using a Nonuniform Interpolation Approach for Remote Sensing Satellite Camera

Youngsun Kim, Haeng-Pal Heo

Korea Aerospace Research Institute

[P-49] Satellite Image PRNU Verification for Payload Performance Monitoring Using Spacelook and Lunar Observations

Jun-Ho Kim

National Meteorological Satellite Center (NMSC)

[P-50] Ritchey-Chrétien Telescope Design for Small-Satellite VLEO Missions

Jeeyeon Yoon, Goeun Kim

Korea Aerospace Research Institute (KARI), Space Optics Team

[P-51] Plan for Public Satellite Tile Image Service Through Next-Generation KSATDB

Myung-Jun Lee, Jaeung Han, Gap-Ho Jeun, Min-A Kim

Korea Aerospace Research Institute

[P-52] Enhanced Processing Workflow for Rapid Modification Satellite Imagery

Jaeyeol Lee, Jihyeon Yim, Min-A Kim

Korea Aerospace Research Institute

[P-53] A Study on the Development of a System for Enhancing the Efficiency of Satellite Imagery Requests

Eunsook Lim, JungNam Jun, Min-A Kim

Korea Aerospace Research institute

[P-54] Incremental Learning and Error Correction for Enhanced Automated Cloud Detection in LEO Satellite Imagery Catalogs

JiHyeon Yim, GuHyeok Kim, Min-A Kim

Korea Aerospace Research institute

[P-55] Development of a Web-Based Ordering and Distribution System to Enhance Accessibility of Satellite Data

Gabho Jeun, Myungjun Lee, Jaeung Han, Mina Kim

Korea Aerospace Research Institute

[P-56] Analysis of the Secondary Mirror Despace Sensitivity for the CAP-W Payload of CAS-4 Satellite

Dae-Jun Jung[1], Jong-Un Kim[2], Sang-Gyu Lee[1]

[1]*Korea Aerospace Research Institute*
[2]*SATREC INITIATIVE*

[P-57] A Comparative Analysis of Spatio-Temporal Processing Capabilities in Temperature Prediction Models Using GK2A Satellite Imagery: LSTM vs. Transformer

Jun-Yeob Choi

National Meteorological Satellite Center (NMSC)

[P-58] Analysis of Seasonal Variations in GK-2A AMI MWIR Channel-to-Channel Image Registration Over Two Years

Sungsik Huh

Korea Aerospace Research Institute

▶ 미소중력실험

[P-59] Airflow Analysis Study on Oxygen Supply to Air Conditioning and Ventilation Unit in Subsea Structures

Younkyu Kim, Joohee Lee

Korea Aerospace Research Institute

▶ 우주생물학

[P-60] System Design of Lunar Infrared Spectrometer, Gamma-Ray Spectrometer and Neutron Spectrometer for Future Korean Lunar Exploration

GyeongRok Kwon[1,2], Kyeong Ja Kim[1,2]

[1]*Korea Institute of Geoscience and Mineral Resources*
[2]*Resource Engineering, Korea National University of Science and Technology*

▶ 우주감시

[P-61] System Architecture and Preliminary Results of the Module Operational Test for the KEPLER System

Hye-Young Kim[1], Eun-Jung Choi[1,2], Jung Hyun Jo[1], Ki Pyoung Sung[1], Hosik Kam[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

[P-62] A Study on the Impact of Artificial Satellites on Astronomical Observations

Sang Hyun Lee[1,2], Inyeong Jang[3], Eunbi Yi[3], Eunsoo Jung[4], Yejin Choi[4], Jiwan Woo[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*Department of Semiconductor Physics and Engineering, University of Ulsan*
[3]*Department of Physics, University of Ulsan*
[4]*Busan Science High School*

[P-63] Introduction to the Hosted Payload Program of a Satellite Navigation System for Space Domain Awareness

Deok Won Lim, Dea Ho Ko, Jung Pyo Kim
Korea Aerospace Research Institute

▶ 안보우주

[P-64] Aircraft and Satellite EMP Requirements and Test Overview

Hyung-Uk Kim, Yun-Goo Huh, Dong-Chul Chae
Korea Aerospace Research Institute

[P-65] Applying Zero-Trust Architecture to Satellite Flight Software

Hyun-Kyu Shin
Korea Aerospace Research Institute

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▶ 초소형위성

[P-66] Establishment of Early Operation Procedure for Low Earth Orbit Satellite

Chiho Kang
Korea Aerospace Research Institute

[P-67] Surface Charging in Low Earth Orbit: A CubeSat-Based Preliminary Study

Go Woon Na, Jongho Seon, Seo Hyun Park, Dong-Hun Lee
Kyung Hee University

[P-68] Routing Strategy for Satellite Constellation Networks

Sangseob Park, Inkyu Kim, Hyun-Su Lim
Korea Aerospace Research Institute

[P-69] Review on the Preliminary Design of Electrical Power Subsystem for Scalable Test Platform

Sungwoo Park, Sangman Moon, Sangtaek Lee
Korea Aerospace Research Institute

[P-70] Autonomous Relay-Based Navigation System for Satellite Constellations

Sang-Youn Shin, Yee-Jin Cheon
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[P-71] Considerations on Launch Early Operation Phase of Synthetic Aperture Radar Satellite

Jae-Min Shin
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[P-72] Feasibility Study on Small Satellite System Design Sustainable in VLEO Environment

Choon Woo Lee
Korea Aerospace Research Institute

[P-73] A Study on the Development Plan for Space Tug with Autonomy and Reusability (STAR)

Yee-Jin Cheon[1,2]
[1]*Korea Aerospace Research Institute*
[2]*University of Science and Technology*

[P-74] Design and Implementation of a Software-Defined Ground Station for Small Satellite Communications in VHF, UHF, and S-band

Myung-Gil Kim, Kang Toi Yoon, Je Guen Lee
SpaceK Inc

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[P-75] The Current Status of Korea LandSat (CAS500)

Deog-Gyu Lee, Young-Sun Kim, Eun-Soo Kang, Jin-Kwang Kim, Seung-Hun Ha
Korea Aerospace Research Institute

[P-76] A Study on the Application of DevSecOps for Space Applications

Yee-Jin Cheon[1,2]
[1]*Korea Aerospace Research Institute*
[2]*University of Science and Technology*

[P-77] Specific Applications of Storable Bipropellant Propulsion Engine

Cho Young Han

Korea Aerospace Research Institute

[P-78] Comparison of North-South Station-Keeping Strategies and Inclination Control Performance in Geostationary Satellites

Ha Eun Kim[1], Bong Kyu Park[2]

[1]*LIG Nex1*

[2]*Korea Aerospace Research Institute*

[P-79] Analysis of the Characteristics of Line Impedance Stabilization Network (LISN) for EMC Testing of Satellite Electrical Components

Sangrok Lee, Tae-Youn Kim, Jae-Woong Jang, Kyung-Duk Jang, In-sang Yu, Chang-Eun Lee

Korea Aerospace Research Institute

[P-80] Design Considerations for Focal Plane Units in High-Resolution Wide-Swath Satellite Camera

Youngyun Kim, Youngsun Kim, Kihoon Seo, Il-seop Lee, Jinkwang Kim

Korea Aerospace Research Institute

[P-81] Design of Solar Array Simulator System for Testing Satellite Power Systems

Seung-Won Cho, Yun-Goo Huh

Korea Aerospace Research Institute

[P-82] A Case Study on Integrated Design and Visualization of a Web-Based Satellite Operations Support Platform

Seo-Yoon Jeong, Yeong-Ju Park, Yeong-il Kim, Geun-Seok Song, Kyung-Ju Min

Intelligent Operations, I-OPS

[P-83] Assessment of MTF Loss in Electro-Optical Cameras Induced by Optical Distirtion

Jeoung-Heum Yeon, Young-Sun Kim

Korea Aerospace Research Institute

[P-84] Assembly and Alignment Configuration Design of the Earth Observation Camera for the Next Generation Medium Satellite

Won-Beom Lee, Deog Gyu Lee

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[P-85] Design Modifications to the Next-Generation SAR Satellite Resulting from Launch Vehicle Change

Hong Won Park

Korea Aerospace Research Institute

[P-86] Research on the Efficient Operation Design and Verification Method of an Acquisition Data Transmission System for the Effective Mission Performance of Satellite Payloads

Jong-Euk Park, Haeng-Pal Heo

Korea Aerospace Research Institute

[P-87] A Method of Processing Satellite Electrical Test Data based on Probability Theory

Kyung-Keun Kim

Korea Aerospace Research Institute

[P-88] Contamination Measurement and Verification of Black Anodized Specimens in Thermal Vacuum Test

KyuMin Oh, Sung-Wook Park, SunKi Baek, Sung-Wook Park, KeunShik Kim, Hee-Jun Seo, Ji-Seok Kim, Ji-Hoon Choi, KyuMin Oh, SeungMo Hong

Korea Aerospace Research Institute

[P-89] Preparation and Verification Method at ETB/FM Test Level for Establishing Satellite IAC Procedures

Bosung Kim, Junho Lee, Juhwang Kim, Jongjin Jang, Hyunseok Seo

Department of Satellite Research, KAI, Co., Ltd.

[P-90] A Study on the Design of Payload Data Transmission System for CAS500-5

Eun Su Kang, Sang Burm Ryu, Sang Gyu Lee

Korea Aerospace Research Institute

[P-91] GEO-KOMPSAT-3 Launch Window Analysis

Bong-Kyu Park[1], Mi-Ri Shin[1], Myeung-Un Kim[1], Ha-Eun Kim[2]

[1]*Korea Aerospace Research Institute*
[2]*LIGNex1*

[P-92] Analysis of ETB Results for AOCS FDIR of the GEO-KOMPSAT3

Woo Yong Kang, Hanwoong Ahn

Korea Aerospace Research Institute

[P-93] Low-Resolution Image Generation Method Using MTF-Based Filter for Super-Resolution Image Reconstruction of Electro-Optical Payloads

Ki-Hoon Seo, Youngsun Kim, Youngyun Kim, Ilseop Lee, Jin Gwang Kim

Korea Aerospace Research Institute

[P-94] Introduction to the Fault Management Test Plan Using the Electrical Test Bed (ETB) for the Geostationary Public Multipurpose Communication Satellite

Chang-kwon Cho[1], Taehyun Kim[2]

[1]*Korea Aerospace Research Institute*
[2]*LIG Nex1*

[P-95] Performance Analysis Using DQM/DQE and MLBD (Maximum Likelihood Bit Detection) in NARO Space Center Telemetry Environments

Na-Gyun An[1], Chun-Won Kim[1], Doug-Hyun Kim[1], Young-Kyun Cho[2]

[1]*Korea Aerospace Research Institute*
[2]*Chungam National University*

[P-96] Performance Validation of the Ground Telemetry System at Naro Space Center through Integrated Interoperability Test

Jina Ma, Nagyun An, Soonho Kwon, Donghyun Kim

Korea Aerospace Research Institute

[P-97] Analysis for Rubidium Atomic Frequency Standard Frequency Stability of the End of Life through Initial RF Signal

Su-Hyeon Kim

Korea Aerospace Research Institute

▶ 우주 인프라

[P-98] KARI's Medium-Sized Thermal Vacuum Chamber Failure Case Study

Sung-wook Park

Korea Aerospace Research Institute

[P-99] BIRD: Build It Right, Dude (Flight Software Build Script)

Su-Hyun Park

Korea Aerospace Research Institute

[P-100] Design Concept of EGSE for Verification of Selected Satellite Avionics

MinJun Kim, Seung-Won Cho, Yun-Goo Huh

Korea Aerospace Research Institute

[P-101] Development Results of a Low Earth Orbit (LEO) Satellite Mission Planning Verification and Operation Situation Display System

Sunju Park[1], Yoonju Yo[2], Jongcheoi Choi[2], Youngil Kong[2]

[1]*Korea Aerospace Reserach Institute*
[2]*HANCOM InSpace*

[P-102] A Study on the Establishment and Operation of a Satellite Development Data Management System Based on the Zero Trust 2.0 Model

Chul Kang

Korea Aerospace Research Institute

[P-103] Input Load Analysis of Sinusoidal Vibration Testing of Satellite Systems Using Force Sensors

Hee-Kwang Eun, Nam-Jin Moon, Seon-Je Jo, Jin Park, Chang-Rae Cho, Sung-Hyun Woo

Korea Aerospace Research Institute

[P-104] Conceptual Design of an Adjustable Satellite Shock Test System

Jong-Hyub Jun, Jong-Min Im, Hee-Kwang Eun, Nam-Jin Moon, Seon-Je Jo, Jin Park, Chang-Rae Cho, Tae-Seok Oh, Sung-Hyun Woo
Korea Aerospace Research Institute

[P-105] Container Internal Monitoring System for K6/K7 Shipping

Ji-Seok Kim, Sang-Hoon Lee, Sang-Won Lee, Ju-Hyun Kim
Korea Aerospace Research Institute

[P-106] Modeling and Analysis of Transient Phenomena During Satellite Power-On

Suwan Bang, Yungoo Huh
Korea Aerospace Research Institute

[P-107] Proposal for Witness Plate Installation Location Criteria for Satellite Thermal Vacuum Test Contamination Measurement

Seungmo Hong, Sungwook Park, Gyumin Oh, Jihoon Choi
Korea Aerospace Research Institute

[P-108] Influence of Circulating Nitrogen Density on Shroud Surface Temperature Uniformity under High Vacuum Conditions

Keun-Shik Kim, Ji-Seok Kim, Sung-Wook Park, SunKi Baek, Hee-Jun Seo, Ji-Hoon Choi, KyuMin Oh
Korea Aerospace Research Institute

[P-109] A Study on AI-Based Operation Methods for Thermal Vacuum Chamber

Hee-Jun Seo
Korea Aerospace Research Institute

[P-110] Comparative Analysis of Integration Strategies for Satellite Ground Stations

Gyeoul Lee, Hyunchul Baek
Korea Aerospace Research Institute

[P-111] Privacy-Preserving Centralized Learning Framework for Satellite Data Across Multi-Ground Station Environments

Jaehyoung Park, Hyunchang Lee, Jungsik Choi, Hyunchul Baek, Okchul Jung
Korea Aerospace Research Institute

[P-112] A Study on Necessity of Integrated Satellite Control through Overseas Cases

Hyun-Chul Baek, Gyeoul Lee
Korea Aerospace Research Institute

[P-113] Comparision of the Advantages and Disadvantages of Integrated and Individual Controls for Operating Multi-Satellites

Hyun-Chul Baek, Gyeoul Lee
Korea Aerospace Research Institute

[P-114] Development of an Integrated Image Collection Planning Function for LEO Optical Payloads

Jung-Nam Jun, Eun-Suk Lim, Min-A Kim
Korea Aerospace Research Institute

[P-115] Comparative Analysis of FDIR in Geostationary Satellites

Taehyun Kim[1], Chang-Kwon Cho[2], Sujeong Kim[1]
[1]*GEO-Satellite System Engineering Team, LIG Nex1*
[2]*Korea Aerospace Research Institute*

[P-116] Reliability Prediction of Satellites Considering Ground Operations and Storage

Seoyoon Lee, Guen-Young Park
Korea Aerospace Research Institute

[P-117] Design and Results of the Ground Segment Integrated Test for KOMPSAT Operation

Jun-Yeong Bok, Dong Oh Kim
Korea Aerospace Research Institute

[P-118] Study on Automated Management Methods for Requirements Discrepancies in the Aerospace Industry

Cheol-Su Shin, Dai-Ho Ko, Joong Pyo Kim
Korea Aerospace Research Institute

▶ SS: GCR 측정 실험 및 측정 기술

[P-119] Measurement of Cosmic-Ray Neutron Spectrum on the Ground Using a High-Sensitive Neutron Spectrometer

Young Soo Yoon, Joong Hyun Kim, Jungho Kim, Hyeonseo Park, Sinchul Kang

Korea Research Institute of Standards and Science

▶ SS: 달 착륙선을 위한 월면 탐사 임무

[P-120] Towards Realistic Lunar Rover Exploration: An Integrated Rover-Simulator Framework

Sumin Lee, Minseok Song, Suwan Lee, Seokju Lee

Korea Institute of Energy Technology

[P-121] Emerging Power and Electrical System Technologies for Lunar Exploration Rovers and Landers

NaYoung Lee[1], Jaeseon Yu[2], Changseup An[2]

[1]*Hyundai Motor Company, Lproject Team*
[2]*Hyundai Motor Company*

[P-122] Lunar Science Exploration Mission Concept for Lunar Landers

Chae Kyung Sim[1,2], Sunjin Kim[3], Sunghwan Kim[4], Woojin Kim[1,2], Uk-Won Nam[1], Dongseok Ryu[2,3], Sung-Joon Park[1], Jaeheung Park[1,2], Nikolay Vedenkin[5], Seul-Min Baek[1], Bongkon Moon[1,2], Woohyeong Seol[1], Sung-Joon Ye[6], Seungkyun Ryu[7], Sukwon Youn[6], Dae-Young Lee[8], Dae-Hee Lee[1,2], Eunji Yi[1,2], Janggeun Lee[2,9], Jaeho Lee[10], Hyung-Kwon Lee[11], Minsup Jeong[1], Taeil Chung[9], Namsuk Cho[10], Young-Jun Choi[1], Jeong-Yeol Han[1,2], Jintae Hong[3]

[1]*Korea Astronomy And Space Science Institute (Kasi)*
[2]*University Of Science And Technology (Ust)*
[3]*Korea Atomic Energy Research Institute (Kaeri)*
[4]*Cheongju University*
[5]*Kairospace*
[6]*Seoul National University*
[7]*Im Technology*
[8]*Korea Advanced Institute of Science And Technology (Kaist)*
[9]*Korea Institute of Civil Engineering And Building Technology (Kict)*
[10]*Unmanned Exploration Laboratory (Uel)*
[11]*Leospace*

[P-123] Concept Design of Lunar Surface Infrared Spectrometer (LSIS) for Lunar Landers

Chae Kyung Sim[1,2], Sung-Joon Park[1], Woojin Kim[1,2], Dae-Hee Lee[1,2], Bongkon Moon[1,2], Minsup Jeong[1], Young-Jun Choi[1], Dukhang Lee[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*

[P-124] Multi-Criteria Evaluation of Lunar Pit Craters as Landing Site for Future Missions

Eunji Yi[1,2], Chae Kyung Sim[1,2], Minsup Jeong[1]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*

▶ SS: 국제 달 착륙선을 통한 과학 탐사 임무

[P-125] Predicting Electron Cutoff Energies for LUSEM Pre-Landing Observations at Reiner Gamma Using Geant4 Simulation

Sung-Jin Kim, Jongho Seon, Ensang Lee, Go Woon Na, Dongseok Yun, Hyeonhu Park, Beom-Su An

Kyung Hee University

[P-126] SurfCam Data Processing: Initial Tests with the Engineering Qualification Model

Mingyeong Lee[1], Minsup Jeong[1], Woojin Kim[1,2], Yunjong Kim[1,2], Bongkon Moon[1,2], Jihun Kim[1,2], Sung-Joon Park[1], Seonghwan Choi[1], Dae-Hee Lee[1,2], Dukhang Lee[1,2], Chae Kyung Sim[1,2], Seul-Min Baek[1], Jehyuck Shin[1], Sungsoo S. Kim[3], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Kyung Hee University*

[P-127] Operational Overview of K-RadCube in the Launch and Early Orbit Phase (LEOP)

Donguk Song[1], Chae Kyung Sim[1,2], Dukhang Lee[1,2], Jehyuck Shin[1], Young-Jun Choi[1], Seul-Min Back[1], Uk-Won Nam[1], Woo-Hyeong Seol[1], Won-kee Park[1], Kwangwon Lee[3], Hyojeong Lee[3], Seongwhan Lee[3], Taewan Kim[4], Hyeonggu Kim[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Nara Space Technology Inc.*
[4]*KT SAT*

[P-128] Assembly and Performance Verification of the GrainCams Optical System

Woojin Kim[1,2], Bongkon Moon[1,2], Dukhang Lee[1,2], Dae-Hee Lee[1,2], Minsup Jeong[1], Jihun Kim[1,2], Sung-Joon Park[1], Yunjong Kim[1,2], Seonghwan Choi[1], Jehyuck Shin[1], Seul-Min Baek[1], Mingyeong Lee[1], Chae Kyung Sim[1,2], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*

▶ 학부생 세션

[P-129] Development of a Portable Long-Slit Spectroscopic System for Faint Astronomical Sources

Dohee Kim[1], Yeojin You[1], Chanmin Park[1], Dayoung Byun[1], Heesu Yang[2]

[1]*Chungnam National University*
[2]*Korea Astronomy and Space Science Institute*

[P-130] Development of a Viewer Program for Imaging Spectrograph Data

Taejun Kim[1], Heesu Yang[2]

[1]*Korea Astronomy Research Institute*
[2]*Dankook University*

[P-131] Development of a Portable Single-Slit Spectrometer

Yoo-Chan Baek[1,2], Heesu Yang[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Ajou University*

[P-132] High-Time-Resolution Solar Spectroscopy Targeting the Na D and Hα Lines

Hyunsoo Lee, Sanghoon Lee, Jieun Choi, Shinhoe Heo

[P-133] Height-Dependent Velocity Distribution in Ellerman Bombs

Subin Jung[1], Heesu Yang[2], Maria S. Madjarska[2,3,4]

[1]*Department of Astronomy and Space Science, Chungnam National University*
[2]*Korea Astronomy and Space Science Institute (KASI)*
[2]*Max Planck Institute for Solar System Research, Germany*
[4]*Space Research and Technology Institute, Bulgarian Academy of Sciences, Bulgaria*

[P-134] Temporal Evolution of Flare Ribbon Fine Structures Using Imaging/Spectroscopic Observation

Ye-Eol Jin[1], Heesu Yang[2], Maria S. Madjarska[2,3,4]

[1]*Department of Astronomy and Space Science, Chungnam National University*
[2]*Korea Astronomy and Space Science Institute (KASI)*
[3]*Max Planck Institute for Solar System Research, Germany*
[4]*Space Research and Technology Institute, Bulgarian Academy of Sciences, Bulgaria*

[P-135] Spectroscopic Observations of Solar Filaments with a Custom-Built Spectrograph

Min-kyu Kim[1], Ye-Eol Jin[1], Yudam Kim[1], Subin Jung[1], Minju Cha[1], Heesu Yang[2]

[1]*Department of Astronomy and Space Science, Chungnam National University*
[2]*Korea Astronomy and Space Science Institute (KASI)*

[P-136] Determining the Minimum Spectral Resolution to Reduce Physical Information Loss in Filter-Based Imaging Spectroscopy through Statistical Error Analysis

Uijin Gu[1], Eun-kyung Lim[2], Donguk Song[2], Yong-jae Moon[3,4]

[1]*Department of Astronomy and Space Science, Chungnam National University*
[2]*Korea Astronomy and Space Science Institute*
[3]*School of Space Research, Kyung Hee University,*
[4]*Department of Astronomy and Space Science, Kyung Hee University*

▶ 우주탐사

[P-137] Electromagnetic Compatibility and Electrostatic Discharge Evaluation for Satellite Systems: Requirements, Testing, and Design Strategies

Kwangho Lee

Korea Aerospace Research institute

[P-138] The Conceptual Design of the Payload Interface Unit for Navigation Satellite

Gwangho Choi, Yun-Ki Lee, Joong-Pyo Kim, Dai Ho Ko

Korea Aerospace Research institute

구두발표 논문 초록

10월 29일(수) Landing Ballroom A

Invited Talk I

Chair: 조경석(천문연)

13:20 [IS-1]

Dare Mighty Things

Richard Cook

NASA/JPL

Since its founding in 1938, NASA's Jet Propulsion Laboratory (JPL) has been at the forefront of robotic space exploration, developing pioneering missions that have reshaped our understanding of the Earth, the solar system, and the universe beyond. In this plenary talk, Richard Cook, Director for Strategy and Formulation at JPL, will reflect on the laboratory's remarkable legacy of achievements and highlight how international partnerships have been central to these successes. The presentation will explore JPL's contributions across multiple scientific frontiers. In Earth science, JPL continues to deliver critical observations that help us monitor climate, natural disasters, and the health of our planet. In astrophysics and heliophysics, JPL missions are probing the origins of the universe, the nature of black holes, and the dynamics of the Sun's influence on the solar system. Planetary science efforts—from the Moon to Mars and beyond—are enabling new discoveries about planetary formation, the potential for life elsewhere, and humanity's future in space exploration. The talk will also address advances in communications infrastructure through the Deep Space Network, which continues to provide the backbone for exploration across the solar system and into interstellar space.

Guided by the ethos of "Dare Mighty Things,"Richard Cook will illustrate how JPL translates bold scientific visions into reality. He will share examples of how missions have been successfully formulated and implemented through innovative partnerships with academia, industry, and international collaborators. Looking ahead, the talk will discuss how these partnerships and strategies are shaping the next generation of exploration missions.

Landing Ballroom A

Invited Talk II

Chair: 박종욱(천문연)

13:50 [IS-2]

Exploring Cosmic Rays from Space: Unexpected Findings and Emerging Questions

Eun-Suk Seo

University of Maryland

Cosmic rays, high-energy messengers that constantly reach Earth from space, continue to challenge our understanding of the universe. With unprecedented precision, recent measurements have revealed puzzling features, including an unexpected excess of high-energy positrons and a striking bump in the elemental spectra. Space missions such as AMS-02, CALET, DAMPE, and ISS-CREAM are not only reshaping our understanding of how cosmic rays are accelerated and travel through the galaxy, but they also offer a potential avenue for shedding light on the elusive nature of dark matter. In this presentation, I will highlight recent discoveries from these missions, reflect on the questions that still challenge us, and look ahead to the exciting possibilities that lie on the horizon for space exploration.

Landing Ballroom A

I-1 안보우주 I

Chair: 송영범(천문연)

16:20 [I-1-1]

Numerical Analysis of Propagation of Laser Beams Through the Atmosphere: Modeling and Analysis

Eojin Kim[1], Gwibong Kang[1], Ki-Pyung Sung[1], Sung-Yeol Yu[1], Jinhyeok Choi[2], Eunyeong Kim[2], Jongwon Yu[2], Jaemin Kim[2], Yun Gon Lee[2]

[1]*KASI*

[2]*Chungnam National University*

Lasers, characterized by their high collimation and focus, are indispensable tools in a broad spectrum of scientific and industrial domains. Their applications have progressively expanded to include precision measurement, medical diagnostics and treatment, optical communications, and defense technologies, enabled by distinctive properties such as monochromaticity, coherence, and directionality. Nevertheless, as laser beams propagate through free space, they are subject to energy

attenuation and phase perturbations arising from absorption, scattering, refraction, diffraction, and atmospheric turbulence. These atmospheric effects are particularly pronounced for coherent laser systems, with turbulence inducing wavefront distortions that degrade transmission efficiency and measurement accuracy. Moreover, molecular absorption by water vapor and aerosols at specific wavelengths exacerbates signal degradation. Consequently, a rigorous understanding and mitigation of atmospheric propagation effects are essential for advancing laser-based applications. In this study, we investigate the evolution of a laser beam's wavefront as it propagates vertically through the atmosphere, employing atmospheric profile data in conjunction with the MODTRAN radiative transfer model to characterize altitude-dependent influences on laser transmission.

16:35 [I-1-2]

Conceptual Design and Prototype Tests of Disposable Deorbiter for Active Debris Removal

Min-Ki Kim

Korea Aerospace Research Institute

Active space debris removal (ADR) is essential for maintaining space environment and sustaining space development. This paper introduces novel concept of active space debris removal technique. Conventional ADR is that cleaner satellites capture the debrice and remove them by falling themselves into the Earth. It means that cleaner satellite is inefficiently used in only one time to remove the debris. This work is developing the prototype of disposal deorbiter for ADR. According to the proposed scenario, a range of deorbiters are carried by the cleaner satellite. Cleaner approaches to the target debris, then a deorbiter grap the debris and cleaner departs to next target. Deorbiter consists of three components, first is the sail deployment part and the other two are capture mechanisms. In this paper, basic concepts of proposed ADR and design of the deorbiter prototypes.

16:50 [I-1-3]

SPACEMAP Capability for K-SDA/STM: Algorithms, Services, and SpaceTube

Shawn Choi[1], Hyeonoh Hur[1], Alina Shymanska[2], Peter Ryu[1,3], Douglas Kim[1,3]

[1]*SpaceMap Inc.*
[2]*Hankuk University of Foreign Studies*
[3]*School of Mechanical Engineering, Hanyang University*

In recent years, the rapid growth in the number of satellites and cataloged debris objects has highlighted the need for Space Domain Awareness (SDA) and Space Traffic Management (STM), which are essential for ensuring the safety of space assets and for supporting international coordination. Currently, major space actors are developing STM systems, including TraCSS (United States), EUSST (European Union), Milky Way (Russia), and NETRA (India). China and Japan are also pursuing STM initiatives, though public details remain limited. Against this backdrop, we need to evaluate developing Korea's own STM system (K-STM) to ensure the safety of space assets and enhance the competitiveness of Korea's space industry. Doing so would also strengthen standing in international cooperation of Korea, such as standardization and norm-setting discussions in space-related fields. This presentation provides a brief overview of SPACEMAP's current capabilities toward developing K-SDA/STM.

17:05 [I-1-4]

Severe GNSS Signal Disturbances over Korean Peninsula during Geomagnetic Storm

Junseok Hong[1], Byung-Kyu Choi[1], Jong-Kyun Chung[1], Woo Kyoung Lee[1], Hyosub Kil[1,2], Hyuck-Jin Kwon[3]

[1]*Korea Astronomy and Space Science Institute*
[2]*Johns Hopkins University Applied Physics Laboratory*
[3]*Korea Polar Research Institute*

Most modern equipment, for both civil and military applications, relies indispensably on the Global Navigation Satellite System (GNSS) for timing and positioning. While the convenience of GNSS is a significant advantage, its performance is subject to a variety of error sources, among which the ionosphere is the most prominent factor. The mid-latitude ionosphere is generally more stable than its low- and high-latitude counterparts. In mid-latitude regions, irregularities in ionospheric electron density are quite rare and, when they do occur, are usually of small magnitude, making ionospheric error correction relatively straightforward. In particular, both ground-based and satellite-based augmentation systems are able to correct ionospheric effects in near-real time, with even higher availability at mid-latitudes. This offers a clear advantage to users in these regions, as they are generally less affected by ionospheric errors. However, severe GNSS signal disruption was observed over the Korean Peninsula on November 5, 2023. In this unusual case, strong GNSS signal fades were detected across all GNSS constellations, including augmentation systems, originating from intense ionospheric electron density fluctuations over the Asian sector due to a geomagnetic storm. In contrast, the ionosphere over the American and European sectors remained undisturbed. This event demonstrates that the mid-latitude ionosphere can also become highly disturbed under specific geomagnetic conditions, and users should be aware of the potential for such natural hazards to impact GNSS-based systems. In this presentation, we will introduce the severe case of GNSS signal disturbance over the Korean Peninsula and discuss possible underlying mechanisms.

17:20 [I-1-5]

INNOSPACE's HANBIT: A Small Satellite Launch Solution

Young-Il Park, Tae Seung-Kuk, Kyoungjin Woo, Hun Jung, Soojong Kim

INNOSPACE Co., Ltd.

This paper introduces INNOSPACE's small satellite launch vehicles and discusses the company's commercialization progress. INNOSPACE, founded in 2017, is a South Korean aerospace company specializing in dedicated launch services for small satellites. The company is currently developing the HANBIT series of launch vehicles powered by hybrid rocket engines, aiming to provide innovative launch services characterized by low latency, cost efficiency, and high reliability. INNOSPACE has successfully conducted a stage-level qualification test of the HANBIT-NANO at its independently established Goheung Comprehensive Test Facility. Furthermore, in the second half of 2025, the HANBIT-NANO is scheduled to be launched from the Alcantara Launch Center in Brazil, marking the first mission by a Korean enterprise to deploy five small satellites and three types of navigation payloads.

17:35 [I-1-6]

Development of DaejeonSat-1: A City-Participatory Optical Earth Observation Mission for Daejeon Metropolitan City

Hyun-Ung Oh[1,2], Tae-Yong Park[1], Bong-Geon Chae[1], Chi-Hwa Song[3]

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[2]*Korea Aerospace University*
[3]*Daejeon Technopark*

DaejeonSat-1 is a 16U CubeSat system development project funded by local government of Daejeon city. The STEP Lab led the entire system development process with a consortium of local companies in the space sector. The primary mission objective is to develop and operate a 16U CubeSat system to acquire 1-meter resolution panchromatic and color imagery of Daejeon city. This project aims to generate educational, public, and social value through a city-participatory mission that aligns with Daejeon's vision of becoming a space industry cluster. In addition, STEP Lab and companies involved in this consortium will demonstrate their development capabilities for small satellite systems and secure space heritage for four key proprietary technologies: an electro-optical camera, a satellite selfie camera, high-damping deployable solar panels, and a space-grade high-capacity memory. DaejeonSat-1 is scheduled to be launched in 2026 by the KSLV-II FM5, and deployed from a 16U satellite deployer developed in-house by STEP Lab. This paper describes the overall system development status of DaejeonSat-1 and outlines future plans, including the utilization of satellite data.

Landing Ballroom B

I-2 우주탐사 I

Chair: 김은혁(항우연)

16:20 [I-2-1]

Key Calibration Outcomes and Preliminary Global Maps of the Moon from Danuri/PolCam

Kilho Baek[1], Sungsoo S. Kim[1], Minsup Jeong[2]

[1]*Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*

South Korea's first lunar orbiter, Danuri, carries the wide-angle Polarimetric Camera (PolCam), an instrument with the unprecedented objective of conducting the first-ever global polarimetric survey of the entire lunar surface. Its initial two-year nominal phase, concluded in February 2025, was dedicated to systematically mapping the lunar surface from a 100 km orbit across ± 70° latitude in polarized light. The calibration of PolCam's raw data into scientifically meaningful products is accomplished through a comprehensive data processing pipeline. We focus here on the three key calibration processes: the mitigation of smear artifacts, the estimation of the camera model, and geometric correction to produce orthorectified images. The successful implementation of these calibration processes has led to the creation of the first global lunar map from a South Korean mission. This achievement provides a significant technical foundation for the mission's ultimate goal to create the world's first global polarimetric map of the Moon.

16:35 [I-2-2]

Lunar Swirl Studies with Danuri/PolCam: Polarimetric Analysis of Reiner Gamma Swirl

Minsup Jeong[1], Kilho Baek[2], Sungsoo S. Kim[2], Young-Jun Choi[1,3]

[1]*Korea Astronomy and Space Science Institute*
[2]*Kyung Hee University*
[3]*University of Science and Technology*

The Korea Pathfinder Lunar Orbiter (KPLO, Danuri) has successfully operated in lunar orbit for more than three years, carrying the Wide-Angle Polarimetric Camera (PolCam), the first dedicated polarimetric instrument at the Moon. In this presentation, we report results from PolCam observations focusing on lunar swirls, with particular attention to the Reiner

Gamma region. Lunar swirls are enigmatic high-albedo, sinuous surface features whose formation has been linked to local magnetic shielding, cometary impact processes, and dust transport dynamics.
PolCam measurements reveal characteristic correlations between albedo, grain size, phase ratio, and degree of polarization, enabling us to assess the surface scattering properties of the Reiner Gamma swirl. Our results indicate that high albedo regions correspond to enhanced multiple scattering by fine grains, while phase ratio-polarization analyses provide constraints on regolith texture and dust depletion in swirl interiors.
These findings demonstrate the power of orbital polarimetry in distinguishing swirl surface properties and contribute to resolving long-standing debates on their origin and evolution.

16:50 [I-2-3]

Time-Series Data Correction of Korea Pathfinder Lunar Orbiter (KPLO) Gama-Ray Spectrometer (KGRS)

Ik-Seon Hong[1], Suyeon Kim[1], Kyeong Ja Kim[1,2]

[1]*Korea Institute of Geoscience and Mineral Resources*
[2]*Korea National University of Science and Technology*

The Korea Pathfinder Lunar Orbiter (KPLO) Gamma-Ray Spectrometer (KGRS) is Korea's first lunar surface resource exploration payload. GRS data include non-scientific information in addition to lunar observation information, so reduction and correction are necessary to analyze the lunar surface scientifically. Data subject to correction includes solar events, high-energy events, satellite attitude, and abnormal data. The solid angle correction is the process of adjusting the solid angle of KGRS to account for changes in satellite altitude. The galactic cosmic-ray (GCR) correction uses the oxygen@6.129 MeV as a GCR proxy in the gamma-ray spectrum observed above 85° north latitude to remove the trend of gamma-ray count rate. Finally, the background spectrum removal is performed. An abundance map in the thorium@2.614 MeV is created to validate the reduction and correction results. It was also confirmed that the result was similar to thorium abundance maps produced by previous GRS missions. If the quality of KGRS is guaranteed, the 2-year observation time will be an advantage.

17:05 [I-2-4]

Initial Results of In-Orbit Temperature Calibration of the KPLO Magnetometer

Yesun Ahn[1], Ho Jin[1], Hyeonhu Park[1], Yunho Jang[1], Khan-Hyuk Kim[1], Ian Garrick-Bethell[2]

[1]*Kyung Hee University*
[2]*University of California, Santa Cruz*

The Korea Pathfinder Lunar Orbiter (KPLO) was launched at August 4, 2022, and KPLO Magnetometer (KMAG) is measuring the magnetic field of the Moon for about 2.5 years. KMAG aims to support scientific objectives such as studies of the lunar crustal magnetic field and structure of the lunar interior. To enable these scientific studies, in-orbit calibration of the magnetometer is essential.
Calibration methods include offset determination, noise reduction, and thermal calibration. Since the measured data includes various noises, we apply several methods to remove these fields. After the launch, zero level offset determination and periodical noise removal methods are used for in-orbit calibration. Following this, temperature calibration is work in progress, which is one of the critical procedure for the reliable data.
In this presentation, we introduce the initial methods and results of temperature calibration. We examine variations in the measured magnetic field caused by sensor temperature changes, and compare with the ground test results. Furthermore, we evaluate the impact of thermal calibration in comparison to the previous approach used for research-grade data generation.

17:20 [I-2-5]

Space Weathering at the Reiner Gamma Swirl: Insights from Unmixing

Marcel Hess, Eung-Seok Yi, Jae-Soo Lim, Kyeong-Ja Kim

Korea Institute of Geoscience and Mineral Resources

Introduction

Space Weathering describes the chemical and physical alteration of planetary surfaces due to the constant impact of micrometeorites and the solar wind [e.g., 1]. The solar wind consists of charged particles, mainly electrons and protons. The protons are implanted into the lunar surface and form OH/H_2O with the abundant oxygen in the top layer of the regolith [2, 3, 4]. Importantly, submicroscopic iron particles are created that lead to optical changes that influence almost every observation we make of the lunar surface. Consequently, understanding the processes that lead to the production of these iron particles and the exact changes introduced is essential for remote sensing applications. Lunar swirls are particularly interesting as they constitute a real world laboratory for space weathering. These swirls are bright albedo features that appear less space weathered than the surrounding terrain [e.g., 5]. Almost all swirls are co-located with magnetic anomalies, which are believed to be effective in reducing the solar wind influx and protecting the surface from some part of space weathering [e.g., 6]. However, the influx of micrometeorites is not affected by magnetic fields.

Methods

We use Moon Mineralogy Mapper (M^3) [7] level 1b data

calibrate the data photometrically and thermally [2]. We then calculate the OH integrated band depth (OHIBD) of the 3,000 nm absorption band diagnostic for hydroxyl/water for each available observation of the region. Using this data we can evaluate the time-of-day dependent changes of OHIBD. Furthermore, we calibrate the spectra for usage of up to 2,500 nm wavelength, where we do not observe time-of-day dependent changes, using all observations of each pixel to reduce noise. This data are subsequently clustered into 64 representative centroid spectra. Which are then fed into the unmixing framework [8] to obtain mineral and iron particle abundances. Iron particles are modeled using the model of Wohlfarth et al., (2019) [9]. Nanophase iron (npFe) particles are modeled with a size of 10nm and the larger microphase iron (mpFe) particles are modeled using a diameter of 150 nm.

Results and Discussion

The diurnal variations of the OHIBD parameter are reduced at swirls indicated that the magnetic shielding is effective to reduce the influx of protons at the Reiner Gamma Swirl.
The unmixing shows strong differences between on-swirl and off-swirl npFe abundance. However, there is only a small difference in the abundance of the larger mpFe particles. The regional differences correlate with the magnetic field strength. We used a strong prior on the abundance of the mineral endmember ilmenite as the abundance is not well constrained in the VIS-NIR wavelength range. Despite this strong prior we see a reduced ilmenite abundance at swirl locations. However, there is no real mechanism that would explain a deficiency in ilmenite abundance. A possible alternative explanation is that other processes like a more compact surface or a different grain size influence the spectrum as well in addition to reduced space weathering.

Conclusion

The reduced diurnal variations in the OH/H_2O absorption band and the lower abundance of nanophase iron particles within the swirl confirm that magnetic shielding effectively reduces the influx of solar wind protons. The lack of a significant difference in microphase iron abundance between on-swirl and off-swirl regions might suggest that this larger-grained iron is primarily produced by micrometeorite impacts, a process not affected by the magnetic field. Our study also reveals an unexpected reduction in ilmenite abundance at the swirl locations, a result that cannot be easily explained by the current understanding of space weathering. This suggests that the distinct spectral signature of lunar swirls may be influenced by other factors, such as surface compaction or grain size, in addition to the reduced effects of space weathering.

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17:35 [I-2-6]

From the Moon to Mars and Beyond: Neutron Insights into Subsurface Water for Exploration Missions

Sang Woo Kim, Kyeong Ja Kim

Korea Institute of Geoscience and Mineral Resources

Introduction

The detection and utilization of water resources on planetary bodies have become central to the future of space exploration. On the Moon, water is a critical enabler of in-situ resource utilization (ISRU), serving as a source of drinking water, breathable oxygen, and rocket propellant. The ability to identify accessible water ice or hydrated deposits is also a prerequisite for the sustainable human presence envisioned in NASA's Artemis program and related international missions. Neutron spectroscopy, a technique sensitive to hydrogen abundance in planetary regolith, has played a crucial role in providing indirect evidence of water at the lunar poles. However, neutron measurements are fundamentally limited to probing the shallow subsurface, typically within about one meter in depth, and their interpretation strongly depends on assumptions regarding the spatial distribution of hydrogen.

Methods

In this study, we used Monte Carlo simulations with the GEANT4 toolkit to model neutron leakage from lunar regolith under galactic cosmic ray (GCR) irradiation. Four representative hydrogen distribution scenarios were considered: (1) uniformly hydrated regolith, (2) discrete shallow or buried hydrogen-rich layers, (3) depth-dependent gradient profiles, and (4) localized lens-type deposits. Neutron fluxes were recorded in thermal, epithermal, and fast energy ranges, and variations in cosmic ray spectra reflecting solar modulation conditions were incorporated to evaluate environmental effects.

Results

The simulations reveal robust qualitative patterns:

1) Even modest hydrogen concentrations lead to a suppression of epithermal neutrons and a corresponding enhancement of thermal neutrons.
2) Shallow hydrogen deposits within the top tens of centimeters produce the strongest neutron moderation signatures, while deeply buried layers yield weaker signals.
3) Gradient distributions concentrated near the surface are more detectable than uniform cases with the same total hydrogen content.
4) Localized hydrogen deposits result in diluted neutron signatures when observed with coarse detector footprints, suggesting that orbital instruments may underestimate small-scale anomalies.
5) Solar cycle variations affect the absolute neutron flux magnitude but do not alter the diagnostic trends of hydrogen moderation.

Discussion

These findings demonstrate that neutron spectroscopy can provide constraints not only on the bulk hydrogen content of the regolith but also on the depth distribution and geometry of near-surface water within about one meter. While orbital neutron detectors have offered invaluable global maps, rover-based or lander-mounted neutron instruments could achieve higher spatial resolution and detect localized volatile deposits more effectively. Such an approach would be especially useful for future polar rover missions targeting permanently shadowed regions on the Moon, where water ice is expected to be heterogeneously distributed.

Broader Implications for Exploration

The methodology and results of this work are not limited to the Moon. Neutron spectroscopy can be applied to Mars, where near-surface hydrogen signatures have already been detected by orbiters, as well as to small bodies such as asteroids. On Mars, constraining the vertical distribution of shallow ice is directly tied to understanding climate history and evaluating accessible resources for human missions. For asteroids, neutron detection of hydrogen could identify hydrated minerals or volatile-rich deposits that are otherwise challenging to measure, providing insights into solar system evolution and potential ISRU opportunities.

Conclusions

Our simulations highlight the diagnostic power of neutron spectroscopy for detecting shallow hydrogen within planetary regolith. By probing approximately the top meter, neutron measurements can reveal both the abundance and distribution geometry of subsurface water. This approach offers crucial guidance for the design of future exploration payloads and strengthens the scientific and practical foundation for resource utilization in human and robotic missions—from the Moon to Mars and beyond.

Landing Ballroom C

I-3 태양 및 우주환경 I

Chair: 이경선(서울대)

16:20 [I-3-1]

Progress Report of the CODEX Mission

Yeon-Han Kim[1], Su-Chan Bong[1], Seonghwan Choi[1], Kyungsuk Cho[1,2], Jeffrey Newmark[3], Nicholeen Viall[3], KASI-NASA Coronagraph Team

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[2]*University of Science and Technology*
[3]*NASA Goddard Space Flight Center, USA*

The Coronal Diagnostic Experiment (CODEX) is a KASI-NASA-INAF joint project to develop a diagnostic coronagraph on the International Space Station, which is designed to obtain simultaneous measurements of the electron density, temperature, and velocity using multiple filters in the 2.75-10 Rs range. On November 5, 2024, CODEX was launched to the International Space Station aboard SpaceX's Dragon cargo ship from the Kennedy Space Center launch pad. Installation on the ISS was completed a week later, and after approximately two months of commissioning, it began normal operations in January. During 16 daily ISS orbits, narrow-band filter observations are performed to measure temperature and velocity of the coronal electrons, and occasionally dark images or broad-band filter observations are performed. Observation plans are typically prepared every three to five days. CODEX concluded operations at the end of September, including a three-month extension mission. The CODEX team is currently focusing on data release preparations and data analysis for scientific research, with data release scheduled to begin sequentially, starting with the L1 data.

16:35 [I-3-2]

Optical Design of Space Coronagraph based on Off-Axis Refelctive System

Dohoon Kim[1], Seunghyuk Chang[2], Changgon Kim[1,3], Nayeon Kim[1], Hojae Ahn[1], Hyukmo Kang[3], Daewook Kim[3], Kyohoon Ahn[4], Kyung-Suk Cho[4], Seong-Hwan Choi[4], Uk-Won Nam[4], Soojong Pak[1]

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[4]*Korea Astronomy and Space Science Institute*

We propose an optical design of a space coronagraph telescope. It can monitor coronal mass ejection (CME) events in 3 to 22 R_sun. Based on the linear astigmatism-free condition in the confocal off-axis reflective system, the field of view is 15° at

450–750 nm bands. Since the reflective system coronagraph does not contain lenses, there is no stray light from the lens surface. Furthermore, the off-axis reflective optical system is more advantageous than the on-axis reflective optical system in terms of preventing stray light. The aperture diameter of the system is 16 mm, and the focal length is 85 mm. The off-axis reflective mirror surfaces are optimized as freeform surfaces. The optical design shows a modulation transfer function (MTF) value of over 50% for 450–750 nm wavelength at the Nyquist spatial frequency. We also design an external occulter (EO). The locations and structure designs of EO are optimized by zeroth-order stray light analysis.

16:50 [I-3-3]

Jeju Volcanic Island Geomagnetic Observatory: Studying Magnetic Field Variations through Ground-Based Measurements

Sang Cheol Han, Jae-Hyung Lee, Jaehun Kim, Ji-Hoon Ha, Soojeong Jang, Wonhyeong Yi

Korea Space Weather Center, Korea AeroSpace Administration

During the solar maximum, enhanced solar activity has resulted in an increased frequency of geomagnetic storm alerts, amplifying the societal and technological risks posed by space weather. A notable example is the 2021 coronal mass ejection (CME) event, which caused disruptions in GPS signals and temporary power system instabilities across several regions, underscoring the necessity for reliable geomagnetic storm monitoring and warning systems. To address these challenges, Korea Space Weather Center (KSWC) has strengthened its forecasting and alert capabilities and established a new geomagnetic observatory on Jeju Island in December 2023. Owing to the volcanic characteristics of Jeju, the underground environment exhibits strong magnetic anomalies, making conventional underground installations unsuitable. Instead, the observatory was constructed above ground, comprising an absolute measurement facility, a scalar observation room, and a vector observation room. Preliminary data collected in 2024 satisfy INTERMAGNET membership standards, including maintaining an annual baseline variation within ± 5 nT, and demonstrated clear responses to G4-level geomagnetic storms. This study presents the performance of Jeju geomagnetic observatory, evaluates its capability to capture storm-time geomagnetic variations, and discusses its operational strategies and ongoing preparations for formal integration into the INTERMAGNET global network.

17:05 [I-3-4]

Current Status and Prospects of the Radio Blackouts (R) Forecast at Korea Space Weather Center

Soojeong Jang, Jae-Hyung Lee, Jaehun Kim, Ji-Hoon Ha, Sang Cheol Han, Wonhyeong Yi

Korea Space Weather Center, Korea AeroSpace Administration

Solar flares, measured by the GOES X-ray flux, affect the ionosphere and cause disruptions in various domains such as HF communication and aviation. Therefore, forecasting Radio Blackouts (R), which are associated with M-class and X-class flares, is an important component of space weather prediction. In this talk, we present the current status and future prospects of R forecasting at Korea Space Weather Center (KSWC). First, we briefly summarize the operational forecasting manual along with the space-based (e.g., soft X-ray flux, Magnetogram, and EUV image) and ground-based (e.g., F10.7 flux and H-alpha image) observations currently utilized for R forecasting. Second, we introduce KSWC's flare prediction models, which is based on ASSA and Solar Region Summary (SRS) data. We discuss possible improvements to the models by evaluating its accuracy over Solar Cycle 25.

17:20 [I-3-5]

Five-Year Review of Space Weather Observations from GK2A KSEM (2020–2024)

Daehyeon Oh, Eun-Jeong Cha, Hanbyul Lee, Euidong Hwang

National Meteorological Satellite Center, Korea Meteorological Administration

Since 2019, the Korea Meteorological Administration (KMA) has been operating the Korean Space Weather Monitor (KSEM) onboard the GEO-KOMPSAT-2A (GK2A) satellite, located at 128.2°E in geostationary orbit. KSEM provides continuous in-situ observations of energetic particles, geomagnetic field variations, and satellite charging conditions. These data have been widely used for both reference for real-time space weather alert services and scientific research. This presentation reviews five years of full-year KSEM data from 2020 to 2024, highlighting the key characteristics and operational insights gained over this period. Based on this long-term dataset and accumulated experience, we also discuss the design improvements planned for KSEM-II, the upgraded space weather payload to be launched on the upcoming GK5 satellite.

17:35 [I-3-6]

Performance Evaluation of Thermospheric Density Models under Quiet and Disturbed Space Weather Conditions

Jeong-Heon Kim[1], Young-Sil Kwak[1,2], Yongha Kim[3], GeonHwa Jee[2,4], In-sun Song[5], Woo-Kyoung Lee[1], Tae-Yong Yang[1], Eun Jeong Cha[6], Guk-hyeon Oh[6]

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[2]*University of Science and Technology*
[3]*Chungnam National University*
[4]*Korea Polar Research Institute*
[5]*Yonsei University*
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Accurate representation of thermospheric neutral density is essential for reliable predictions of satellite drag and orbital evolution. In this work, we present a comparative evaluation of widely used empirical and physics-based thermospheric density models, including MSIS 2.1 (Emmert et al., 2022), JB2008 (Bowman et al., 2012), Karman (Acciarini et al., 2024), and TIEGCM (Richmond et al., 1992). The assessment is conducted under two contrasting conditions: (1) quiet times across different solar activity levels, and (2) storm periods characterized by strong geomagnetic disturbances. For quiet conditions, we analyze model-derived densities at satellite altitudes to identify systematic biases and solar cycle dependence. During geomagnetic storms, we investigate spatio-temporal variations in thermospheric density, with particular attention to rapid enhancements and recovery phases. In situ density measurements from the Swarm and GRACE-FO missions serve as reference datasets for validation. The results provide quantitative metrics of model performance under diverse geophysical environments, highlighting strengths and limitations of each model. These findings offer guidance for improved thermospheric density modeling, with implications for orbit prediction and space situational awareness in operational contexts.

Halla Room

I-4 SS: GCR 측정 실험 및 측정 기술

Chair: 윤영수(표준연)

16:20 [I-4-1]

Detection Techniques and Instrumentation in the Telescope Array for Ultra-High-Energy Cosmic Rays

Jihyun Kim, for the Telescope Array Collaboration

Graduate School of Science, Osaka Metropolitan University, Japan

The Telescope Array (TA) experiment, located near Delta, Utah, is the largest ultra-high-energy cosmic ray (UHECR) observatory in the Northern Hemisphere. When a UHECR enters Earth's atmosphere, it interacts with air molecules and produces an extensive air shower (EAS), a cascade of secondary particles. TA detects these air showers using two complementary systems: fluorescence detectors (FDs), which observe faint nitrogen fluorescence light at night using telescopes equipped with large mirrors and photomultiplier tube cameras, and surface detectors (SDs), which measure charged particles at ground level using plastic scintillators distributed across the desert. By combining data from both detection methods, TA enables precise measurements of the energy spectrum, mass composition, and arrival directions of cosmic rays. This presentation introduces the TA experiment's design and detection techniques and highlights key results that contribute to our understanding of UHECRs.

16:35 [I-4-2]

Explore the Universe with the Fermi Gamma-Ray Space Telescope

Donggeun Tak

Seoul National University

The Fermi Gamma-ray Space Telescope, operating since 2008, has revolutionized high-energy astrophysics with continuous coverage from keV to GeV energies. Equipped with the Gamma-ray Burst Monitor (GBM) and the Large Area Telescope (LAT), Fermi has detected thousands of gamma-ray bursts, including the landmark GRB 170817A associated with gravitational waves and the unprecedentedly bright GRB 221009A. Beyond GRBs, Fermi revealed the giant gamma-ray bubbles in the Milky Way, provided the strongest constraints on dark matter annihilation from the Galactic center and dwarf galaxies, and contributed to understand cosmic-ray electron and proton spectra. These discoveries lead to probe particle acceleration, compact objects, and cosmological questions, establishing it as a cornerstone of multi-messenger astronomy. This presentation will summarize the mission's significant achievements and its enduring impact on understanding the extreme Universe.

16:50 [I-4-3]

Measurement of Heavy Ion Beams Using the Silicon-Based Particle Dosimeter and Spectrometer for the GCR Charged Particle Environment

Sukwon Youn[1], Uk-won Nam[2], Sunghwan Kim[3], Jongdae Sohn[2], Woo-Hyeong Seol[2], Bobae Kim[4], Hongjoo Kim[5], Hwanbae Park[5], Won-Kee Park[2], Dahye Ahn[1], Eunji Yi[2], Chae Kyung Sim[2], Dukhang Lee[2], Seul-Min Baek[2], Jehyuck Shin[2], Young-Jun Choi[2], Insoo Jun[6], Sung-Joon Ye[1]

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The Galactic Cosmic Rays (GCR) environment in space is primarily composed of high-energy charged particles. Although heavy ions account for only about 1% of the charged particle environment of GCR, their biological impact on the human body is significant. The silicon-based particle dosimeter and spectrometer were developed to measure the biological effects of GCR charged particles. The Linear Energy Transfer (LET) spectra of high-energy heavy ion beams at the Heavy Ion Medical Accelerator in Chiba (HIMAC) were measured using the dosimeter and spectrometer to confirm the measurement capability of the GCR charged particle environment in space. Additionally, the proton energy of the proton beam at the Korea Institute of Radiological and Medical Sciences (KIRAMS) and the National Cancer Center (NCC) was measured using the spectrometer to measure the proton energy spectrum, which accounts for a large portion of the GCR. The measurement and calibration results of silicon-based detectors for charged particles and protons using heavy ion and proton beams will be presented in this talk.
This work was supported by the National Research Foundation of Korea (NRF) Grant funded by Korea government (MSIT) (NRF-2020M1A3B7040417, NRF-2020M1A3B7108845).

17:05 [I-4-4]

Isotropic Helium Monte Carlo Simulations for the ISS-CREAM Instrument

A. Bagga[1], S. Pandey[2], G. H. Choi[1], M. H. Lee[2], M. J. Lee[1], S. C. Kang[3], E. S. Seo[2,4], Y. S. Yoon[2,4], on behalf the ISS-CREAM Collaboration

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The goal of the Cosmic Ray Energetics and Mass for the International Space Station (ISS-CREAM) was to conduct direct measurements of the energy spectra of cosmic rays over the energy range of $\sim 10^{12}$ to 10^{15} eV, encompassing protons to iron nuclei, in order to probe their origin, propagation, and acceleration mechanisms. The ISS-CREAM instrument is composed of a tungsten scintillating-fiber Calorimeter for energy measurements and trajectory reconstruction, and a four-layer segmented Silicon Charge Detector for charge measurements and particle identification. The Calorimeter also provides the main high energy physics trigger, while the Top and Bottom scintillator-based counting detectors provide an additional low energy trigger. Events were first simulated using the GEANT3 package with the FLUKA hadronic model to maintain consistency with previous analyses. Updated analyses were performed using data simulated using the Geant4 and Geant4 multithreaded models to extend Monte Carlo analysis to higher energies and improve data generation speeds. This presentation will focus on events generated by an isotropic event generator with particles incident from the upper hemisphere onto the detector geometry. The MC data analysis procedure and results, such as the energy response, position resolution and efficiency, for ISS-CREAM will be presented.
Keywords: Geant, Cosmic rays, Monte Carlo simulations, ISS-CREAM

17:20 [I-4-5]

High Energy Cosmic Ray Experiment Instruments, CREAM and ISSCREAM

Moo Hyun Lee[1,2] on behalf of the CREAM and ISSCREAM collaborations

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[2]*IBS School, University of Science and Technology (UST)*

Cosmic Ray Energetics And Mass (CREAM) and ISS-CREAM (CREAM on the ISS) are the high-energy cosmic ray experiments studying cosmic rays from the Universe at the balloon and the International Space Station. The CREAM instrument, comprising redundant charge detectors for identifying the cosmic particles from proton to Iron and a tungsten-scintillating-fiber sampling calorimeter to measure their energies from 1,012 to 1,015 eV, had seven successful flights with a total of ~100 days of exposure in Antarctica from 2004 to 2017. The ISS version detector, ISS-CREAM, was installed on the ISS in August 2017 via the SpaceX Falcon 9 rocket to increase the measurement statistics in the high-energy region close to 10^{15}eV. In this talk, an overview of the two almost identical instruments will be presented.

17:35 [I-4-6]

Detection of Cosmic Rays in the PeV to EeV Energy Range

Donghwa Kang

Karlsruhe Institute of Technology

The origin of cosmic rays in the PeV to EeV energy range remains one of the main open questions in astroparticle physics. In particular, cosmic rays around the knee are generally believed to be of galactic origin, while the highest energies above EeV are found to be of extragalactic origin. However, details of their acceleration, propagation, and the transition to extragalactic sources are still not fully understood. Precise measurements of the energy spectrum and chemical composition are therefore

crucial for clarifying these processes. In this talk, I will present recent results from KASCADE-Grande and IceTop/IceCube on the all-particle energy spectrum and composition between the knee and the ankle, and discuss their implication for the galactic-extragalactic transition.

10월 30일(목) Landing Ballroom A

II-1 안보우주 II

Chair: 최성환(한화시스템)

09:00 [II-1-1]

Proposed Framework for Military Integration of Commercial Satellite Imagery

Woo-Seok Lee, Hyun-Ki Moon

Policy Office, ROKA HQ

The commercial satellite services market, a key domain within the broader space industry, is undergoing rapid growth driven by innovation capacity, scalable production, and accelerated technological advancement. Notably, major allied nations are actively integrating commercial satellite imagery into military operations as part of strategic efforts to enhance spacepower. In this context, the ROK Army must also establish a structured framework to adopt and exploit commercial satellite imagery in ground operations. By integrating these assets into reconnaissance and surveillance activities, the ROK Army can reinforce its ISR capabilities and empirically verify the utility and effectiveness of commercial space-based resources.

Furthermore, this initiative serves as a policy-level enabler for the ROK Army to actively leverage commercial spacepower as part of its broader defense strategy.

09:15 [II-1-2]

Leveraging Commercial Satellites to Enhance ROK Army Combat Power: Focusing on the Operational Application of the U.S. Space Force TacSRT Model

Sechan Song

ROK Strategic Command Space Operation Center

The modern battlefield is undergoing a fundamental paradigm shift due to the increased transparency provided by commercial satellites. In this environment, the U.S. Space Force's (USSF) Tactical Surveillance, Reconnaissance, and Tracking (TacSRT) program stands out as an innovative model for integrating civilian space capabilities into military operations. However, with an average turnaround time of 24–72 hours, TacSRT's utility is greater for operational planning than for real-time tactical response.

This study analyzes the core concepts and operational methods of the TacSRT model to propose a 'Korean-style TacSRT' framework optimized for the Republic of Korea (ROK) Army's operational environment. Our analysis identifies key constraints for ROK military application, including dependency on the U.S.-led platform, delays in information acquisition, and the absence of security protocols for sensitive but unclassified information.

To overcome these limitations, this paper proposes three core policy actions. First, building an independent 'Korean-style TacSRT' platform in collaboration with domestic space and data analytics firms. Second, introducing a 'Rapid Analysis Contract' system to leverage the agility of private-sector analysis by streamlining procurement. Third, establishing an institutional foundation by enacting 'Regulations for Operating Commercial Satellite Intelligence' to clarify the handling standards and procedures for sensitive unclassified data.

Ultimately, the successful implementation of a 'Korean-style TacSRT' model represents more than a technological adoption; it signifies a shift in operational philosophy to internalize private-sector innovation as a military capability. This will serve as a key strategic asset, dramatically enhancing the ROK Army's operational planning capabilities and securing information superiority in future multi-domain combined operations.

09:30 [II-1-3]

Legal and Regulatory Frameworks for the Establishment and Operation of a National Defense Space Launch Site

Young-Jin Jeong, Ho-Jun Lee, Kyu-Min Lee, Hae-Jun Jeong

Korea National Defense University

This study aims to systematically derive legislative and regulatory framework revision measures for the establishment and operation of a national defense space launch site. As outer space has emerged as a central arena of strategic competition in the military and security domains, threats have become increasingly diverse and severe, including adversaries' enhanced capabilities to disrupt or destroy satellites, the accelerating trend of space weaponization, and the potential for cyber and electromagnetic attacks. At the same time, the Republic of Korea is projected to face a sharp increase in defense satellite launch demand in areas such as reconnaissance, communications, and navigation over the coming decades. Continued reliance on foreign launch services entails inherent limitations in terms of cost, timeliness, and security autonomy. Accordingly, the necessity of constructing an independent national defense space launch site has become imperative.

This study first examines the space development policies and military space strategies of major countries (including the

United States, Europe, and Russia) and analyzes their launch site operations and relevant legal frameworks. It then reviews Korea's national defense space policy and the space power development master plans of each military service, diagnosing their interconnections with the domestic legal system. In particular, it analyzes existing legislation applicable to the construction of defense space launch facilities and associated infrastructure, identifying shortcomings in the current framework. Based on these findings, the study proposes concrete measures and procedures for the enactment and revision of legislation to support the establishment of a defense space launch site.
In conclusion, this study seeks to provide the legal and institutional foundation for the independent establishment of a national defense space launch site in Korea, thereby contributing to the enhancement of space security capabilities and the attainment of strategic autonomy.

09:45 [II-1-4]

Suggestion for the Use of Commercial Surveillance and Reconnaissance Satellites to Support Rear Area Operations

Kangwoo Kim[1], Hosung Choi[2]

[1]*2nd Operation Command, ROK Army*
[2]*ROK Army Head Quarter*

After case-study Russia-Ukraine war, space operation is essential for protect war endurance ability and we can see that Ukraine has been able to offset its lack of space capabilities by buying in commercial services from private US satellites companies. Especially considering North korea's special forces tactics and Korean war case study (Partisan/guerrilla), North Korea's special forces will go into hiding in mountainous terrain. So it will be so difficult to find North Korea's special force hiding in mountain. Also rear area is so huge and large for finding NK's special forces. it need to lots of effort to find them. For finding them easily and effectively, Korea army especially 2OC need signal intelligence satellites. signal intelligence satellites can find locations where NK's special forces make signal for example communication signal. First using commercial signal intelligence satellite find the locations and then later Additional information can be obtained through the SAR satellite.

10:00 [II-1-5]

Tactical ISR Based on Low Earth Orbit (LEO) Small Satellites and the Republic of Korea Army's Space Strategy: Comparative Analysis of the Ukraine and Israel Cases with U.S. and NATO Strategies

Sang-soon Jung

Republic of Korea Army

This study examines the military strategic value of tactical Intelligence, Surveillance, and Reconnaissance (ISR) based on Low Earth Orbit (LEO) small satellites, focusing on the cases of the Ukraine–Russia War and Israel's Operation Rising Lion. Using Arthur F. Lykke Jr's three-element military strategy model—Ends, Ways, and Means—the research compares the operational concepts and capabilities of the United States and NATO, and derives applicable implications for the Republic of Korea (ROK) Army's space strategy.
The Ukraine case demonstrates the effectiveness of a civil–military integrated ISR network that combines commercial EO/SAR satellites, the Starlink satellite communication network, unmanned aerial systems, and ground sensors to support real-time targeting and long-range precision strikes. In contrast, Israel's Operation Rising Lion, initiated on June 13, 2025, illustrates a preemptive ISR model by integrating military and commercial satellite networks with multi-link communications and AI-based Threat/Vulnerability analysis to identify weaknesses in Iran's air defense system prior to operations.
The U.S. strategy emphasizes global ISR superiority and multi-domain operations through the Triad Concept and the Space Development Agency's Transport Layer with Free-Space Optical (FSO) inter-satellite links. NATO focuses on maintaining resilience through its six principles—Distribution, Disaggregation, Diversification, Protection, Proliferation, and Deception—while integrating allied and commercial space assets via standardized data fusion centers and multi-orbit satellite networks.
Based on these insights, this study proposes that the ROK Army should adopt the following five strategic directions:

1. LEO constellation-based ISR force developmen
2. Civil–military integrated operational framework
3. AI-based preemptive threat analysis system
4. Resilience enhancemen.
5. Space operations expertise developmen

This dual approach—real-time wartime ISR and preemptive peacetime ISR—will be essential for the ROK Army to achieve decision superiority in future multi-domain operations.

Landing Ballroom B

II-2 우주탐사 II

Chair: 정민섭(천문연)

09:00 [II-2-1]

Conceptual Design Study for Lunar Surface Localization and Lunar PNT Improvement to Determine the Position of a Lunar Surface Vehicle

Sangman Moon[1], Inkyu Kim[1], Jaehoon Song[1], Yoon-Jeong Jang[1], Huiung Park[1], Jong-Myung Woo[2]

[1]*Korea Aerospace Research Institute*
[2]*Chungnam National University*

This paper presents a conceptual design study for radio and navigation equipment for future lunar surface vehicle positioning. The lunar surface vehicle discussed in this paper is not limited to low-speed vehicles such as lunar rovers, but also includes a lunar ground station-mounted surveillance device that determines the absolute and relative positions of all objects intended to move on the lunar surface from a fixed point on the lunar surface. This paper discusses the following design concepts for this device. This device will be installed on a future lunar lander or a lunar fixed ground station. Its primary function is to improve the accuracy of lunar PNT positioning within a certain area surrounding the landing or installation site and to provide absolute and relative position information for the vehicle. If miniaturized, this device could be installed on a future Korean lunar lander, enabling the location of rovers near the lander's landing site and providing precise positioning services for lunar surface exploration vehicles in other countries.

09:15 [II-2-2]

A Case Study on Path Planning and Tracking Strategies for Planetary Exploration Rovers Based on Limited Field-of-View Camera Vision

Kicheol Jeong, Hyomin Jin

Korea Automotive Technology Institute

This paper presents a case study on the development of autonomous path planning and tracking strategies for planetary exploration rovers, with a limited field of view (FOV) to reach global target points provided by higher-level systems such as ground stations. The study is structured as follows. First, a strategy is introduced in which local waypoints are determined to enable arrival at the global target point, taking into account both perceptual field constraints and the target location. The local waypoints are computed through an A* algorithm–based optimization process, using the current position and available perception data. Next, a method is described for generating navigation paths based on local waypoints, the current position, and bird-eye view (BEV) images obtained from the camera. Path generation is carried out in two stages: (1) updating the BEV map using obstacle information and rover dimensions, and (2) deriving an optimized path from the current position to the local waypoint through the A* algorithm. Subsequently, a case study on path tracking strategies is presented, in which a four-wheel independent steering system is employed and the pure-pursuit method is applied. Finally, to partially overcome the limitations of restricted FOV perception, an approach is proposed to extend the environmental awareness by incorporating special driving maneuvers such as zero-turn, and real-world experimental results validating this method are presented.

09:30 [II-2-3]

Reconstruction of Atmospheric Entry of the Pioneer Venus Mission

Hyeonjun Kim[1], Yeon Joo Lee[2]

[1]*Korea Aerospace Research Institute*
[2]*Planetary Atmospheres Group (PAG), Institute for Basic Science (IBS)*

Since the success of the Nuri launch vehicle, interest in space exploration has grown. In Korea, the focus has been primarily on the exploration of the Moon, Mars, and asteroids, with little interest in Venus, which is relatively close to Earth. Due to its close proximity, Venus is a planet worthy of exploration with the Nuri launch vehicle. Korea Aerospace Research Institute (KARI), along with Venus experts from the Institute for Basic Science (IBS), has a serious interest in Venus exploration. This study presents the results of a reconstruction of NASA's Pioneer Venus mission, focusing on an atmospheric entry mission for in-situ measurements of the Venusian surface.

09:45 [II-2-4]

Design Study for the Mars Atmosphere Entry Mission (EDL)

Gi-Hyuk Choi[1], Jae-Ik Park[1], Yeong-Sil Kwak[2], Dae Yeong Kim[1]

[1]*Korea Aerospace Research Institute*
[2]*Korea Astronomy & Space Science Institute*

According to the 4th National Space Development Promotion Basic Plan, the national space exploration plan, a Mars orbiter is scheduled to be launched in the 2030's and a Mars lander in 2045. To design the Mars lander's atmospheric entry mission, the scientific and technological mission, weight, and size of the Mars lander were first determined, and a landing site was selected. Then, through Martian atmospheric modeling and database construction, the physical vertical distribution of the Martian atmosphere at entry was analyzed. Subsequently, orbital maneuvers were performed from altitude from 500 km to 120 km, and the optimal entry trajectory, aerodynamic heating analysis, and thermal protection system thickness distribution were determined altitude from 120 km to 12 km. The ultra-rarefied gas region between altitude from 120 km and 50 km is characterized by complex phenomena such as shock wave generation, chemical reactions, and transition from laminar to turbulent flow. A basic analysis of this region was conducted. Through repeated analysis, the shape of the atmospheric entry aeroshell and the thickness distribution of the thermal protection system were finally determined. The final deceleration was achieved using a supersonic parachute from an altitude of 12 km to 1 km, and this study performed a basic analysis. Through this series of analyses and designs, this study

conducted a mission design for the Entry & Descending phases of the Martian atmospheric entry EDL (Entry, Descending & Landing) process.

10:00 [II-2-5]

Concept of a Micro-Satellite Mission for Mars Orbital Science in the International Cooperation Framework

Dukhang Lee[1,2], Minsup Jeong[1], Youngbum Song[1], Sung-Joon Park[1], Jehyuck Shin[1], Chae Kyung Sim[1,2], Hong-Kyu Moon[1], Pureum Kim[3], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*
[3]*Yonsei University*

A 36U MicroSat mission for Mars polarimetric observations is proposed to investigate atmospheric aerosols and to generate a global surface polarization map. The mission concept was first introduced within the International Mars Exploration Working Group (IMEWG)/Lower-Cost Mission Working Group (LCMWG) framework and was subsequently discussed in more detail through NASA JPL Team X's design study of the Earth-to-Mars (E2M) Tug in July 2025. While still at the planning stage, this framework is expected to provide an opportunity for cost-effective, internationally coordinated Mars exploration relevant to future human missions alongside the scientific objectives.

Landing Ballroom C

II-3 SS: 도요샛 자료활용

Chair: 송호섭(천문연)

09:00 [II-3-1]

In-Situ Observations of Energetic Electron Loss in the Inner Radiation Belt

Jaejin Lee, Jaeheung Park, Tae-Yong Yang, Jongdae Sohn, Hosub Song

Korea Astronomy and Space ScienceInstitute

The energetic electron loss process, alongside acceleration, is crucial for understanding radiation belt dynamics. In the inner radiation belt, electrons are primarily lost by being absorbed into the Earth's atmosphere through pitch angle diffusion toward the loss cone, and in this process, the electron's pitch angle distribution is severely distorted. However, the relationship between these changes in pitch angle distribution and the loss process has not been well studied, which is attributed to the rarity of *in-situ* observations of such loss events due to limitations in pitch angle sampling. The SNIPE mission, with its fast spacecraft body rotation of 48 deg/s and 10 Hz sampling rate in low Earth Orbit (LEO), captured pitch angle distributions of ~100 keV electrons. This high-resolution operation enabled a novel observation of the Butterfly Pitch Angle Distribution (BPAD, characterized by a flux minimum at ~90° pitch angles) in LEO during the May 2024 geomagnetic superstorm. BPAD has been often reported in the outer radiation belt, however discoveries in the inner radiation belt are unusual, and particularly in LEO, this may be the first observation of BPAD. This study successfully simulates the observed BPAD using a simple model incorporating three key processes: pitch angle redistribution via wave-particle interactions, diffusion due to collisions with atmospheric particles, and gradual loss within the loss cone. While these findings in this study may be a unique phenomenon that only occurs during periods of heavy space storms, the analysis will contribute to our understanding of the mechanisms that cause the loss of electrons from the radiation belts.

09:15 [II-3-2]

Ionospheric Responses to the May 2024 Superstorm: Combined Ground-Based and LEO Observations

Hosub Song[1], Jaeheung Park[1,2], Jaejin Lee[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Department of Astronomy and Space Science, University of Science and Technology (UST)*

We report combined ground-based and in-situ observations of ionospheric responses to the super geomagnetic storm of May 10–12, 2024. In addition to electron density and temperature measurements from Langmuir probes aboard the Small-scale magNetospheric and Ionospheric Plasma Experiment (SNIPE) CubeSats, ground-based GNSS total electron content (TEC) data and observations from other low-Earth orbit (LEO) satellites were examined. This study highlights storm-time features such as the abnormal expansion of the equatorial ionization anomaly (EIA) and transient polar Tongue of Ionization (TOI). The combined analysis of these datasets offers complementary insights into ionospheric variability under extreme space weather conditions.

09:30 [II-3-3]

Multi-Satellite Observations of Morning Overshoot During the Recovery Phase of the October 2024 Superstorm

Tae-Yong Yang[1], Hosub Song[1], Jaeheung Park[1,2], Jae-Jin Lee[1], Jongdae Sohn[1], Youngbum Song[1], Ki Hwan Keum[1], Young-Sil Kwak[1,2], Seungjun Yoo[3], Ochang Kwon[1,2]

[1]*Korea Astronomy and Space Science Institute (KASI)*

[2]*University of Science and Technology (UST)*
[3]*Republic of Korea Army (ROKA)*

In this study, we investigate the evolution of the morning overshoot during the recovery phase of the October 2024 superstorm, with a focus on multi-satellite observations from Swarm, SNIPE, and DMSP. Our results complement the climatological trends reported by Smirnov et al. (2025), which characterize the morning overshoot as (1) enhanced during the main phase, (2) suppressed during the early recovery phase, and (3) fully revived in the late recovery phase, approximately 15 hours after the peak geomagnetic disturbance.
Our analysis reveal that, contrary to the expected suppression, the morning overshoot at ~500 km altitude persisted into the early recovery phase. This anomaly was accompanied by an unusually pronounced dawnside Appleton anomaly, as observed by Swarm and SNIPE. Despite the overall consistency in large-scale latitude profiles, fine-scale structures exhibit significant differences across longitudinal separations of 1.5°–5.2°. In contrast, the morning overshoot during the superstorm early recovery phase was inconspicuous at ~840 km altitude, likely due to the underdevelopment of the Equatorial Ionization Anomaly (EIA) structure at higher altitudes, as confirmed by Swarm, SNIPE, and DMSP measurements.
During the late recovery phase, the morning overshoot re-emerged but exhibited additional short-term temporal modulations following auroral intensification.
These results underscore the complexity of ionospheric dynamics during storm recovery and highlight the importance of coordinated multi-altitude satellite observations in resolving fine-scale electrodynamic structures.

09:45 [II-3-4]

High-Energy Electron Injection into the Inner Plasmasphere during the May 2024 Super Storm Observed by SNIPE

Young Gyung Ko[1], Ensang Lee[1], Jaejin Lee[2]

[1]*School of Space Research, Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*

A very intense geomagnetic storm occurred on 10 May 2024. During the recovery phase of the storm large enhancements of high-energy electron fluxes were observed by the low-Earth orbit cubesats SNIPE-B and SNIPE-D. SNIPE-B was followed by SNIPE-D on a sun-synchronous orbit, which enables us to identify the variation of fluxes over time. Detailed examination of the location of the flux enhancements reveals that some enhancements occurred inside the plasmasphere. Moreover, the flux enhancements within the plasmasphere was not observed by SNIPE-B, but only by SNIPE-D on a successive pass. These observations suggest that high-energy electrons are injected into the plasmasphere across the plasmapause boundary. We discuss the possible mechanism of the injection in relation to the geomagnetic super storm.

10:00 [II-3-5]

SNIPE-2 for Monitoring Very-Low-Earth-Orbit (VLEO) Space Environment

Jaeheung Park[1], Jae-Jin Lee[1], Jongdae Sohn[1], Tae-Yong Yang[1], Hosub Song[1], Youngbum Song[1], Ki Hwan Keum[1], Seungjoon Yoo[1,2], Ochang Kwon[1,2], Jeong-Heon Kim[1], Young-Sil Kwak[1], Won-Kee Park[1], Wook-Won Nam[1], Dae-Hee Lee[1]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*Republic of Korea Army (ROKA)*

In May 2023, Small scale magNetospheric and Ionospheric Plasma Experiment (SNIPE) mission involving four 6-U CubeSats was launched. Operating at a polar orbit of ~550 km altitude, it has successfully monitored parameters of the terrestrial ionosphere and radiation belt at Low-Earth-Orbit (LEO). Based on its success, a follow-on project named SNIPE-2 is being planned, to be carried forward to PrePhase-A. SNIPE-2 consists of six 6-U CubeSats at a Very-Low-Earth-Orbit (VLEO), below ~450 km altitudes, where space weather monitoring is of high significance for optimal operations of reconnaissance satellites. Each CubeSat will be manufactured using the full heritage of SNIPE. The CubeSats will be placed at 3 different orbit planes having different Local Time of the Ascending Node (LTAN) to achieve global coverage. SNIPE-2 CubeSats, when combined with the Orbital Transfer Vehicle (OTV) project of the Korea AeroSpace Administration (KASA), can be put into various altitudes at VLEO to extend its guarded block and supply more comprehensive space weather data at VLEO.

Halla Room

II-4 우주감시 I

Chair: 유지웅(천문연)

09:00 [II-4-1]

The Policy Evolution of Korea's National Space Hazard Response Framework and Its Institutional Implications

Seung-Hoo Shin, Sungki Cho

Korea Astronomy and Space Science Institute

Korea's national framework for space hazard management has progressively evolved in response to the increasing risks posed

by satellites, orbital debris, and natural celestial bodies. This presentation first delineates the unique characteristics of space hazards and the imperative for dedicated national mechanisms, then traces institutional developments since the amendment of the Space Development Promotion Act, which authorized the establishment of the National Basic Plan for Space Hazard Preparedness. Major milestones include the designation of the National Space Situational Awareness Organization in 2015, its formal institutionalization in 2025 through the creation of the Secretariat within the Division of Space Information Research, and the systematic advancement of manuals, training exercises, and emergency operations. The establishment of the Korea Aerospace Administration in 2024 further integrated space hazard management into the national disaster management architecture. Looking forward, the presentation identifies priorities such as AI-driven early-warning capabilities, enhanced international cooperation, and strengthened public engagement, thereby offering insights into the policy evolution and prospective directions of Korea's national space hazard management system.

09:15 [II-4-2]

Evolution of the Development Roadmap of the Center for Space Situational Awareness

Jung Hyun Jo

Korea Astronomy and Space Science Institute

The First Basic Plan for Space Risk Preparedness, established in 2014, was the result of Korea government —a latecomer to space development—actively participating in the emerging international paradigm of "sustainable space development." However, over the decade following the plan's establishment, the government failed to make adequate investments aligned with the proposed technology development roadmap. Amid the New Space trend that emerged in the early 2000s, the Trump administration's policy push around 2018 to expand commercialization and military utilization of space spurred: development and deployment of space internet constellation satellites, creation of space forces, establishment of space hazard response observation infrastructure, creation of space hazard management agencies, and development of space-based space hazard monitoring equipment. Fortunately, our government initiated the 'Space Risk Response System Development' project in 2023 as Korea's first national R&D initiative before the conclusion of the first 10-year plan. Following the launch of the Korea AeroSpace Administration in 2024, development of the Korean Integrated Space Situational Awareness System (K-SSA) commenced in 2026 under the framework of the Second Basic Plan for Space Risk Preparedness. This demonstrates that technological maturity has reached a level capable of establishing an independent ecosystem, driven by both the government's policy shift in response to emerging needs and continuous research and technological development within the space science industry, academia, and government-funded research institutes. Particularly, the evolution of the technology development roadmap at the Center for Space Situational Awareness (CSSA) of the Korea Astronomy and Space Science Institute (KASI), which has consistently led research and development in the field of tracking and monitoring natural and artificial space objects since 1986, warrants a renewed examination regarding Korea's space risk monitoring or space situational awareness R&D. There is ample reason to address any shortcomings to advance the field of space surveillance over the next decade.

09:30 [II-4-3]

Research Activities Supporting the National Space Situational Awareness Organization's Mission

Jiwoong Yu[1], Jaemann Kyeong[1], Hee-Jae Lee[1], Yun Hak Kim[1], Hosik Kam[1], Hong-Suh Yim[1], Jin Choi[1], Eun Jung Choi[1,2], Jung Hyun Jo[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea National University of Science and Technology*

The Korea Astronomy and Space Science Institute (KASI) operates various space surveillance infrastructures and is building new infrastructures to serve as a National Space Situational Awareness Organization. Technology development and research activities supporting the operation and new projects are carried out. The size distribution modeling of asteroids, the shape modeling of asteroid, the effect of the physical properties of asteroid to Earth collision, and meteoride trajectory analysis pipelines are being developed. The effort are being made to upgrade satelite orbit determination and orbit propagation tools, as well as to develop radar surveillance technologies. Meanwhile, we are developing artificial intelligence (AI) technology adopting all-sky images in order to determine whether it is observable on the site.

09:45 [II-4-4]

Development of an Integrated Space Risk Response System

Jung Hyun Jo

Korea Astronomy and Space Science Institute

The 'Integrated Space Risk Response System Development' project aims to establish a system that integrates the fundamental capabilities for responding to space risks: acquiring, analyzing, processing, and distributing space risk information. The exponentially increasing number of space objects in low Earth orbit and medium Earth orbit now requires capabilities beyond the Space Track system operated by the U.S. Air Force (Space Force) through the Combined Space Operations Center (CSpOC). This includes the U.S. civilian-led space traffic

management system, Traffic Coordination System for Space (TraCSS), which aims for Initial Operational Capability (IOC) and is set to begin operations. (IOC: Initial Operation Capability) by 2025. The new space race, fueled by the New Space wave beginning in the early 2000s, has led to increased commercial development and military utilization of space, its expansion as a domain, and even the Earth-Moon system falling within the scope of constant space surveillance. Even with the introduction of new international policies related to space development, the goal of 'sustainable space development' risks becoming a mirage without substantial international cooperation. Furthermore, space traffic management remains a distant goal unless spacefaring nations cultivate space situational awareness capabilities. If the system derived from the 'First National Space Risk Preparedness Plan' established and implemented by the Korean government in 2014 is completed in a timely manner and begins functioning as the 'National Space Risk Response System,' it will represent the minimum effort we can contribute to the international community.

10:00 [II-4-5]

Design of a Space Surveillance Integrated Data System 'SpaceBook' for Space Hazard Response in the Republic of Korea

Hosik Kam[1], Eun Jung Choi[1,2], Jung Hyun Jo[1], Ki Pyoung Sung[1], Jin Choi[1], Jaemann Kyeong[1], Myung-Jin Kim[1], Dong-Goo Roh[1], Jiwoong Yu[1], Hong-Suh Yim[1], Hye-Young Kim[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea National University of Science and Technology*

The rapid increase of satellites, the growing population of space debris, and the developments of observational technologies the detection capability for natural space objects have elevated the global importance of Space Situational Awareness (SSA). To address the increasing complexity of risk assessment resulting from the growing number of identified space objects and to ensure the protection of human safety and Korean space assets, it is essential to establish a systematic and proactive national system for space hazard monitoring and information management. This paper presents the design of 'SpaceBook', the integrated space surveillance information data system that serves as a core subsystem of the Korean space hazard response system, Korean Enhanced Platform for Lowering space Risk (KEPLER). SpaceBook of KEPLER standardizes, stores, and manages diverse space surveillance data collected from Korean domestic and international observatories, satellite operators, other SSA platforms, and analyzed observation results. Using those, it is designed to support real-time interoperability with space risk analysis, mission operation, and alert systems, with the goal of effectively disseminating space risk information. The system employs a hybrid architecture that integrates a relational database with file-based storage. As SpaceBook operates in conjunction with all subsystems of KEPLER, it performs a central role in supporting all KEPLER's function. This presentation describes the system architecture and implementation strategy concept of SpaceBook, highlighting its role as the foundational data infrastructure for space hazard response in the Republic of Korea.

Landing Ballroom A

III-1 안보우주 III

Chair: 송세찬(육군)

10:25 [III-1-1]

A Strategy for Securing Tactical Communication and ISR Capabilities for the ROK Army Using CubeSat Constellations

SenugJun Yoo[1,2], Hosub Song[2], OhChang Kwon[1,2], KiHwan Keum[2], Ho-sung Choi[1]

[1]*Republic of Korea Army*
[2]*Korea Astronomy and Space Science Institute*

To meet the demands of future warfare, the ROK Army urgently needs to secure its own space capabilities. This presentation introduces a strategy to enhance the Army's military power, focusing on satellite communication and reconnaissance within the '7 Major Space Operation Capabilities' framework.
We argue that low-cost, rapidly deployable CubeSat constellations are the most realistic solution for overcoming the vulnerabilities of large satellites and resolving the Army's persistent challenges with communication dead zones and surveillance gaps.
Specifically, this presentation will show operational scenarios where a distributed CubeSat network forms a highly survivable communication relay against enemy threats. It will also demonstrate how the high revisit rate of these constellations can ensure information superiority by continuously tracking mobile targets.
In conclusion, we strongly recommend a paradigm shift: the ROK Army must recognize CubeSats as a core asset and urgently pursue a systematic adoption strategy.

10:40 [III-1-2]

The Role of Mobile Ground-Based Anti-Satellite Laser Systems in the Space Battlefield

Dong-Woo Kim[1,2]

[1]*Republic of Korea Army (ROKA)*
[2]*Korea Astronomy and Space Science Institute (KASI)*

The space domain provides critical information for warfare,

reshaping the dynamics of future battlefields and serving as the central axis of Multi-Domain Operations (MDO). Within this emerging operational environment, mobile ground-based anti-satellite laser systems can be maneuvered and deployed near key national assets and operational hubs, thereby neutralizing adversary satellites' reconnaissance and surveillance activities and contributing to the protection of critical facilities.
As an anti-satellite deterrent capability, such systems enhance the freedom of action and survivability of ground forces, while also evolving into strategic technology assets through civil-military cooperation enabled by the shared development of laser-based technologies. Furthermore, their modular design facilitates expansion into other laser weapon systems, and their ability to deliver non-contact, precision strikes without generating debris grants them unique military value.
This study examines these characteristics to explore the roles and necessity of mobile ground-based anti-satellite laser systems in the era of space warfare.

10:55 [III-1-3]

A Methodology for Developing Military-Customized AI Models with KOMPSAT Satellite Imagery and Open-Source LMM

Dong-Bin Shin[1,2,3], Ju-Young Kim[1,2,3], Hyun-Woo Seo[2,3,4], Dae-Won Chung[2,3], Han Oh[2,3]

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In the contemporary security landscape, the ability to rapidly and accurately analyze satellite imagery is critical for maintaining a strategic advantage. While AI technologies are increasingly applied to image analysis, commercial cloud-based models pose significant security risks when handling sensitive military intelligence. Consequently, there is an urgent need to establish a methodology for developing customized AI models that can operate in secure, on-premises environments, thereby ensuring sovereign intelligence analysis capabilities.
In this study, we constructed a multimodal dataset using high-resolution imagery from the KOMPSAT-3/3A satellites and used it to fine-tune LLaVA, a leading open-source Large Multimodal Model (LMM). The entire process was conducted in a physically isolated, on-premises environment, and this paper details the complete workflow for building, training, and deploying AI models specialized in satellite imagery analysis. The significance of this research extends beyond mere model performance evaluation; it provides a tangible blueprint for the safe and effective development of military-customized AI models. The methodology proposed in this study serves as a practical roadmap for enhancing future military Intelligence, Surveillance, and Reconnaissance (ISR) systems.

11:10 [III-1-4]

Japan's Decision to Develop QZSS: Focusing on Threat Perception and Alliance Trust

Hae-Jun Jeong

Korea National Defense University

This study examines Japan's decision to develop the Quasi-Zenith Satellite System (QZSS), focusing on the roles of threat perception and alliance trust in the post-Cold War period. Previous research has often attributed Japan's initiative to U.S. PNT (Positioning, Navigation, Timing) policy changes, such as the termination of Selective Availability (SA) and interoperability initiatives. In contrast, this study emphasizes Japan's own strategic assessment.
Japan perceived direct threats from China's rapid rise in national power, the Taiwan Strait crisis, territorial disputes over the Senkaku Islands, and North Korea's Taepodong missile launch in 1998. At the same time, Japan's alliance trust toward the United States increased through the 1998 U.S.-Japan Joint Statement and the 2000 termination of SA, which assured stable access to GPS. These factors combined to underscore the need for an independent PNT capability. However, rather than pursuing a global navigation system (GNSS) like the EU's Galileo, Japan opted for a regional navigation system (RNSS) to complement GPS.
The study demonstrates that Japan's decision was not simply the outcome of U.S. policy, but of its own strategic assessment—specifically, the interaction between region-focused threat perception and high alliance trust. This analysis highlights the importance of these factors in shaping both the scope and character of independent PNT systems.

11:25 [III-1-5]

Attitude Control of Reusable Launch Vehicle Using Finite Time Control Theory

Seung-Jin Kang, Chang-Hun Lee, Ki-Wook Jeong

Korea Advanced Institute of Science and Technology

This study addresses the attitude control problem of reusable launch vehicles (RLVs) based on finite-time control theory. Recently, reusable launch vehicles developed and utilized primarily by private companies overseas have demonstrated both economic viability and operational efficiency through the recovery and reuse of first-stage rockets, thereby also proving their flexibility in launch operations. From the perspective of building military space capabilities at an early stage and reducing costs, the reuse of launch vehicles has emerged as a highly promising technology.
To enable such reusability, additional flight phases that were not required in conventional expendable launch vehicles become essential. Among them, the transition maneuver flight phase—

where the vehicle undergoes significant rotational motion—has a unique requirement: the control objective must be achieved within a specified finite time due to the increasing demands of reusable launch vehicle missions.
In this paper, we propose an attitude control method for reusable launch vehicles during transition maneuvers using finite-time control theory, ensuring that the desired attitude is achieved within the given time constraints. The proposed method analyzes the feasible time domain for attitude control based on an RLV model to secure implementability, and applies appropriate finite-time control formulations tailored to each vehicle model to address mission-specific challenges.

11:40 [III-1-6]

Reinforcement Learning-Based Evasive Guidance in J2 Perturbed Elliptic Orbital Pursuit-Evasion Game

Taeyeon Choe[1,2], Hyeongjun Park[3]

[1]*Republic of Korea Army*
[2]*Department of Aerospace Engineering, Seoul National University*
[3]*Institute of Advanced Aerospace Technology, Seoul National University*

Active Debris Removal (ADR) has recently emerged as a key technology trend within the global space industry. While the primary application of ADR is the mitigation of orbital debris, its proximity operation capabilities present a dual-use potential for anti-satellite operations. This study addresses the scenario of a satellite's hostile rendezvous by formulating a zero-sum pursuit-evasion game. We applied a Soft-Actor Critic-based reinforcement learning framework to train an optimal evasion policy for a evader against a heuristically guided pursuer within J_2 perturbed elliptic orbit. The trained model is verified to perform robust evasion maneuvers across a variety of Low Earth Orbit scenarios under a constrained Δv budget. This research demonstrates the feasibility of using deep reinforcement learning to develop autonomous defensive strategies for space assets.

11:55 [III-1-7]

A Study on Space Traffic Management Systems for Space Security and International Cooperation

Jooyoung Kim

Korea Aerospace University, ROK Army College

The rapid growth of Low Earth Orbit (LEO) satellites has elevated the need for advanced Space Traffic Management (STM) beyond collision prediction under traditional Space Situational Awareness (SSA). This Study reframes STM from a security-space perspective, introducing orbital spacing optimization algorithms, maneuver-based collision avoidance procedures, and evaluation methods for resilience against electronic warfare (EW) and cyber threats. It further proposes a satellite survivability assessment framework under anti-satellite (ASAT) threats and outlines international cooperation models applicable to coalition space operations. The findings aim to establish a defense-oriented STM concept and guide future technological and policy development in space security.
Keywords: Space Traffic Management (STM), Space Situational Awareness (SSA), Satellite Survivability, Coalition Space Operations

Landing Ballroom B

III-2 SS: 달 착륙선 설계 · 개발 진행 현황

Chair: 송영주(경희대)

10:25 [III-2-1]

Strategic Vision and Scientific Impact of South Korea's Lunar Lander Mission

Jinhye Park

KASA

South Korea is advancing the development of its lunar lander, targeting a successful landing by 2032. The lander's science and technology mission aims to support the establishment of a future lunar economic base in alignment with the national lunar exploration strategy and roadmap. The mission has three primary objectives: 1) Observation of the lunar surface and space environment, 2) Analysis of lunar surface chemical composition, 3) Investigation of lunar surface topology and geology. This presentation will introduce the importance of each mission objective and the corresponding payload candidates designed to accomplish these tasks. Through this mission, South Korea aims to strengthen fundamental scientific research based on lunar exploration and enhance capabilities for future resource utilization and space exploration technologies.

10:40 [III-2-2]

달 표면 탐사를 위한 착륙 후보지역 검토

Seungsoo Park

Korea AeroSpace Administration, Lunar Lander Program

달 표면 탐사에서 착륙 후보지역의 선정은 과학적 성과 확보와 임무 수행의 실현 가능성을 동시에 보장하기 위한 핵심 단계이다. 본 발표에서는 먼저 세계 각국의 달 탐사 임무에서 선정된 착륙 지역과 그 과학적·탐사적 의미를 살펴본다. 이어 우리나라의 달 탐사 로드맵을 소개하고, 이를 기반으로 도출된 잠정적 착륙 후보지역을 검토한다. 아울러 학계와 커뮤니티에서 제안된 유망한 착륙 후보지들에 대한 의견을 공유하고, 향후 우리나라 달 탐사 임무를 위한 착륙 후보지역 선정

절차와 고려사항을 제시한다. 이를 통해 향후 착륙지 결정 과정이 과학적 타당성과 투명성을 갖춘 방향으로 발전하는 데 기여하고자 한다.

10:55 [III-2-3]

Introduction to the Korea Pathfinder Lunar Lander (KPLL) Program

Hyungjoo Yoon

Korea Aerospace Research Institute

This presentation introduces the Korea Pathfinder Lunar Lander (KPLL), the first lunar lander program of South Korea. Its goal is to develop independent capability for lunar landing and surface exploration, while also advancing space technology, inspiring the public, and strengthening Korea's role in the international space community. The presentation will cover the global background and trends of lunar lander projects, and explain the significance of KPLL in this context. It will describe the project structure, schedule, and preliminary lander design, including configuration, key requirements, and specifications. The technical roadmap will also be introduced, focusing on GNC (guidance, navigation, and control), propulsion, and system-level integration and verification. This first lunar lander program is expected to become an important milestone for Korea, representing both technological achievement and a growing role in global space exploration.

11:10 [III-2-4]

System Design and Payload Accommodation Plan for Korea Pathfinder Lunar Lander

Moon-Jin Jeon, Hyungjoo Yoon

Korea Aerospace Research Institute

Korea Pathfinder Lunar Lander (KPLL) is Korea's first lunar lander mission, with development initiated in October 2024. Building on pre-development studies of key enabling technologies conducted by May 2025, system design began in June 2025. Because the surface mission had not yet been finalized, we first established design requirements for elements that can be defined independently of the surface mission to progress the lander system design. Work to date includes mission phase definition, trajectory design, operation mode design, power analysis, mechanical configuration, and propulsion system configuration. For payload interfaces, to accommodate cases in which payloads are selected after the system design is baselined, we provide standardized payload interfaces to be incorporated during payload design. This paper summarizes the current status of the system design for the Korean lunar lander and presents an approach for payload accommodation.

11:25 [III-2-5]

Preliminary Mission Design Status for the Korea Pathfinder Lunar Lander

SeungBum Hong, Jun Bang, Jonghee Bae, Kiduck Kim, Moon-Jin Jeon

Korea Aerospace Research Institute

The mission design for the Korea Pathfinder Lunar Lander (KPLL), the Republic of Korea's first lunar landing mission, is actively in progress. This work aims to present the current status and preliminary results of the ongoing mission design effort. As part of the initial framework development, the overall mission has been categorized into distinct phases, and a draft version of the mission requirements has been set up to guide the design process.

Since a landing site has not yet been selected, a case study for trajectory design was conducted. The study involved designing trajectories for different launch dates, each utilizing 3.5 phasing-loop transfer. The scope of the trajectory design for each case covers the mission segment from the Trans-Lunar Injection (TLI) to the Powered Descent Initiation (PDI). The results from these case studies provide a baseline and valuable data for trajectory characteristics and operational strategies.

11:40 [III-2-6]

Design and Development Concepts of the Korea Pathfinder Lunar Lander (KPLL) Ground System

Dong-Gyu Kim

Korea Aerospace Research Institute

The Korea Aerospace Research Institute (KARI) is developing the Korea Pathfinder Lunar Lander (KPLL) together with its ground system for mission operations and control. The design of the KPLL ground system builds upon the operational concepts, core functions, and data products established during the development of the Korea Pathfinder Lunar Orbiter (KPLO, Danuri) ground system (KDGS). For communications, the system will employ the Korea Deep Space Antenna (KDSA), originally developed for KPLO operations, while also considering the integration of NASA's Deep Space Network (DSN) and international commercial antennas to ensure robust tracking and commanding of the lander throughout launch and surface operations. The KPLL ground system is being designed with multi-mission capability in mind, including support for two KPLL spacecraft that will be launched separately but perform identical missions, as well as general-purpose functionality that can be extended to future lunar landers and other planetary exploration missions. This approach highlights scalability and reusability of both operational concepts and system functions.

This paper presents the overall design concept of the KPLL ground system, along with its implementation strategy and test

and evaluation plans, to ensure reliable mission operations for Korea's first lunar lander and to support future deep-space exploration initiatives.

11:55 [III-2-7]

Testing Lunar Lander Visual Navigation with Robots

Dawoon Jung, Kwangyul Baek, Jae Wook Kwon, Ju-Hyun Kim

Korea Aerospace Research Institute

A robust visual navigation system will be key in landing the Korea Pathfinder Lunar Lander safely and precisely. To ensure reliability of the system, a robotic test campaign is being designed. This work describes one such test using a mobile robot on which a test rig with camera and IMU are mounted. The camera views a large vertically suspended canvas or screen on which test patterns such as lunar terrain images are presented. The robot is commanded to travel horizontally along precise two-dimensional trajectories on the ground to simulate the movement of a lunar lander. An onboard computer attempts to perform visual-inertial navigation using inputs from the test rig. The main advantage over outdoor tests with UAVs or cranes and trucks is repeatability and control over environmental factors. Moreover, each test can be performed easily, enabling rapid, test-driven development.

Landing Ballroom C

III-3 SS: 우주환경 국제협력(영어 발표)

Chair: 곽영실(천문연)

10:25 [III-3-1]

ROKITS and ATHENA: Imaging the Aurora and Airglow from Space

Woo Kyoung Lee[1,2], Hyosub Kil1[1,3], Larry J. Paxton[3], Young-Sil Kwak[1,2], ROKITS Team[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Johns Hopkins University Applied Physics Laboratory*

The Republic of Korea Imaging Test System (ROKITS) developed by Korea Astronomy and Space Science Institute (KASI) is a wide-field aurora and airglow imager onboard the CAS500-3 satellite, scheduled for launch in November 2025. Operating in a sun-synchronous orbit at an altitude of 600 km, ROKITS features a 90° field of view, enabling it to capture images spanning approximately 700 km in width. The primary scientific objective of ROKITS is to identify the boundaries of the auroral oval and characterize the diverse morphologies of auroral structures. By combining ROKITS' visible-band imagery with satellite-based far-ultraviolet (FUV) observations, we aim to investigate auroral boundaries across different wavelengths and enhance the interpretation of fine structures in FUV images. Simultaneous ground-based auroral observations will further support studies of auroral dynamics and evolution.
KASI is also preparing for a follow-on mission to observe auroras and atmospheric gravity waves, in collaboration with the Johns Hopkins University Applied Physics Laboratory. The threshold payloads are ROKITS_IR, an upgraded instrument that enhances gravity wave detection, and GUVI+, designed to measure auroral emissions and neutral atmospheric density profiles. ATHENA will provide critical and unique measurements from high-latitude and low-altitude regions, enabling investigation of the global response of the ionosphere and upper atmosphere to both external and internal forcing from below.

10:40 [III-3-2]

Earth's Upper Atmosphere Exploration from Space Using a Visible and Infrared Imager

Hyosub Kil[1], Serin Jeon[2], Woo Kyoung Lee[1], Young-sil Kwak[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungnam National University*

The Earth's upper atmosphere, composed of neutral and ionized particles, spans an altitude range of 80–1,000 km. This region is highly sensitive to both external and internal energy inputs. Geomagnetic storms driven by solar activity are the major external energy sources, with auroral phenomena in the polar atmosphere serving as their visible manifestation. On the other hand, various activities on Earth's surface, such as earthquakes, volcanic eruptions, and tropical storms, act as internal energy sources, transferring energy to the upper atmosphere through atmospheric waves. Optical imagers can detect auroras and atmospheric waves by observing atmospheric emission lines at different wavelengths. ROKITS (Republic of Korea Imaging Test System) and ATHENA (Aurora, THErmosphere, ioNosphere for spAceweather) are space missions led by the Korea Astronomy and Space Science Institute that will provide such observations using optical imagers. This study highlights the capabilities of space-based optical imagers, with a focus on observations in the visible and infrared wavelengths.

10:55 [III-3-3]

Development of Ground-Based Geospace Instruments for Coordinated Space Weather Monitoring

Hyomin Kim[1], Gareth Perry[1], Alex Chartier[2], Geonhwa Jee[3], Hyuck-jin Kwon[3], Changsup Lee[3],

Nathaniel Frissell[4], Anton Kashcheyev[5]

[1]*New Jersey Institute of Technology, USA*
[2]*Applied Physics Laboratory, Johns Hopkins University, USA*
[3]*Korea Polar Research Institute*
[4]*University of Scranton, USA*
[5]*University of New Brunswick, Canada*

Geospace studies require an extensive, multi-point observation network to understand the large-scale, complex coupling dynamics within geospace environments. However, establishing such a network presents logistical challenges. Here, we report on two ground-based geospace instrument network projects designed to enable coordinated space weather monitoring. The first project involves an automated ground-based instrument network to be deployed at remote locations across Antarctica. This network is designed to house advanced space weather instruments, capable of collecting data autonomously in harsh conditions with minimal maintenance. The power and telemetry systems integrate solar panels, wind turbines, batteries, and two-way satellite communication for data acquisition and system management. This new system will be deployed in the deep polar cap regions of Antarctica as part of the Antarctic Korean Route Expedition project, led by the Korea Polar Research Institute (KOPRI). The second project features a geographically distributed, multi-instrument system known as the Personal Space Weather Station (PSWS), which enables ground-based measurements of the space environment. PSWS units are designed to be relatively low cost, easily constructed and deployed by science professionals, educational institutions and citizen scientists. Each system uses a software-defined radio (SDR) for high-frequency (HF) radio wave propagation studies as well as a magnetometer to measure geomagnetic field variations. Both projects are made possible through extensive inter-institutional and international collaboration.

11:10 [III-3-4]

Ground-Based Observations of the Polar Upper Atmosphere

Geonhwa Jee

Korea Polar Research Institute (KOPRI)

The upper atmospheric and space science research group at KOPRI has been operating various optical and radar instruments at Korean Arctic and Antarctic stations to monitor characteristics of the polar upper atmosphere. For example, a meteor radar has been operated for more than 15 years at King Sejong station (KSS) to investigate gravity wave activities in the mesosphere and lower thermosphere (MLT) region together with the airglow all-sky camera. Recently, we also installed the mesospheric temperature mapper at KSS to enhance our observation capability for the MLT region. At Jang Bogo station (JBS), located near the polar cap boundary, the observations are focused on the ionosphere-thermosphere (IT) system, using the ionospheric sounder and Fabry-Perot interferometer (FPI), in relation to the magnetosphere-ionosphere (MI) coupling together with the auroral imagers and magnetometers. In the Arctic, we are also conducting polar IT system with auroral observations at two observation sites in Svalbard, Norway, and Kiruna, Sweden. With these observational activities in the polar regions, we are actively participating in international research programs. For example, we have been a member of the Antarctic Gravity Wave Instrument Network (ANGWIN) which is led by the UK, USA, Japan, Australia, Brazil, and South Korea. Recently, the Antarctic Geospace and Atmosphere Research (AGATA) Scientific Research Programme was initiated within the SCAR as a coordinated, worldwide effort to monitor, investigate, and better understand the physics of the polar atmosphere and the impact of the Sun-Earth interactions on the polar regions. In this presentation, we will briefly introduce our observational activities in the polar region in association with these international cooperations.

11:25 [III-3-5]

Exploring ATHENA GUVI+: An Example of International Cooperation in Space Weather

Larry Paxton

Johns Hopkins University Applied Physics Laboratory

The ATHENA mission is an example of how RoK and USA can establish deeper collaboration to address space weather data needs. The ATHENA mission explores the behavior of the upper atmosphere and quantifies the auroral energy inputs that drive the response of the system with the GUVI+ sensor. Space weather, the day-to-day variability of the space environment, is arguably more important for space commerce and defense than the very rare geomagnetic storms. We study the large geomagnetic storms because they are global. With only have a relatively small number of sensors that are designed with the intent of being space weather sensors, it is easiest for us to see the large-scale changes. In order to make progress, we need more sensors. It is unlikely that any one nation will invest in a comprehensive space weather monitoring network that provides information at the granularity required for operational use. GUVI+ is useful but its value is enhanced by other data. ATHENA demonstrates how collaboration has the potential for providing more information about the LEO space environment. ATHENA investment is urgently needed – by 2035 there are likely to be 150,000 satellites in Earth orbit. Data that can be used understand the relatively small space weather changes that occur in geomagnetic storms and substorms as well as those that arise from tropospheric waves will be important for space traffic management.

Halla Room

III-4 우주감시 II

Chair: 성재동(항우연)

10:25 [III-4-1]

Development of a BRAHE Telescope System: Progress Report

Jin Choi[1], Jung Hyun Jo[1], Hong-Suh Yim[1], Dong-Goo Roh[1], Myung-Jin Kim[1], Yunhak Kim[1], Ki-Pyoung Sung[1], Jang-Hyun Park[1], Jaemann Kyeong[1], Sungki Cho[1], Eun-Jung Choi[1,2], Jiwoong Yu[1], Seong-Yeol Yu[1], Youn Kil Jung[1,2], Wookyung Lee[1], Hong-Kyu Moon[1], Min-Jung Kim[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

A dedicated space situational awareness (SSA) infrastructure—initially codenamed NSOS-beta (Near-Space Optical Survey-beta) and now officially named the BRAHE (Beyond suRveillance for spAce risk in the Korean High Earth orbit region) telescope system—is under development to detect, track, identify, and monitor space objects in the medium to high Earth orbit (MEO, GEO, and adjacent HEO) regime over and around the Korean Peninsula. The system's primary objective is to maintain custody of Korean MEO/GEO assets and to surveil the adjacent HEO region, including secondary objects that may pose risks to national space infrastructure. This presentation outlines the system objectives, architecture, and installation plan for BRAHE.

10:40 [III-4-2]

Toward Space-based Space Situational Awareness Systems: Development Challenges and Strategic Implications

Eun Jung Choi[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea National University of Science and Technology*

The rapid growth of satellite constellations, the emergence of cislunar activities, and the rising risks of orbital congestion have highlighted the limitations of ground-based infrastructures for Space Situational Awareness (SSA). SSA is entering a new era where space-based optical surveillance plays a pivotal role in monitoring the rapidly evolving orbital environment. Unlike ground-based sensors constrained by atmospheric and geographical limitations, satellites equipped with optical payloads offer continuous, high-resolution observations across multiple orbital regimes. As a response, the development of space-based SSA systems has emerged as both a technological necessity and a strategic imperative. This paper examines the development challenges and strategic implications associated with realizing such systems.

10:55 [III-4-3]

A Decade of the OWL-Net (Optical Wide-Field Patrol Network) and Beyond

Hong-Suh Yim[1], Myung-Jin Kim[1], Dong-Goo Roh[1], Jin Choi[1], Jung Hyun Jo[1], Hong-Kyu Moon[1], Jaemann Kyeong[1], Young-Sik Park[1], Yoon-Ho Park[1], Jiwoong Yu[1], Youn Kil Jung[1,2], Eun-Jung Choi[1,2], Sungki Cho[1], Young-Jun Choi[1], Jang-Hyun Park[1]

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[2]*Korea University of Science and Technology*

The Optical Wide-field patroL Network (OWL-Net) is the first Korean optical surveillance system for space objects, deployed at five sites worldwide between 2010 and 2016. Designed as an unmanned robotic monitoring system, OWL-Net operates solely with internet and power connections, without on-site operators, and is equipped with self-protection functions in emergency situations. The five identical instruments were deployed in Mongolia, Morocco, Israel, the United States, and Korea. The headquarters (HQ) at the Korea Astronomy and Space Science Institute (KASI) is networked with all sites to monitor real-time operations, distribute observing schedules, and collect and archive observational data. After a two-year testing period (2017–2018), OWL-Net began full-scale operations in 2019. Over the past decade, it has successfully acquired optical data on numerous space objects, including near-Earth asteroids and Korean satellites. In particular, OWL-Net has independently tracked re-entering satellite such as Tiangong, thereby fulfilling KASI's mission as a national space situational awareness organization (NSSAO). OWL-Net has also conducted successful observations of international space missions, including DART. Currently, all sites except the Israel station remain in stable operation, continuously performing optical monitoring of space objects. Based on these achievements, we are now preparing a new generation of OWL-Net.

11:10 [III-4-4]

Korea Meteor Monitoring and Observation Network(MONET): Overall System Introduction with Statistical Results during Test Operation

Dong-Goo Roh[1], Yun Hak Kim[1], Sungki Cho[1], Eun-Jung Choi[1,2], Jang-Hyun Park[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

Meteoroids entering Earth's atmosphere appear as meteors. While most are destroyed through atmospheric friction, those

of sufficient size can survive the descent and strike the surface as debris. Such impacts, though infrequent, have the potential to cause severe harm to humanity and infrastructure, emphasizing the importance of systematic monitoring.
In order to address this necessity, the Korea Meteor Monitoring and Observation Network (MONET) was established in 2022 as a continuous all-sky surveillance system across the South Korea. MONET employs a network of cameras installed at 16 observation stations.
The improvements for this system is in progress since 2023, and full-scale operations are expected to begin after 2027. In this presentation, we describe the configuration of the MONET system, outline the image processing pipeline for meteor detection, and demonstrate methods for estimating meteor positions and reconstructing their trajectories.

11:25 [III-4-5]

Development Progress of KOSPAW (Korea Space Surveillance Active Phased Array Radar Window)-Testbed: A Phased Array Radar for Space Surveillance

Jiwoong Yu[1], Eun Jung Choi[1,2], Sungki Cho[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea National University of Science and Technology*

KOSPAW-T is an S-band large phased array radar system under development to enhance satellite detection and tracking capabilities. With 784 transmit/receive elements, the system provides wide coverage and high resolution. GPU-based parallel processing is applied to enable real-time handling of large-scale data. Currently, site construction and electromagnetic environment testing are in progress, with full installation scheduled for the second half of next year. Research on advanced tracking algorithms such as Multiple Hypothesis Tracking (MHT) and Joint Probabilistic Data Association (JPDA) is also being conducted. This presentation will introduce the system development status, preliminary performance evaluation, and future research directions.

11:40 [III-4-6]

NSOS-α: The First Korean Asteroid Survey Telescope

Myung-Jin Kim[1], Hong-Suh Yim[1], Jaemann Kyeong[1], Youngmin JeongAhn[1], Hee-Jae Lee[1], Hong-Kyu Moon[1], Dong-Goo Roh[1], Jung Hyun Jo[1], Jang-Hyun Park[1], Youn Kil Jung[1,2], Sungki Cho[1]

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As of September 2025, over 39,200 near-Earth asteroids (NEAs) had been discovered. Approximately 2,500 of these are classified as potentially hazardous asteroids (PHAs) — those larger than 140 meters in diameter and have a minimum orbital intersection distance (MOID) of 0.05 AU (about 19.5 times the distance between Earth and the Moon) or less, which could cause a disaster on a national-scale if they collided with Earth. Since NASA initiated its Spaceguard goal program in 1998, over 95% of near-Earth asteroids larger than one kilometer in diameter — capable of causing a global catastrophe upon impact — have been discovered. However, the discovery rate for 140 m class asteroids remains below 50%. Furthermore, most NASA near-Earth asteroid survey telescopes are located in the Northern Hemisphere.
KASI has initiated a project for a 1.5 m optical surveillance system targeting Earth-threatening asteroids. The NSOS-α system is the first Korean asteroid survey telescope to be installed at CTIO Observatory in Chile. Designed specifically to discover potentially hazardous asteroids, it has a field of view of five square degrees and is scheduled to begin normal operations in 2028. It will be the first 1.5 m class telescope in the Southern Hemisphere dedicated to surveying near-Earth asteroids. This presentation will introduce the telescope system, providing an overview of its scientific objectives and survey strategy.

Landing Ballroom A

Ⅳ-1 안보우주 Ⅳ

Chair: 최호성(육군)

14:10 [Ⅳ-1-1]

AI-Driven Space Power Innovation for Victory in Future Ground Warfare: Focusing on the Reformation of the Defense Acquisition System and the Establishment of Collaborative Governance

Sechan Song

ROK Strategic Command Space Operation Center

Victory in future ground warfare hinges on achieving ‘decision superiority’—securing information dominance and enabling rapid decision-making through AI in a Multi-Domain Operations (MDO) environment. The Republic of Korea Army’s “Army Tiger 4.0” vision is a core plan to realize this future warfare concept, yet its combat power is critically dependent on space capabilities. This is because Army Tiger’s hyper-connected network and AI-based command and control system harbor a ‘critical vulnerability’: the entire system could be paralyzed if the continuous flow of intelligence, surveillance, and reconnaissance (ISR), satellite communications (SATCOM), and positioning,

navigation, and timing (PNT) data from satellites is disrupted. In essence, the moment access to space is lost, this advanced combat system can be rendered powerless.
This study, grounded in this critical perspective, diagnoses the dual limitations currently facing the ROK Army: the absence of independent space power and a rigid defense acquisition system. To overcome these challenges and rapidly secure space capabilities, this paper proposes several policy recommendations. These include: ▲ innovating the acquisition process to focus on 'utilization,' such as subscribing to commercial satellite services; ▲ establishing a data-centric collaborative governance to fuse private sector technology; and ▲ fundamentally reforming the acquisition system by introducing a 'Korean-style Other Transaction Authority (OTA)' benchmarked from the U.S. model. This research holds significant policy implications as it presents a concrete roadmap for the ROK Army to leap forward as an 'AI-powered, science and technology-driven military force' by leveraging the space domain as a core force multiplier for ground operations.

14:25 [Ⅳ-1-2]

Integrating Commercial Space into National Security: Opportunities and Challenges

Seonghwan Choi

Hanwha Systems

The Russia-Ukraine war, which broke out in 2022, highlighted the importance of using commercial satellites (Starlink, Capella, Finland, ICEYE, etc.). In March, when Trump and Zelenskyy's negotiations over the end of the war broke down, the U.S. immediately stopped providing satellite image information, putting pressure on Ukraine. This satellite image was obtained by the U.S. National Reconnaissance Office (NRO) through a commercial space utilization program. As such, commercial satellites today are positioned as a key game changer in the war. Reflecting this situation, the U.S. Department of Defense and the Space Force announced the Commercial Space Integration Strategy and the Commercial Space Strategy, respectively, in April 2024. And the U.S. detailed strategies for securing and fostering commercial partnerships in the space sector. In response, the Trump administration will introduce the commercial space strategy of the U.S. Space Force and the current status of the civilian-military cooperation of the U.S. Space Force, and discuss the integration of commercial space and national security in the Korean defense space field.

14:40 [Ⅳ-1-3]

Satellite as a Service: New Era of Satellite Data Industry

KeunHui Lee

SI Imaging Services

Leasing or rental services were once met with skepticism when first introduced into our daily lives. Yet today, they are widely recognized as familiar and efficient solutions, offering users the freedom to access and use.
The satellite imagery industry is now facing a similar transformation. It is shifting from a traditional data supply model to a service oriented approach, where satellites can be leased for user-driven data collection. In the traditional model, users were bound by supplier guidelines, restrictive licensing, and shared satellite capacity with other users. Such limitations often failed to meet critical needs such as regional exclusivity and true data ownership, ultimately hindering mission success. To address these challenges, SIIS introduces Satellite as a Service. This innovative model empowers users with exclusive access to pre-defined regions and full ownership of their data, eliminating the constraints of conventional licensing. With Satellite as a Service, users can achieve their mission efficiently and effectively.

14:55 [Ⅳ-1-4]

Where It Is Today: Space-Borne SAR Technology and Its Applications

Jin-Yong Lee

ICEYE

SAR technology, especially in the space-borne arena, has come a long way. SAR has blossomed in such a diverse yet rapid fashion that it is beyond astonishing as to how far we have advanced. However, there still remains a very important question: How are we utilizing such technology to the best of our abilities? ICEYE has become synonymous with the word, Synthetic Aperture Radar (SAR), by deploying the world's largest satellite constellation while providing best-in-class SAR technologies never thought possible. This presentation will capture how we have gotten this far and introduce the technologies such as GEN4 Satellite, ISR Cell, AI-driven Detect & Classify, and Tactical Access.

15:10 [Ⅳ-1-5]

Advanding Synthetic Aperture Radar-based Change Detection for Surveillance: From High-Resolution Coregistration to Strategic Monitoring Applications

Heein Yang, Mirza Muhammad Waqar,
Muhammd Umer Kakli, Joo-hyung Kang

Division on Satellite Mission S/W, CONTEC

Synthetic aperture radar (SAR) provides advantages for strategic surveillance, offering all-weather and day-and-night imaging capabilities. The increasing demand for high-resolution surveillance on critical areas highlights the need for quick and reliable change detection methods. As 24/7 high-resolution change

detection requires highly accurate coregistration, especially in SAR cases, we developed technique that establishes a reliable foundation for time-series high-resolution SAR analysis, enabling consistent detection capabilities of subtle changes across multiple acquisitions and multiple geometries.
To monitor significant changes over conflict areas and disaster areas, we have applied statistical change detection algorithms, yet the requirement for multiple pre- and post-event images remains a significant limitation.
Techniques such as amplitude/coherence change detection (ACD/CCD), which support focused detection of changes in specific regions, and colorized sub-aperture imaging (CSI), which enables intuitive visualization of scattering dynamics of SAR, have been proposed as promising approaches. This study reviewed and examined their applicability as potential solutions to enhance both operational efficiency and interpretability.
By presenting both the current state and future directions of SAR-based change detection, this study outlines how high-resolution SAR can play an important role in supporting reliable and scalable monitoring capabilities for strategic applications.

15:25 [Ⅳ-1-6]

Time-Series Satellite SAR for infrastructure Stability Monitoring

Jonghyuk Yi[1], Minha Choi[2], Yangwon Lee[3]

[1]*SELab, Inc.*
[2]*Sungkyunkwan University*
[3]*Pukyong National University*

Satellite SAR can observe target areas regularly with minimal impact from weather or daylight. Because water scatters radar differently from land, we can separate water surfaces and measure the area of reservoirs and dams to estimate storage. Using interferometric phase (which relates to travel distance), time-series processing (PSInSAR / SBAS) can also detect very small structural movements and track them over time.
In this study, we present cases that use time-series satellite SAR for both infrastructure deformation monitoring and reservoir water surface area monitoring. We describe the data, core processing steps, and basic quality checks.
This work is supported by the Korea Agency for infrastructure Technology Advancement(KAIA) grant funded by Ministry of Land, Infrastructure and Transport(Grant RS-2022-00155763).

Landing Ballroom B

Ⅳ-2 우주탐사 III

Chair: 심채경(천문연)

14:10 [Ⅳ-2-1]

Spectral and Polarimetric Properties of Reduced Lunar Simulants

Eunjin Cho[1], Seungju Han[2,3], Minsup Jeong[1], Serin Kim[1,3], Young-Jae Kim[2], Chae Kyung Sim[1,3], Eunji Yi[1,3], Mingyeong Lee[1], Keewook Yi[4]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*Korea Institute of Civil Engineering and Building Technology (KICT)*
[3]*University of Science and Technology (UST)*
[4]*Korea Basic Science Institute (KBSI)*

The lunar surface, lacking a protective atmosphere, is directly exposed to space environments such as solar wind and micrometeorite bombardment. These processes gradually alter the surface by reduction of iron oxides to submicroscopic metallic iron (SMFe), which leads to darker and redder reflectance spectra. In addition, repeated impacts can break rocks and reduce regolith grain sizes, influencing optical properties of the surface. In this study, we experimentally simulated the space weathering effect by thermochemically reducing lunar simulants (JSC-1A and KLS-1) to produce metallic iron on grain surfaces. Spectral measurements were taken after various reduction durations to monitor the evolution of optical changes. Additionally, we sieved the simulants into <250 μm, <150 μm, 90–150 μm, 45–90 μm, and <45 μm, comparing both spectral and polarimetric properties before and after reduction for each fraction. These results could provide insights into how space weathering affects the optical behavior of lunar regolith as a function of grain size and could contribute to improved interpretation of remote sensing data.

14:25 [Ⅳ-2-2]

Photometric Properties of High Porosity Lunar Regolith Simulants Fabricated by 3D Printing

Mingyeong Lee[1], Minsup Jeong[1], Gorden Videen[2], Matthew J. Berg[3], Dong Lin[4], Chae Kyung Sim[1,2], Antti Penttila[5], Karri Muinonen[5], Sungsoo S. Kim[6], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Space Science Institute*
[3]*Kansas State University*
[4]*Oregon State University*
[5]*University of Helsinki*
[6]*Kyung Hee University*

Light interacting with the lunar surface provides valuable insights into surface properties such as grain size, roughness, and porosity. Using the opposition effect and degree of linear polarization as functions of phase angle (i.e., Sun–target–detector angle), it is possible to infer these properties. Many laboratory studies have explored this subject, but the link between surface microstructure and these observables is still unclear because high porosity structures are hard to reproduce and maintain under terrestrial conditions.

To address this, we design an experiment to measure the reflectance of 3D printed regolith simulants under controlled geometric conditions. As part of a KPLO/PolCam science study, we fabricated high porosity structures by 3D printing and sintering using olivine and SiO_2 powders, which are one of the materials for the analog of lunar regolith. As the first step of this project, we measured their reflectance at small phase angles (1.4°–5°).

In this presentation, we introduce the experimental design and procedures for the reflectance measurements of 3D regolith simulants at small phase angles and briefly present initial results. We also suggest plans for further experiments and for connecting the observations with PolCam.

14:40 [Ⅳ-2-3]

Lunar Neural Elevation Model: Multi-View 3D Reconstruction with Shadow-Aware Irradiance Modeling

Suwan Lee, Seokju Lee

Korea Institute of Energy Technology

We propose Lunar Neural Elevation Model (LNEM), a learning-based multi-view 3D reconstruction method that is robust to illumination variability. Traditional digital elevation models (DEMs) rely on stereo photogrammetry, which derives elevation from parallax and therefore requires favorable stereo geometry. As a consequence, coverage is discontinuous across a scene, producing holes in the DEM that necessitate interpolation. In contrast, our approach yields a continuous scene representation, yet varying illumination conditions on the lunar surface undermine photometric consistency in NeRFs, inducing geometric inconsistencies. To address this, LNEM leverages the light-source direction to incorporate an explicit shadow-aware irradiance model during optimization, enforcing multi-view geometric consistency and improving robustness under varying illumination conditions. We perform qualitative comparisons with the NAC DTM, SLDEM, ASP and quantitative evaluation against LOLA point measurements in NAC DTM. Experimental results show that LNEM reconstructs intricate lunar terrain with high fidelity, enabling realistic lunar terrain and environment modeling for mission simulation and supporting pinpoint landing and rover path planning for forthcoming Korean lunar lander missions.

14:55 [Ⅳ-2-4]

Application of DC and Electrical Integration Tests during the Development of a Lunar Rover

Dongyoung Kwon[1], Kyudong Kim[1], Sunwook Kim[1], Mangyu Lee[2], Jaeseon Yu[2], Hyoungsic Park[2], Youngseok Lee[1], Kihan Noh[1], Changseop Ahn[2]

[1]*Korea Automotive Technology Institute*

[2]*Hyundai Motor Company*

This study presents the development and application of systematic DC integration and electrical integration test procedures for ensuring system reliability of a lunar rover. The proposed integration test procedures aim to minimize system integration risks in the early development stage by verifying the rover's complex electrical systems through a stepwise approach, consisting of a structured verification process.

The test procedures employed a three-stage approach: cable harness physical verification, electrical connectivity verification, and system integration verification. First, cable harness length measurements were conducted to evaluate rover body installation compatibility, followed by pin-to-pin connectivity inspections and short circuit tests. Subsequently, electrical components were arranged on an expanded Engineering Test Bed (ETB), while the rover's driving, steering, and suspension motors along with wheels were maintained on the rover body and connected through extension harnesses to enable real-time operation verification.

In the electrical interface verification stage, end-to-end signal connectivity was examined across the entire system, and voltage levels for each channel were measured with the Power Distribution Unit (PDU) harness disconnected, along with verification of remote power control functions. After PDU reconnection, input voltage verification for each electrical component and power consumption profile measurements for individual components in the integrated configuration were performed. Finally, system integration was verified through communication and control interface signal monitoring and waveform analysis.

Following completion of verification on the ETB, all electrical components and harnesses were reinstalled on the rover body, and equivalent power and interface verification procedures were repeated. After mechanical assembly completion, terrestrial driving tests were successfully conducted.

The application of the developed integration test procedures enabled efficient completion of electrical system integration for the rover. Based on this foundation, lunar simulant driving tests and autonomous driving tests were successfully performed. The systematic integration test methodology presented in this study is expected to contribute to improved development efficiency and reliability assurance in future lunar rover system integration processes.

15:10 [Ⅳ-2-5]

Deep Learning-Based Real-Time 3D Terrain Generation for Lunar Exploration

Myeung Un Kim[1], Dae-Kwan Kim[1],
Dong-Geol Choi[2], Seokbok Lee[3]

[1]*Korea Aerospace Research Institute*
[2]*Hanbat National University*
[3]*ANTLAB Corp.*

Lunar exploration faces unique challenges due to extreme optical environments such as permanent shadow regions, high illumination zones, and complex subsurface structures including lava tubes and pit craters. In such conditions, traditional vision-based approaches relying solely on optical imagery are insufficient to ensure astronaut safety and mission efficiency. This study presents a novel framework for real-time 3D terrain generation that integrates texture synthesis via deep learning with depth data acquired from LiDAR, which operates regardless of the presence or absence of light. The proposed approach enhances astronaut and rover situational awareness in diverse lunar environments and supports safe exploration activities. Beyond space applications, the technology also holds significant potential for terrestrial use cases, including disaster response, search and rescue, and other safety-critical operations.

15:25 [Ⅳ-2-6]

Developing the Tool Influence Function Prediction Model Using Artificial Intelligence

Seung Ho Han[1,2], Jeong-Yeol Han[1,2], Jiwoo Lee[1,2],
Eunsu Park[2], Seonghwan Choi[2]

[1]*University of Science and Technology*
[2]*Korea Astronomy and Space Science Institute*

Polishing the optical surface is a critical process in the mirror development of space telescopes, as it affects surface quality and optical performance. In particular, the performance of optical surfaces is influenced by the controllability of the Tool Influence Function (TIF), which governs the material removal characteristics during polishing. However, TIF exhibits high sensitivity to variations in process conditions due to the nano-scale characteristic of the polishing process. Therefore, it remains challenging to predict the TIF solely based on an analytic equation. In this study, we present an artificial intelligence-based optimization approach to improve the accuracy of TIF prediction on Silicon Carbide (SiC) mirror surfaces. The proposed method achieved a validation loss of 4.24 nm in terms of Mean Absolute Error (MAE) and the trained model yielded an MAE of 6.75 nm for the additional experimental data. These results demonstrate that the data augmentation method enhances the robustness to the model against experimental errors.

Landing Ballroom C

Ⅳ-3 태양 및 우주환경 II

Chair: 홍준석(천문연)

14:10 [Ⅳ-3-1]

Multispacecraft Observations of Upstream Waves Near the Moon in the Solar Wind

Khan-Hyuk Kim[1], Junhyun Lee[2], Ho Jin[1],
Seul-Min Baek[2], Jungjoon Seough[2]

[1]*Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*

Although upstream waves are commonly observed in the solar wind, the mechanisms and locations where they establish as regular oscillations are not completely understood. In this study, we present observations of upstream waves observed by KPLO, ARTEMIS P1, and ARTEMIS P2 spacecraft, which were orbiting the Moon in the solar wind on January 26, 2025. The waves exhibited strong spectral power in the 14–20 mHz band at each spacecraft and occurred when the interplanetary magnetic fields were connected to the Earth's bow shock. By analyzing the solar wind data acquired by ARTEMIS P1 and P2, we confirmed that the wave occurrence is associated with fluxes of reflected solar wind ions flowing back upstream from the direction of the bow shock. The analysis of time series magnetic field data shows that the order of wave occurrence was identified from a spacecraft close to the bow shock to one farther away, indicating a sunward propagation speed of approximately 600 km/s. This speed is 30 times higher than the local Alfvén speed in the spacecraft frame. We discuss how and where the upstream waves are generated and propagated.

14:25 [Ⅳ-3-2]

Conditions for Solar Wind Ion Reflection over Lunar Magnetic Anomalies Observed by Kaguya

Yewon Hong[1], Khan-Hyuk Kim[1], Jaehee Lee[1],
Seul-Min Baek[2], Ho Jin[1], Yoshifumi Saito[3],
Masaki N. Nishino[3], Shoichiro Yokota[4]

[1]*School of Space Research, Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*
[3]*Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, Sagamihara, Japan*
[4]*Osaka University, Toyanaka, Japan*

We analyzed data acquired by Kaguya on 17 March 2009, when it was in a polar orbit around the Moon at altitudes between approximately 43 and 50 km, to understand the mechanism responsible for solar wind ion reflection over the lunar magnetic anomaly of Reiner Gamma. We observed that solar wind ions

are reflected over the magnetic anomalies, without striking the lunar surface, with a flux corresponding to approximately 10% of the incident solar wind flux. The reflected solar wind ions exhibit energy levels comparable to those of incident solar wind ions, which are approximately 800 eV, consistent with mirror reflection processes. To further elucidate the physical conditions governing the reflection mechanisms, we discuss the key controlling parameters, using particle trajectory calculations.

14:40 [Ⅳ-3-3]

Frequency-Dependent Evolution of Propagating Intensity Disturbances in Polar Plumes

Kyung-Suk Cho[1], D. Y. Kolotkov[2], Il-Hyun Cho[3], V. M. Nakariakov[2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Warwick*
[3]*Kyung Hee University*

Quasi-periodic disturbances in EUV emission intensity, propagating along polar plumes in the solar corona, are frequently observed. Analysis of these propagating disturbances in the 17.1 nm bandpass of SDO/AIA reveals that the wave spectrum evolves with height. Near the footpoints, the dominant spectral peak corresponds to oscillation periods of 12–15 min. As the disturbances propagate upward, the shorter-period spectral component diminishes, while a longer-period component of 20–30 min becomes dominant. Theoretical modeling of coronal slow magnetoacoustic waves effectively reproduces this spectral evolution. The model incorporates field-aligned thermal conduction and the back-reaction of wave-induced perturbations on local thermal equilibrium. Coronal slow waves, driven by a broadband source with a peak at a shorter period, show a decrease in shorter-period spectral power with height, while the 20–30 min spectral power increases due to thermal over-stability. Analysis of the dispersion relations reveals that, given the chosen model parameters, the most rapidly growing spectral component corresponds to a 22.5-min period, which aligns well with the observational findings.

14:55 [Ⅳ-3-4]

Spectroscopic Observation of a Solar Anemone Jet

Heesu Yang

Korea Astronomy and Space Science Institute

Various lengths and energies of the solar jets share their physical properties and their dynamics, particularly their shape of inverse-Y, lambda, fan-spine, or sometimes called Anemone. We investigate the plasma motion along the spine structure of the anemone jet using the FISS and the IRIS. The thin and collimated jet observed with IRIS shows the properties of a hot jet, whereas the jet observed with FISS is likely showing the properties of a cool jet. The plasma flow in the IRIS EUV slit spectra exhibits two bulk velocity components at the same pixel, reaching up to ~200 km/s and ~100 km/s, respectively. However, plasma motions of such high speed are not recognized in the FISS data. In this presentation, we report our preliminary results and discuss their implications.

15:10 [Ⅳ-3-5]

Winds and Gravity Waves in the Antarctic Mesosphere-Lower Thermosphere from 18 Years of Meteor Radar Observations and Comparison with SD-WACCM-X

Byeong-Gwon Song[1], In-Sun Song[1], Nicholas M. Pedatella[2,3]

[1]*Department of Atmospheric Sciences, Yonsei University*
[2]*NSF National Center for Atmospheric Research, High Altitude Observatory*
[3]*COSMIC Program Office, University Center for Atmospheric Research*

The mesosphere and lower thermosphere (MLT; ~70–110 km) is a transitional region of the atmosphere that includes the Karman line, often regarded as the boundary between Earth's atmosphere and outer space. The dynamics of the MLT are strongly modulated by atmospheric gravity waves (GWs), which play a dominant role in driving the seasonal variability of zonal winds and in establishing the summer-to-winter pole circulation. The MLT remains less well understood than other atmospheric layers because making observations with sufficient spatial and temporal coverage is challenging. Meteor radars (MRs) are among the most effective ground-based instruments, providing continuous, high-temporal-resolution measurements of horizontal winds in the MLT under all weather conditions. The MR at King Sejong Station (KSS) on the Antarctic Peninsula (hereafter KSS-MR) is one of the longest-operating observational systems in the Southern Hemisphere (SH) high-latitude region. In addition, the KSS-MR detects a large number of meteor echoes, making it particularly well suited for deriving GW momentum fluxes (GWMFs) and GW drag (GWD), which are essential for understanding wave-mean flow interactions in the MLT. To overcome the scarcity of MLT observations, a number of studies have utilized high-top numerical models. However, it is well known that simulated horizontal winds in the MLT during the SH winter at high latitudes exhibit large biases, indicating that improved representations of GWD are required. In this study, we analyze 18 years (March 2007 to February 2025) of MR observations from KSS to investigate the characteristics of winds and GWs, and compare them with simulations from SD-WACCM-X. The observed zonal winds exhibit distinct annual and semiannual variations below and above ~90 km, respectively. Eastward winds are consistently observed throughout all altitudes during winter, while SD-WACCM-X does not

adequately capture those above ~90 km. The meridional winds reveal a clear summer-to-winter pole circulation in both the observations and SD-WACCM-X below ~90 km, although the model generally produces stronger winds than observed. During winter, the observed zonal GWD shows negative values near 90 km and positive values both below ~85 km and above ~95 km, whereas the simulated zonal GWD remains negative across all altitudes. This inconsistency likely reflects the absence of secondary GWs in the model, with the associated GWD bias contributing significantly to the wintertime wind biases.

15:25 [Ⅳ-3-6]

Medium-Scale Travering Ionospheric Disturbances Induced by Secondary Gravity Waves During the 2021 August Breaking-record Heavy Rainfall over Kyushu, Japan

Masaru Kogure[1], In-Sun Song[1], Byeong-Gwon Song[1], Huixin Liu[2], Michi Nishioka[3], Septi Perwitasari[3], Hosik Kam[4], Junseok Hong[4]

[1]*Yonsei University*
[2]*Kyushu University, Japan*
[3]*National Institute of Information and Communications Technology*
[4]*Korea Astronomy and Space Science Institute*

From August 11, 2021, warm and humid air flowed into Kyushu, the western of Japan's island, intensifying the stationary front over East Asia and leading to record-breaking precipitation levels in Japan (Cabinet Office Japan, 2022: https://www.bousai.go.jp/en/documentation/white_paper/2022.html). This study investigates the potential impacts of this extreme meteorological weather event on near-Earth space, i.e., the thermosphere and ionosphere. AIRS/Aqua captured gravity waves with horizontal wavelengths of ~150–500 km in altitudes of ~30–40 km over Kyushu and Shikoku (~127–133°E, ~31–34°N) around 17 UT on August 12. Simultaneously, meteorological radar detected a very high cloud top (~15 km) and an intense precipitation rate (over ~80 mm/hour) near the west coast of Kyushu (~130°E, ~33°N). The WRF (Weather Research and Forecast) simulation, initialized with ERA5 data, successfully reproduced both the heavy precipitation and stratospheric gravity waves. In the simulation, gravity waves were generated by strong convection near Kyushu's west coast and propagated eastward. Ray-tracing analysis, using the latest JAWARA reanalysis data, results showed that these eastward-propagating gravity wave packets likely broke up over Kyushu and Shikoku at altitudes of 70–90 km between 18 and 23 UT, due to self-induced shear and/or convective instability, and/or their critical level.

Regarding the ionosphere, GNSS-TEC observations revealed concentric medium-scale traveling ionospheric disturbances (MSTDIs) propagating north to southeastward over western Japan(~133–140°E, ~30–38°N) between ~23 and 24 UT. The epicenters of these disturbances coincided with the regions where stratospheric gravity waves broke, suggesting that the MSTIDs were likely driven by secondary gravity waves emitted from the convectively-generated primary waves.

This presentation will show these findings and discuss potential impacts of extreme meteorological weather events on the thermosphere and ionosphere.

Halla Room

Ⅳ-4 우주감시 III

Chair: 안재명(과기원)

14:10 [Ⅳ-4-1]

Preliminary Assessment of Earth Impact Probabilities for Near-Earth Asteroids

Hee-Jae Lee[1], Myung-Jin Kim[1], Youngmin JeongAhn[1], Dong-Goo Roh[1], Jin Choi[1], Eun-Jung Choi[1,2], Sungki Cho[1], Jung Hyun Jo[1], Hong-Suh Yim[1], Jaemann Kyeong[1], Jiwoong Yu[1], Yun Hak Kim[1], Hosik Kam[1], Hye-Young Kim[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

An asteroid impact on Earth has the potential to cause catastrophic human and economic losses. For this reason, there is a clear necessity for reliable prediction and mitigation strategies. With the advent of recent all-sky surveys, the discovery rate of near-Earth objects (NEOs) has increased substantially, further emphasizing the importance of assessing their impact probabilities in a timely manner and identifying potentially hazardous asteroids in advance. At present, however, quantitative impact probability assessments are performed almost exclusively by NASA's Sentry system and ESA's Risk List, leaving the international community largely dependent on these services. For more active planetary defense, it is necessary to develop our own capability to calculate impact probabilities and to assess the risk independently.

In this presentation, we report preliminary results from our own independent analyses of NEO impact probabilities. We compare these results with those published by NASA and ESA in order to evaluate their consistency and reliability. Finally, we discuss how such efforts can contribute to the broader planetary defense framework and enhance preparedness for potential asteroid impacts.

14:25 [Ⅳ-4-2]

Ultra-Wide FoV Video Observations at Jang Bogo and YoungYang Stations for Space Situational Awareness

Yong-Ik Byun[1], Seo-Eun Lee[1], Daewon Kim[2], Hoyoung Hwang[3], Hyuck-Jin Kwon[4], Changsup Lee[4]

[1]*Department of Astronomy, Yonsei University*
[2]*ETRI*
[3]*YSPACE, Co. Ltd.*
[4]*Korea Polar Research Institute*

Our sky surveillance video camera network now has an Antarctic component at the Jang Bogo Station. The location of this site makes it possible to track multiple passes of LEO polar satellites during long winter nights. Multi-pass data are essential for the estimates of mean orbital elements including the drag term. We also commissioned a more sensitive composite video system at a dark site in the YoungYang province, and a similar system will soon be deployed at the Jang Bogo Station. Initial data analysis shows that our new system is capable of tracking several thousands of LEO space objects, and can become an important SSA asset especially for the upcoming age of increasing VLEO operations. We are now developing algorithms to refine existing TLEs with our observations, and also to generate new TLEs for the numerous unlisted objects, which include military and spy satellites. In this paper, we show that simple comparisons of the observed track and TLE prediction allow us to identify unlisted space objects, and to detect signatures of recent maneuvers as well as re-entry indications months before they happen.

14:40 [Ⅳ-4-3]

Association and Orbit Determination for Space Situational Awareness Using Ultra-Wide-Field Optical Observations: Pipeline and Case Studies

Seo-Eun Lee[1], Yong-Ik Byun[1], Daewon Kim[2], Hoyoung Hwang[3]

[1]*Department of Astronomy, Yonsei University*
[2]*Electronics and Telecommunications Research Institute (Etri)*
[3]*YSPACE , Co. Ltd.*

Based on hundreds of thousands of streak observations from the YSPACE video camera network, we constructed an association and orbit determination pipeline and verified its performance. The first step of our association is to compare each streak with the TLE catalog from space-track.org using not just the sky location but also the apparent angular velocity and position angle of streak motion, which proved to be superior to other existing approaches. Our procedure goes beyond object identification, and is capable of detecting subtle orbit variations and indications of re-entry and maneuvering. Depending on the locationand depth of our sensors, the TLE catalog matching rate varies from 65% to 90%. We present the statistics of orbital and physical characteristics of identified space objects. For numerous uncatalogued streaks, we are attempting streak associations through initial orbit determination (IOD), which then lead us to the orbit determination using associated streaks from multiple cameras and multiple sites. Our experiments on selected targets show that our IOD of the Gooding method produces reliable solutions for this purpose, and both multi-pass data from the Antarctic as well as domestic multi-site data are useful in deriving excellent orbit characterization. We conclude that a worldwide network of ultra-wide-field video sensors will be an important asset to construct and maintain an independent and self-sufficient orbit database. We also note that the algorithms developed for this ground video network can be further extended to space based SSA sensors of similar nature. The ultra-wide video sensor network in both ground andspace will greatly contribute to space domain awareness and space sustainability.

14:55 [Ⅳ-4-4]

Survey of Risk Indices for Space Objects and Implications

Jaewoo Kim[1], Eun Jung Choi[2,3], Jin Choi[2,3], Jiwoong Yu[2], Junghyun Jo[2], Hosik Kam[2], Jaemyung Ahn[1]

[1]*Korea Advanced Institute of Science and Technology*
[2]*Korea Astronomy and Space Science Institute*
[3]*University of Science and Technology*

The Korea Advanced Institute of Science and Technology (KAIST) and the Korea Astronomy and Space Science Institute (KASI) have collaborated on the development of space debris models designed for use in a risk assessment framework. Risk indices for space objects are essential for evaluating the hazards posed by each object and for guiding the design of strategies and plans for future space object environment management. In this work, we review existing risk indices for space objects and provide valuable implications for future research.

10월 31일(금) Landing Ballroom A

Invited Talk III

Chair: 곽영실(천문연)

09:00 [IS-3]

Exploring International Cooperation: ATHENA's GUVI+ and the Far Ultraviolet

Larry Paxton

Johns Hopkins University Applied Physics Laboratory

The proposed ATHENA mission will fly a modern version of

the SSUSI and GUVI hyperspectral imagers – GUVI+.
GUVI+ is an instrument that is carefully designed to provide the simplest solution that provides the most information about the upper atmosphere. The sensor operates in the Far Ultraviolet – from 115 to 180 nm. This spectral range corresponds to photon energies of 6.9 to 10.8 eV – meaning that the range is well suited for studying electronic transitions in atoms.
GUVI+ performs horizon-to-horizon scans – and covers one limb – for a field of regard of 140°. This wide range enables GUVI+ to accommodate a large range of altitudes – which opens many opportunities for flight. The spectral range is well suited for any planetary mission as well – especially Venus, Mars and the Earth. If GUVI+ were to be place at a Lagrange point, GUVI+ can be used to scan the entire sky with excellent SNR to addresses questions about the inflow interstellar material and, if a hydrogen absorption cell were used, information about the shape of the heliopause. GUVI+ could fly to Venus and Mars to gather information on their upper atmospheres. With a small modification, GUVI+ could cover the FUV and the MUV (200 to 300 nm). With the lessons learned from SSUSI, GUVI and GUVI+, we could place a 'GUVI' on the Moon to provide Earth observations of the atmosphere and ionosphere. This talk will explore FUV phenomenology and the applications of this technique to other problems – and the impact of ATHENA on our understanding of the Earth's upper atmosphere and ionosphere.

Landing Ballroom A

V-1 SS: 달 탐사 국제 거버넌스

Chair: 정서영(항우연)

09:40 [V-1-1]

The First Step Toward Safe and Sustainable Lunar Exploration: Space Object Registration and Mission Information Sharing

Soyoung Chung

Korea Aerospace Research Institute

Over 300 lunar missions are anticipated in the coming decade, raising growing concerns about potential conflicts among missions and the preservation of the lunar environment. In response, international discussions on safe and sustainable lunar activities have begun within the Artemis Accords Signatories Group and the UN COPUOS Action Team on Lunar Activities Consultation (ATLAC). This paper examines space object registration and mission information sharing as a foundational step toward safe and sustainable lunar activities. It analyzes ongoing dialogues and initiatives within the international community, identifies key legal, technical, and operational issues that require further consideration, and evaluates possible pathways for implementing this initial step in a coordinated and sustainable manner.

09:55 [V-1-2]

Potential Impacts of Lunar Landing Activities on PSR Volatile Science

Dong-Gyu Kim

Korea Aerospace Research Institute

Recent and planned lunar landing missions raise concerns about the preservation of permanently shadowed regions (PSRs), which are recognized as sites of special scientific interest due to their volatile-rich environments. PSRs serve as natural cold traps for water ice and organic molecules that may provide critical insights into the chemical precursors of life. However, spacecraft exhaust and human activities on the lunar surface can introduce volatile contaminants that migrate across the Moon and become trapped in PSRs, potentially obscuring pristine records. Numerical simulations, including those applied to ESA's Argonaut mission scenario, indicate that nearly half of exhaust-derived methane molecules may accumulate in polar PSRs within weeks, with measurable cross-contamination between poles. These findings suggest that repeated or clustered landings near polar regions could significantly compromise long-term scientific investigations of lunar ice chemistry. To mitigate such risks, mission planning should consider landing sites outside sensitive PSR catchment areas, limit repeated activities near polar cold traps, and adopt planetary protection measures aligned with COSPAR guidelines. Careful coordination will be essential to balance exploration objectives with the preservation of the Moon's unique scientific environments. This paper synthesizes and analyzes recent studies on PSR contamination risks to provide reference material for future Korean lunar lander missions and broader lunar exploration initiatives.

10:10 [V-1-3]

Listening to the Early Universe: Protecting Lunar Radio Astronomy

Eun Jung Chung

Korea Astronomy and Space Science Institute

The far side of the Moon offers a uniquely quiet environment, shielded from Earth's radio noise. This makes it an ideal place to study the early Universe using radio astronomy, especially at low frequencies that are blocked by Earth's ionosphere. These faint signals, including those from the cosmic Dark Ages, may help us understand how the first stars and galaxies formed. This presentation highlights the scientific value of lunar-based radio astronomy and introduces missions such as LuSEE-Night, LCRT, and FARSIDE, which are designed to detect these

early-Universe signals. It also discusses international efforts to protect key areas of the Moon from radio interference to ensure such observations can be carried out effectively.

10:25 [V-1-4]

Sharing the Lunar Science Data: Limitation, Challenges & How to Overcome

Eunhyeuk Kim, Seoyoung Chung

Korea Aerospace Research Institute

There are increasing number of lunar missions during the coming decade and the part of the moon missions will be carried out by private companies. The aims of the future lunar missions would be 1) develop and confirm the space technologies, 2) Find and investigate resources which are rare in Earth, 3) Explore moon's polar regions for the sustainable residence, 4) Connect the moon to mars exploration. A substantial amount of science data will be generated from those lunar missions and the use of the data will play an important role in future human society. The "Artemis Accords" a general agreement in lunar mission is already signed by 56 countries, and sharing the science data is one of major points the Accords are dealing with. However, there have been both discussion and debate for the topics of "How to share and which data to be shared with". The debate would be in part related with the missions carried out by private companies. We will discuss in the present study on the status of data sharing in the lunar missions in general.

10:40 [V-1-5]

Current Status and Development of IADC Guidelines for Space Debris Mitigation in Lunar Orbit

Jaedong Seong, Youeyun Jung, Saehan Song, Okchul Jung

Korea Aerospace Research Institute

The Inter-Agency Space Debris Coordination Committee (IADC), established in 1993, serves as an international governmental forum for coordinating activities related to space debris issues among 13 major space agencies including KARI. With the renewed interest in lunar exploration driven by programs such as Artemis and increasing commercial activities, Working Group 4 (WG4) is currently conducting internal technical reviews to develop comprehensive debris mitigation measures specifically tailored for the lunar environment.

The ongoing technical assessment addresses unique challenges of lunar operations, including limited deep space tracking capabilities, absence of navigation infrastructure analogous to Earth's GNSS systems, and significantly greater orbital uncertainties. The review examines key mitigation areas including debris release prevention during normal operations, on-orbit break-up prevention, post-mission disposal strategies, and collision avoidance procedures. Particular attention is given to disposal options suitable for lunar missions—controlled surface impact, heliocentric orbit insertion, graveyard orbits, and Earth return—each requiring careful evaluation against planetary protection protocols and preservation of scientifically valuable sites.

Current operational experiences demonstrate the urgency of these measures, as existing lunar missions including LRO, KPLO, and Chandrayaan-2 already perform collision avoidance maneuvers in overlapping low lunar orbits. With projected increases in lunar activities encompassing commercial payload services, communication constellations, and infrastructure for sustained human presence, establishing effective mitigation guidelines becomes critical. The IADC continues this technical review process through collaborative efforts among member agencies, aiming to develop consensus-based recommendations that ensure long-term sustainability of lunar operations while preserving opportunities for future scientific exploration and resource utilization.

10:55 [V-1-6]

Concept Proposal for Safe and Sustainable Lunar Exploration: The LANTERN (Lunar Activity Notice, Traffic, and Environmental Risk Network) Platform

Young-Joo Song[1], Soyoung Chung[2], Moon-Jin Jeon[2], Chaerin Jeong[1]

[1]*Kyung Hee University*

[2]*Korea Aerospace Research Institute*

Global lunar exploration missions are growing fast. Under frameworks such as the U.S.-led Artemis Accords and the China-led ILRS (International Lunar Research Station), multinational participation is expanding. Plans for crewed base construction and surface activities are becoming more concrete. Given these trends, transparent information disclosure and real-time sharing are essential to protect the safety of crew members and robotic assets. This presentation proposes LANTERN (Lunar Activity Notice, Traffic & Environmental Risk Network), a high-level information-sharing platform system to support safe and sustainable international lunar exploration in the era of permanent bases. LANTERN aims to provide a shared situation picture that integrates surface activities, orbital activities, and environmental data on the Moon. Its core scope includes: (1) real-time notices and updates on the time and mission of spacecraft passing above bases; (2) schedules (time and location) for lander descent and ascent near bases or in other regions; (3) rise and set times of the Sun, Earth, and relay spacecraft, referenced to local base time; (4) regional environmental indicators such as temperature, radiation index, space weather, and dust/plume risk; and (5) sharing of orbit information with conjunction warnings and risk assessment.

Consistent collection and distribution of such information are expected to improve crew safety, reduce interference between missions, and increase operational efficiency. Given the diversity of actors and overlapping schedules, international cooperation and standardization, covering data formats and procedures, access levels, and responsibility rules are required for implementation. This concept is offered as a starting point with clear value for joint refinement by domestic and international partners. With further development, the system could enable Korea to make a practical contribution to the international community. This presentation aims to provide a basis for collaboration among stakeholders.

11:10 [V-1-7]

Current Status and Implications of International Discussions on the Interoperability of Systems and Infrastructure for Lunar Activities

Nammi Choe

Korea Aerospace Research Institute

In 2019, more than five decades after the Apollo missions inaugurated human exploration of the Moon, NASA launched the Artemis program, signaling a paradigm shift in lunar activities. Unlike the Apollo era's brief landings and symbolic achievements, Artemis advances a long-term vision of sustained human presence, encompassing scientific inquiry as well as commercial activity. To implement this vision, the United States initiated the Artemis Accords in 2019, extending participation to a broad range of states and space agencies. As of September 2025, 56 countries have joined, reflecting a significant expansion of international involvement in lunar exploration. This evolution transforms the Moon from an arena of competition among a few advanced nations into a prospective domain of international economic activity involving both states and private actors. Such a transformation necessitates the development of lunar infrastructure—fuel depots, landing platforms, communications, and power systems—comparable to terrestrial logistics, energy, and communication networks. Drawing on lessons from interoperability in fields such as global health and telecommunications, this paper argues that lunar systems must achieve interoperability to ensure effective coordination among diverse national activities. It examines current international discussions on interoperability of lunar infrastructure and considers their implications for South Korea's role in the emerging lunar economy.

Landing Ballroom B

V-2 우주탐사 Ⅳ

Chair: 서행자(항우연)

09:40 [V-2-1]

Sensitivity Analysis on Multi-Revolution Orbit Transfer Trajectory Optimizations with Low/Continuous Thrust

Jaemin Park, Jinah Lee, Chandeok Park

Department of Astronomy, Yonsei University

This study analyzes the effect of initial guesses and embedded integral schemes on the convergence and accuracy of low/continuous thrust trajectory optimization problems for multi-revolution orbit transfer. The continuous-thrust orbit transfer progressively adjusts the orbital elements of a spacecraft by continuously applying thrust during its transition. Among a variety of possible transfer schemes, the multi-revolution approach enables a spacecraft to greatly reduce fuel consumption to reach the target orbit. It is, however, known to be difficult to solve, as the number of revolutions increases, mainly due to strong nonlinearity, high numerical instability and sensitivity to initial guesses. As an attempt to solve efficiently and systematically, this study proposes to design initial guesses for control variables by reflecting their periodicity in multi-revolution trajectories. The initial guesses are constructed from trigonometric functions, with their coefficients determined through curve fitting based on rational functions and their offset term determined through curve fitting based on power functions. Additionally, the effect of scheme/order of integrator, which is embedded into the optimization algorithm, is also shown to be non-trivial. Accoridng to numerical experiments in near-Earth environments, the first-order forward Euler integral scheme achieves the feasible solutions of up to 2 revolutions, even when precise initial guesses are provided. In contrast, with the help of step size adjustment and precise initial guesses, the second-order RK2 integral scheme can develop feasible multi-revolution transfer trajectories of 20 or more revolutions. Switching to the fourth-order RK4 integral scheme enhances the solutions to lead 60 or more revolution trajectories. The overall results demonstrate that the efficient combinations of accurate initial guesses, appropriate step size resolutions and integral schemes affect the convergence and accuracy of the solutions to continuous-thrust multi-revolution orbit transfer trajectory optimizations.

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2021R1I1A2048824 and RS-2024-00452196).

09:55 [V-2-2]

Initial Design of Cryogenic System for Ground and Deep Space Optic Communication

Hojin Lee[1,2], Seonghwan Choi[1], Sanghun Song[1], ByeongChae Bang[3]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*AntBridge, Inc*

Successful Deep Space Optical Communication (DSOC) hinges on high-performance photodetectors capable of detecting faint, photon-level signals. Conventional Single-Photon Avalanche Diodes (SPADs) operate at room temperature but are hampered by a modest detection efficiency of 50–70% and a high dark count rate. In contrast, Superconducting Nanowire Single-Photon Detectors (SNSPDs) boast a superior detection efficiency exceeding 90% and a low dark count rate below 100 cps within a cryogenic environment (~2 K). This makes SNSPDs indispensable for ground stations demanding maximum reception sensitivity. Furthermore, their integration is a promising avenue for significantly enhancing the performance of space payloads. Stable operation of SNSPDs necessitates a cryogenic cooling system capable of maintaining temperatures below 2 K. Leading cryogenic technologies include Gifford-McMahon (GM), Pulse Tube (PT), and Joule-Thomson (JT) cryocoolers. While GM cryocoolers provide high cooling capacity, their mechanically moving parts lead to drawbacks such as limited lifetime and significant vibration. In contrast, PT cryocoolers feature minimal vibration and an impressive lifetime exceeding 20,000 hours, albeit with a relatively low cooling capacity. JT cryocoolers also offer low-vibration operation, thanks to a design with no moving parts at the cold head; however, they necessitate a pre-cooling stage. Addressing these trade-offs, this study proposes hybrid cooling systems tailored to the specific requirements of each platform. For ground stations, where managing high thermal loads is paramount, we have designed a three-stage PT-PT-PT system. Conversely, for space payloads, where low vibration and high reliability are the primary concerns, we propose a two-stage PT-JT hybrid architecture. This presentation will detail the core requirements for these systems and introduce our initial conceptual designs for hybrid coolers tailored to each application.

10:10 [V-2-3]

Feasibility Study of DSOC for L4

Hyun-Jeong Choi[1], Yong-Jae Moon[1], Seonghwan Choi[2]

[1]*School of Space Research, Kyung Hee University*
[2]*Center for Heliophysics Observations and Technology, KASI*

This study addresses the feasibility of Deep Space Optical Communications (DSOC) for an L4 mission and outlines a development roadmap based on its current status. To date, the most advanced DSOC-related technology has been demonstrated in the Psyche Mission by NASA/JPL. It has high-rate optical downlinks over interplanetary ranges (up to 2.67 AU), achieving a space-to-ground data rate of 16–267 Mbps using a 22-cm, 4-W flight transceiver. These results indicate that 100 Mbps is realistic near 1 AU, which is our baseline performance target. To develop a DSOC system for L4 readiness, we propose to enable eight tasks: (1) Development of a wireless optical communication terminal, (2) Advancement of atmospheric channel compensation technologies, (3) Establishment of a DSOC testbed, (4) Construction of a hybrid RF/DSOC system, (5) Research on related standards, (6) Establishment of a DSOC system operations framework, (7) Establishment of QoS operation policies, and (8) Investigation of potential DSOC utilization methods. As part of this study, we will design the end-to-end system architecture to demonstrate the feasibility of DSOC implementation for the L4 mission.

10:25 [V-2-4]

Simulink-Based Modeling and Design for DSOC (Deep Space Optical Communication)

Sanghun Song[1], ByeongChae Bang[2], Seonghwan Choi[1], Hojin Lee[1,3]

[1]*Korea Astronomy and Space Science Institute*
[2]*AntBridge, Inc*
[3]*University of Science and Technology*

This paper investigates Simulink-Based Modeling and design method and approcach for DSOC (Deep Space Optical Communication). Simulink is effective for model-based design (MBD) at the overall system level, enabling rapid simulation and system verification. In particular, it allows for fast modeling of Satellite Communication, Control logic design like the PAT (Pointing Acquisition Tracking) technology, and Signal processing system for Analog/Digital and RF analysis, and further supports automatic code generation for hardware implementation. Therefore Simulink facilitates efficient system development. This study and modeling method presents approach for processing signal and pattern using Optical Communication Modulation of DSOC and proposed Simulink-Based Model. Also the approach demonstrates the feasibility of analyzing key characteristics of the communication system using that model. The designed model employs PPM (Pulse Position modulation) for optical communication system, and Simulation model was used to determine the between transmission and reception signals considering space environment and atmospheric effects. Additionally, the possibility of integrating photon-level detection systems and their various properties into Simulink has been explored.

10:40 [V-2-5]

Radiation Shielding Evaluation for Quantum Key Distribution Payload in Low Earth Orbit

Beom-Su An[1], Sung-Jin Kim[1], Jongho Seon[1], Jun-Bum Park[2], Jeong-Woon Choi[2], Hyung-Chul Lim[3], Chun-Ju Youn[4], Minchul Kim[4], Min-Hyeong Gil[5]

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[2]*SK Telecom*
[3]*Korea Astronomy and Space Science Institute*
[4]*Electronics and Telecommunications Research Institute*
[5]*Korea Testing Laboratory*

The quantum key distribution payload onboard a low Earth orbit (LEO) satellite will be exposed to radiation effects such as total ionizing dose (TID) and single event effects (SEE), which pose potential risks to mission reliability. As part of a conceptual design study, this work focuses on TID evaluation. Geant4 simulations were used to determine the shielding thickness distributions by analyzing particle traversal paths at designated internal positions of a simplified payload model. These distributions were then combined with SPENVIS-derived dose-depth curves to estimate TID contributions from trapped electrons and protons in a 650 km, 97° inclination orbit. Preliminary results indicate that thicker shielding reduces TID but also increases payload mass, highlighting a critical design trade-off for mission planners. This systematic approach enables assessment of radiation protection as a function of shielding thickness and payload configuration. Future studies will extend the framework to evaluate SEE. Our findings provide key insights for optimizing shielding strategies in the conceptual design of quantum communication payloads.

10:55 [V-2-6]

Development of a Cross-Contamination Control System to Improve the Reliability of the ASTM E595 Outgassing Test Method

Yangho Kim, Minsung Kim, Chulwoo Park

Vacuumex Inc.

A Cross-Contamination Control System (CCCS) has been developed to improve the reliability of the ASTM E595 outgassing test, a critical method for qualifying materials for space applications. To mitigate measurement errors caused by sample cross-talk, we employed simulation to engineer an optimal fixture geometry. This design approach prevents cross-contamination between specimens while ensuring the structure itself does not interfere with the intrinsic test results. A prototype based on this simulation-driven design has been manufactured and validated. In this presentation, we will introduce the design methodology and present key data from validation tests that demonstrate a marked improvement in measurement repeatability.

11:10 [V-2-7]

Space ASIC Devices for Space Science Payload Instruments

Minjae Kim[1], Ho Jin[1], Yunho Jang[1], Ik Joon Chang[2], Ickhyun Song[3], Yonghwan Kwon[4], Taeyeong Kim[5], Khan-Hyuk Kim[1]

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[4]*Department of Semiconductor Enginnering, Kyung Hee University*
[5]*Department of Artificial Intelligence Semiconductor Engineering, Hanyang University*

Spacecraft are essential tools for providing in-situ measurements and multiband observation data in space. However, they are constrained by limited mass, size, and power availability for their missions. Therefore, reducing spacecraft mass and power consumption is an ongoing challenge. Application-Specific Integrated Circuit (ASIC) technology offers advantages in terms of mass, volume, and power consumption.
An ASIC is a semiconductor chip designed for specific functions. By integrating only essential operations into a single chip, ASICs enable system miniaturization and reduce unnecessary power consumption. These characteristics provide clear benefits in addressing the mass and power constraints of spacecraft.
We are developing a space search-coil magnetometer (SSCM) in collaboration with the Departments of Electronic Engineering at Kyung Hee University and Hanyang University. The SSCM features an ASIC-based FFT processor and amplifier. These two ASICs are being developed as radiation-hardened devices suitable for space missions.
This presentation introduces the benefits of ASICs for space applications and the SSCM's ASICs currently being developed in collaboration.

Landing Ballroom C

V-3 태양 및 우주환경 III

Chair: 이종길(충북대)

09:40 [V-3-1]

Climatology of Thermospheric Winds in the Southern Polar Cap: Long-Term Ground-Based Observations from JBS-FPI

Eunsol Kim[1], Changsup Lee[1,2], Young-Bae Ham[1,2],

Geonhwa Jee[1,2]

[1]*Korea Polar Research Institute*
[2]*University of Science and Technology*

This study presents the results from a climatological analysis of thermospheric winds (~250 km altitude) in the southern polar cap, based on the first long-term ground-based Fabry-Perot Interferometer (FPI) observations at Jang Bogo station (JBS; 80°S geomagnetic latitude), Antarctica, during 2014–2022. The winds exhibit pronounced diurnal variations, characterized by persistent anti-sunward flow across all magnetic local time sectors with a slight duskward deviation, primarily driven by ion drag in combination with day-to-night pressure gradients. The seasonal and solar activity dependencies show enhanced wind magnitudes during equinoxes and under high solar activity, reflecting stronger ion drag from increased ionospheric densities. The wind patterns are further modulated by increasing geomagnetic activity, which intensifies wind speeds and enhances the duskward deviations, associated with the enhancement of the dusk-side ionospheric convection cell. The orientation of the interplanetary magnetic field (IMF) also influences wind behaviors: a negative IMF Bz component increases wind magnitudes, while the IMF By component induces directional asymmetry by modulating ionospheric convection. These results confirm the climatological characteristics of thermospheric winds over the southern polar cap, demonstrating their modulation by solar activity, geomagnetic activity, and IMF orientation.

09:55 [V-3-2]

Origin of Intense Plasma Depletions After Midnight over the Korean Peninsula during the Geomagnetic Storm on 11 May 2024

Hyosub Kil, Se-Heon Jeong, Woo Kyoung Lee, Junseok Hong

Korea Astronomy and Space Science Institute

A band of total electron content (TEC) depletions of about 5–15 TEC unit passed over the Korean Peninsula after midnight during the geomagnetic storm on 11 May 2024. This magnitude of TEC depletions has not been previously reported in the region. We track the origin and evolution of these depletions using the TEC data from global navigation satellite system network in Korea and Japan. A distinctive TEC depletion band aligned in the northwest-southeast direction emerges in the northern east of Japan. The TEC depletions observed over the Korean Peninsula exhibit a similar band structure, and their appearance coincides with the arrival of the TEC depletion band from Japan. The distributions of the rate of TEC index indicates that the band is part of a midlatitude TEC perturbation layer that propagates equatorward. These observations suggest a high-latitude origin for the TEC depletions over the peninsula.

10:10 [V-3-3]

Coronal Magnetic Field Modeling Improved by Incorporation of 3-D Density Structures

Junmo An, Ryun-Young Kwon

Korea Astronomy and Space Science Institute

We present ongoing work to improve coronal magnetic field modeling by incorporating three-dimensional coronal density structures. The potential field source surface (PFSS) model, commonly employed to generate boundary conditions at 21.5 solar radii for global 3-D solar wind simulations, often fails to reproduce key density features such as coronal streamers. To mitigate these limitations and achieve more realistic 3-D coronal magnetic field configurations, we apply controlled adjustments to the input photospheric magnetic field, with particular emphasis on the polar regions where measurements remain uncertain. These adjustments involve scaling individual spherical harmonic components to assess their influence on coronal modeling. Our results demonstrate that such refinements have potential to improve both the reconstruction of 3-D coronal magnetic fields and the performance of coupled global solar wind simulations at Earth orbit. We also discuss potential strategies for incorporating coronal density information into coronal magnetic field models.

10:25 [V-3-4]

Development of an Anisotropic Visco-Resistive MHD Code with Thermal Conduction for Solar Atmospheric Simulations

Donghui Son[1], Tetsuya Magara[1,2]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Astronomy and Space Science, Kyung Hee University*

Solar coronal X-ray jets are understood to form through the interplay of magnetic reconnection and thermal-conduction-driven chromospheric evaporation (Shibata et al. 1992). While Miyagoshi & Yokoyama (2004) quantified this mechanism under an inviscid assumption, real coronal plasma exhibits anisotropic viscosity due to the strong magnetic fields. Viscosity can fundamentally influence the dynamics of reconnection outflows, energy dissipation pathways, and jet mass determination, yet it has not been systematically incorporated into self-consistent jet formation models.

This study addresses this gap by developing a 2.5-dimensional model that self-consistently solves the viscous-resistive MHD equations coupled with anisotropic thermal conduction. We model anisotropic viscosity using Quinn's (2021) switching formulation, which smoothly transitions from isotropic viscosity near magnetic nulls to Braginskii's parallel viscosity in strong-field regions. This mitigates the numerical indeterminacy

of the classical Braginskii tensor at $|B| \to 0$ while preserving physically consistent viscous dissipation.
Numerically, we replace the conventional Lax-Wendroff scheme with a modern finite volume framework. Spatial reconstruction employs the fifth-order accurate IMWENO-P scheme (Zhong et al. 2023), while fluxes are computed using the low-dissipation Harten-Lax-van Leer discontinuities (HLLD) Riemann solver (Minoshima & Miyoshi 2021). Anisotropic thermal conduction is treated with a monotonicity-preserving scheme (Sharma & Hammett 2007) to suppress spurious oscillations. Hyperbolic and parabolic terms are decoupled via Strang operator splitting, with time integration employing a third-order strong-stability-preserving (SSP) Runge-Kutta (RK) scheme (Suresh & Huynh 1997) for hyperbolic terms and a second-order Runge-Kutta-Legendre (RKL) scheme (Meyer et al. 2014) for stiff parabolic terms (resistivity, thermal conduction, viscosity). This combination enables high-fidelity resolution of shocks, reconnection current sheets, and thermal fronts while minimizing numerical diffusion. In this presentation, we validate the robustness of our newly developed code and present initial simulation results quantitatively analyzing the impact of anisotropic viscosity on the magnetic reconnection rate, chromospheric evaporation, and the density and collimation of the resulting jets.

10:40 [V-3-5]

Solar Wind Charge State Evolution from the Corona to 1 AU with Nonthermal Electrons

Jin-Yi Lee[1], Junmo An[2], John C. Raymond[3], Chengcai Shen[3]

[1]*Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*
[3]*The Center for Astrophysics | Harvard & Smithsonian*

We investigate the evolution of charge states in the solar wind plasma with nonthermal electrons using a 3-D MHD solar wind model. The Reproduce Plasma Universe (REPPU) solar wind model provides the outputs, temperature, density, and velocity, which are used as inputs to a time-dependent ionization model. To present deviations from Maxwellian electron velocity distributions, we apply various κ-values in ionization and recombination rate calculations. The calculated charge states are used to reconstruct the EUV coronal emission, which we compare with the observations by the ultraviolet coronagraph spectrometer (UVCS) on board the solar and heliospheric observatory (SOHO). Additionally, the calculated charge states are compared with in-situ observations by the Solar Wind Ion Composition Spectrometer (SWICS) on board the Advanced Composition Explorer (ACE). We discuss the nonequilibrium effects both in the EUV solar corona and in the solar wind at 1AU.

10:55 [V-3-6]

Investigating Differences and Causes of Two Energy Spectrum Types of Solar Proton Events

Ji-Hyeon Yoo[1,2], Ryun-Young Kwon[1], Dae-Young Lee[2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*

Solar energetic protons are largely understood to be accelerated by the shocks driven by coronal mass ejections (CMEs). When such protons are detected by spacecraft, the event is referred to as a solar proton event (SPE). The energy spectra of SPEs often fall into two cases: (1) sequential arrival of particles from higher to lower energies (HTL), and (2) sequential arrival from lower to higher energies (LTH). In this presentation, we investigate why these SPE energy spectra differ, by analyzing two events that clearly exhibit HTL or LTH cases. To this end, we performed back-tracing analysis of SPE particle trajectories moving along the Parker spiral lines, from its onset time determined for each energy channel. We compared the acceleration sites in two events, by assuming that particles are accelerated at the intersection of the propagating CME-driven shock and the back-traced proton trajectory. As a result, we found that protons for the HTL event were accelerated within 15 Rs across all energy channels, whereas those in the LTH events were accelerated in interplanetary space ($\sim$0.2–0.7 AU). Furthermore, we investigated which parts of the CME-driven shocks encountered the back-traced trajectories of protons for the energy channels. Lower-energy protons were accelerated near the shock flank, whereas higher-energy protons were accelerated near the shock nose. Therefore, we emphasize that both the heliocentric distance and the specific region of the shock at which acceleration occurs play crucial roles in determining SPE energy spectra.

11:10 [V-3-7]

Investigating the Characteristics and Solar Origin of High-latitude Geomagnetic Disturbances During a Deep Solar Minimum

Seohee Jang[1,2], Sung-Hong Park[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*

Even during periods of low solar activity, severe disturbances of the Earth's magnetic field have often occurred especially at high latitudes in the auroral zones, presumably as a consequence of the solar wind interacting with the magnetosphere. It is therefore important to characterize such high-latitude geomagnetic disturbances in response to time-varying solar wind and interplanetary magnetic field conditions for understanding solar

wind-magnetosphere interaction. For this, we first identified and characterized geomagnetic disturbance events at high-latitudes during a deep solar minimum of 2018 to 2020 by analyzing time series of the geomagnetic AL index (as a measure of the intensity of the westward auroral electrojet). The identified events were then classified into different subgroups based on the strength, duration and growth rate of geomagnetic distrubances. Here we will present the superposed epoch analysis of solar wind and interplanetary magnetic field parameters measured at the Sun-Earth Lagrange point L1 around the onset of all geomagnetic disturbance events belonging to each of the subgroups. In addition, we will demonstrate properties of coronal holes that may produce solar wind streams relevant to large geomagnetic disturbance events at high latitudes.

Halla Room

V-4 우주인프라/우주산업

Chair: 김일훈(에스엘랩)

09:40 [V-4-1]

A Study on Requirements for Developing Core Technologies of Microwave Sounder

Changho Woo, Jin-Ho Lee, Sinmu Park,
Hyunsuk Lee, Byong-Suk Suk, Sang-Soon Yong

Korea Aerospace Research Institute

Microwave Sounder (MWS) is a remote sensing instrument that is essential for weather forecasting, climate change monitoring, ocean and glacier research, and disaster monitoring. Specifically, the instrument provides vertical profiles of temperature and humidity, which can be utilized for weather prediction. Instruments such as the Advanced Temperature Microwave Sounder (ATMS) and MetOp-C are currently in operation by NASA and ESA. However, South Korea relies entirely on foreign sources such meteorological data. Within the framework of the Space Pioneer Program, which is aimed to develop Qualification Model that has completed environmental testing at TRL 7, the MWS has been identified as a space key technology for satellite payload. This study provides an analysis of international development trends in MWS and derives the requirements for the core technologies of MWS.

09:55 [V-4-2]

100 Gbps Laser Communication Experiment under Atmospheric Turbulence Channel

Sang-Won Park[1,2], Hyung-Chul Lim[1],
Ki-Pyung Sung[1], Sung-Yeol Yu[1]

[1]*Korea Astronomy and Space Science Institute*

[2]*Chungbuk National University*

Free-space optical (FSO) communication is a next-generation technology offering wide bandwidth and high data rates, but signal attenuation and fading caused by atmospheric turbulence remain a major technical challenge for establishing a stable communication link. To address this issue, the Korea Astronomy and Space Science Institute (KASI) has been developing the Pointing, Acquisition, and Tracking (PAT) technology, which is essential for satellite optical communication. This technology utilizes a closed-loop control system where a Quadrant Photo Detector (QPD) sensor detects the target's position error, and this information is fed back to a piezoelectric Fast Steering Mirror (FSM) to correct the beam pointing in real-time. Furthermore, KASI has been upgrading the Satellite Laser Ranging (SLR) station to utilize as an optical ground station (OGS), which employs a 100 cm telescope and a Coudé optical path. In this study, we plan to conduct a 100 Gbps-class FSO communication experiment using the OGS. The link will adopt the Dual-Polarization Quadrature Phase Shift Keying (DP-QPSK) modulation format. A 15 cm off-axis telescope transmitter, simulating a satellite terminal, will be located 20.5 km away from the OGS along a horizontal path to emulate a realistic atmospheric environment. This study analyzes the effect of the 20.5 km horizontal atmospheric turbulence on the 100 Gbps DP-QPSK signal and describes the detailed experimental plan designed to overcome these effects. This experiment aims to verify the PAT performance and to demonstrate the practical feasibility of high-speed optical communication technology in the presence of atmospheric turbulence.

10:10 [V-4-3]

Maintenance of Large Vertical Vibration Shaker System

Tae Seok Oh, Jong-Min Im, Hee-Kwang Eun,
Jong-Hyub Jun, Seon-Je Jo, Jin Park,
Nam-Jin Moon, Chang-Rae Cho

Korea Aerospace Research Institute

The Korea Aerospace Research Institute (KARI) developed QUAD system composed of four LDS V984 shakers for large vertical vibration testing simulating launch environments. However, during a fixture vibration test, a decrease in the acceleration response of one shaker was observed. To address this issue, the amplitude gain of a Phase Control Unit (PCU), which enables Single-Input Single-Output (SISO) control of the four shakers, was readjusted. The QUAD system achieved uniform vibration response characteristics among the shakers, and vibration test with a military reconnaissance SAR satellite was performed according to the target vibration profile.

10:25 [V-4-4]

A Study on the Optimization of the Mission Orbit Entry of an Inclined Geosynchronous Orbit Satellite Using a Numerical Optimization Method

Bangyeop Kim

Korea Aerospace Research Institute

This study applied numerical optimization algorithms to determine the velocity increments and execution timing required for the mission orbit entry process of a inclined geosynchronous satellite. Considering the use of various launch vehicles, simulations were performed using MATLAB and the SNOPT numerical optimization algorithm to determine the mission orbit injection process under different transfer orbit conditions.

Landing Ballroom A

VI-1 SS: 국제 달 착륙선을 통한 과학 탐사 임무

Chair: 백슬민(천문연)

16:10 [VI-1-1]

Development and Delivery of K-RadCube: A 12U CubeSat for Space Radiation Measurement to be Deployed from Artemis II Mission

Jehyuck Shin[1], Dukhang Lee[1,2], Young-Jun Choi[1], Uk-Won Nam[1], Donguk Song[1], Woo-Hyeong Seol[1], Won-kee Park[1], Seul-Min Baek[1], Chae Kyung Sim[1,2], Hyojeong Lee[3], Seongwhan Lee[3], Taewan Kim[4], Hyeonggu Kim[4]

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[2]*University of Science and Technology*
[3]*Nara Space Technology Inc.*
[4]*KT SAT*

Artemis program is NASA's initiative to return humans to the Moon after the Apollo era, and Artemis II will launch on the Space Launch System (SLS) and carry astronauts in the Orion spacecraft. Beyond demonstrating human spaceflight, Artemis II also accommodates Secondary Payloads (SPLs), CubeSat-class satellites deployed from the Orion Stage Adapter to conduct complementary scientific and technological missions. K-RadCube is a 12U CubeSat manifested as an SPL on Artemis II. Its mission is to investigate the radiation environment in high Earth orbit, covering altitudes ranging from a couple of kilometers to approximately 70,000 kilometers. This trajectory enables the measurement of space radiation across the inner and outer Van Allen radiation belts. K-RadCube was recently completed in development and has passed NASA safety review processes for a crewed mission, with standalone testing and dispenser integration successfully carried out at NASA's Kennedy Space Center.

16:25 [VI-1-2]

Space Radiation Research Using LEO-DOS Data from NEXTsat-2

Jongil Jung[1], Young-Sil Kwak[1,2], Uk-Won Nam[1], Won-Kee Park[1], Jongdae Sohn[1], Sukwon Youn[3], Sunghwan Kim[4], Hongjoo Kim[5]

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[3]*Seoul National University*
[4]*Cheongju University*
[5]*Kyoungpook National University*

Space radiation is one of the greatest risks and challenges for humanity in space exploration. The Next Generation Small satellite-2 (NEXTsat-2) launched on May 23, 2023, carries several scientific payloads, including the Low Earth Orbit Space Radiation Dosimeter (LEO-DOS), designed to monitor the radiation environments in near-Earth space. LEO-DOS provides measurements of absorbed and equivalent doses of space radiation, with the objectives of generating global radiation maps, investigating variations associated with solar activity, assessing radiation risks to astronauts, and evaluating radiation effects on electronic components in near-Earth space. Since June 2023, LEO-DOS has been continuously providing measurement data. Looking ahead, the Artemis II mission, scheduled for launch next year, will carry the K-RadCube, equipped with an instrument similar to LEO-DOS, to measure space radiation exposure between Earth and the Moon. These complementary datasets are expected to provide valuable insights into the radiation environment across different orbital regimes. In this presentation, we report on the initial analysis results of LEO-DOS data collected onboard NEXTsat-2.

16:40 [VI-1-3]

Science Applications of the LVRAD Neutron Spectrometers for Lunar Lander Missions

Eunji Yi[1,2], Uk-won Nam[1], Sukwon Youn[3], Dahye Ahn[3], Sunghwan Kim[4], Hongjoo Kim[5], Woo-Hyeong Seol[1], Won-kee Park[1], Jongdae Sohn[1], Chae Kyung Sim[1,2], Dukhang Lee[1], Seul-Min Baek[1], Jehyuck Shin[1], Young-Jun Choi[1], Insoo Jun[6], Sung-Joon Ye[3]

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[2]*University of Science and Technology (UST)*
[3]*Seoul National University*
[4]*Cheongju University*
[5]*Kyungpook National University*
[6]*NASA Jet Propulsion Laboratory*

Understanding the distribution and abundance of water on the Moon provides critical clues to its formation and evolution, as well as essential knowledge for future resource utilization. Addressing these questions requires in-situ neutron spectroscopy of hydrogen. The Lunar Vehicle Radiation Dosimeter (LVRAD), proposed for NASA's Commercial Lunar Payload Services (CLPS) program, is designed to measure charged particle and neutron environments on the lunar surface. This study focuses on the Fast and Epithermal Neutron Spectrometers (NS-F and NS-E). Their measurements will address not only the distribution of water in permanently shadowed regions (PSRs) at the poles, but also broader scientific questions, including the hydrogen content of non-polar regions such as pyroclastic deposits and KREEP-rich terrains. This presentation will discuss the scientific applications and research prospects of hydrogen exploration with the LVRAD neutron spectrometers.

16:55 [VI-1-4]

LUSEM for Artemis CLPS Mission: Instrument Overview, Pre-Launch Testing, and Science Objectives

Go Woon Na[1], Jongho Seon[1], Sung-Jin Kim[1], Minhyuk Oh[1], Beom-Su An[1], Young-Jun Choi[2,3], Dukhang Lee[2], Chae Kyung Sim[2], Seul-Min Baek[2], Woo-Hyeong Seol[2], Jehyuck Shin[2], Young Jin Jun[4], Sinhyeong Cho[4]

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[3]*University of Science and Technology*
[4]*Satrec Initiative Co., Ltd.*

The Korean Lunar Space Environment Monitor (LUSEM), which contributes to the Commercial Lunar Payload Services (CLPS) of NASA's Artemis mission, represents the first achievement of international collaboration between NASA and KASI in a lunar surface mission. LUSEM has a unique role in measuring the energy distribution of high-energy charged particles, setting it apart from previous experiments conducted on the lunar surface during the Apollo missions. It is also expected to provide new insights into the physical mechanisms responsible for the formation of lunar swirls and space weathering, as its landing site is Reiner Gamma—one of the most intriguing locations associated with lunar swirls. Furthermore, although LUSEM is part of a landing mission, it is designed to continue observations during the cruise phase to the Moon, offering valuable data on the interactions between the Earth's magnetotail and the Moon.
LUSEM was successfully developed and tested in Korea over a four-year period, from 2020 to 2023. The flight model was delivered to NASA in 2023 for integration onto the IM-3 lander, which is currently scheduled for launch in 2026. We are currently in the final stages of preparing for actual mission operations, including procedures for power-on, activation, and data acquisition. In Korea, we are conducting final validation tests for system integration with the lander and for in-orbit commissioning. In addition, we are running simulations to predict the electron cutoff energies that can be observed along LUSEM's landing trajectory.
We will present an overview of LUSEM's capabilities, test results, and upcoming schedule. Furthermore, we will discuss several advanced science goals that could be pursued in collaboration with other payloads onboard the same lander.

17:10 [VI-1-5]

Analysis of Apollo 16 Lunar Surface Magnetometer Data: Implications for the Operations of the Lunar Surface MAGnetometer (LSMAG)

Sanghwa Kim[1], Hyeonhu Park[1], Ho Jin[1], Khan-Hyuk Kim[1], Seul-Min Baek[2], Peter J. Chi[3]

[1]*School of Space Research, Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*
[3]*University of California, Los Angeles*

Lunar Surface MAGnetometer (LSMAG) had developed as one of the candidate scientific payload instruments for NASA's Commercial Lunar Payload Services (CLPS) initiative based on the KASI-NASA exploration Working Group.
The primary scientific objective of the LSMAG is to investigate the magnetic field on the Moon's crust and the interaction between the solar plasma and the lunar surface.
To enhance the scientific return of the LSMAG's lunar surface magnetic field investigation mission, we reviewed previous lunar surface magnetic field investigations. In this study, we analyzed a three-month dataset from the Apollo 16 Lunar Surface Magnetometer (LSM) covering April to June 1975. In addition, we utilized the restored LSM data from the Apollo 12, 15 and 16 missions to investigate variations in the lunar magnetic field.
Based on these reviews, we propose the anticipated operations and expected observations of LSMAG. We expect that this study will provide important insights for the operation of LSMAG.

17:25 [VI-1-6]

GrainCams (CLPS): *In Situ* 3D Regolith Imaging and Levitated Dust Detection, FM Development Status

Minsup Jeong[1], Young-Jun Choi[1,2], Chae Kyung Sim[1,2], Dukhang Lee[1,2], Bongkon Moon[1], Sungsoo S. Kim[3], Woojin Kim[2], Dae-Hee Lee[1], Seonghwan Choi[1], Jihun Kim[1], Yoonjong Kim[1], Mingyeong Lee[1,3], Seul-Min Baek[1], Jehyuck Shin[1]

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[3]*Kyung Hee University*

GrainCams is a rover-mounted dual-camera concept proposed as a Commercial Lunar Payload Services (CLPS) candidate to investigate the microphysics of the lunar surface boundary layer. The system comprises SurfCam, which uses light-field imaging to reconstruct the three-dimensional structure of undisturbed regolith at close range, and LevCam, which detects and characterizes electrostatically levitated dust above the surface. Together, these measurements aim to (i) resolve the in-situ 3-D architecture of lunar soil aggregates and porosity and (ii) detect time-variable dust concentrations to constrain lofting, transport, and settling mechanisms driven by diurnal electric-field changes and local activity. We will report the instrument development status as the payload enters the Flight Model (FM) fabrication phase, including optics and electronics integration, self-illumination design to minimize shadowing, dust-mitigation features near the aperture, and laboratory calibration plans using controlled electric fields for dust-dynamics validation. These updates outline the path to a flight-ready system capable of linking regolith microstructure to near-surface dust processes at future CLPS landing sites.

Landing Ballroom B

VI-2 SS: 소행성 탐사

Chair: 이진성(과기원)

16:10 [VI-2-1]

Construct Korean Asteroid Exploration Mission Roadmap

Junchan Lee[1], Jinsung Lee[1], HyeonKyu Jeon[1], Eunjin Jang[2], YoungJae Choo[1], Jisoo Kim[1], KyoungWook Min[3], Dainel J. Scheeres[4,5], Jaeheung Han[1,2,4,5]

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[4]*Aerospace Engineering Science, University of Colorado Boulder*
[5]*Space Institute, Korea Advanced Institute of Science and Technology*

Asteroid exploration has drawn considerable interest by its unique scientific value, planetary defense relevance, and potential for resource utilization. Asteroids has been regarded to preserve primordial material from the early solar system, offering direct evidence of planetary formation processes and the delivery pathways of volatiles and organics that may have contributed to the origin of life on Earth. Moreover, growing concerns over asteroid impact hazards highlight the necessity of developing detection, characterization, and deflection capabilities as an essential element of planetary defense.
As asteroid exploration constitutes one of the primary strategic directions in Korea's national space exploration, a systematic five phase roadmap for asteroid exploraion research has been established. This roamap consistute from nearEarth reconnaissance missions to advanced multi target capaigns extending into the outer solar system. The roadmap's mission architecture is sequentially structured: (i) rapid reconnaissance of accessible NEOs and technology development (2030–2035), (ii) two stage sample return missions (2035–2050s), and (iii) long-term exploration to Kuiper Belt asteroid via multiple flyby (2060–2070).

16:25 [VI-2-2]

Requirement Analysis of Asteroid Exploration Mission for Technology Demonstration and Planetary Defense

Junchan Lee[1], Jinsung Lee[1], HyeonKyu Jeon[1], Eunjin Jang[2], YoungJae Choo[1], Jisoo Kim[1], KyoungWook Min[3], Dainel J. Scheeres[4,5], Jaeheung Han[1,2,4,5]

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In 5 stages of Korean asteroid exploration roadmap, the first exploration mission has been planned. The prime objective of the first mission is to demonstrate deep space mission technology and to build resilience for the Earth's hazardous situation by extraterrestrial body. In first mission, the satellite will flyby 2024 YR4 and collide against the 2021 PC7 to implement planetary defense. Both asteroids are categorized as Near Earth Objects (NEO) and scheduled to come close to earth around 2031–2032. In this paper, system requirements will be specified by the mission analysis based on optimized trajectory. In conclusion, it can be shown that the 1st mission can be done by the small satellite with the mass about ~200 kg.

16:40 [VI-2-3]

Trajectory Design of Dual Near-Earth-Asteroid Reconnaissance and Impact Mission

Jinsung Lee

KAIST Satellite Technology Research Center

This presentation describes the concept of operations and trajectory architecture for a single-spacecraft, dual-target Near-Earth Object planetary-defense mission: a close reconnaissance flyby of near-Earth asteroid 2024 YR4 followed by a kinetic impact on 2021 PC7. The baseline trajectory uses an Earth-to-Sun-Earth L1 ballistic transfer timed to encounter 2024 YR4 near the L1 region. Placing the flyby near L1 lowers the spacecraft-asteroid relative velocity compared with an Earth-vicinity flyby and exploits the launch vehicle's hyperbolic excess energy (C3), thereby reducing the delta-V required for the subsequent impact leg to 2021 PC7. The Earth-to-YR4 leg is built by following the stable manifold of a Sun-Earth L1 periodic orbit that intersects 2024 YR4's path at the desired epoch and location. After the flyby, retargeting to 2021 PC7 is solved as an N-impulse optimization that minimizes total delta-V subject to encounter-window and operational constraints. We present the end-to-end design flow, key trades, and the evolution of the Sun-Asteroid-Spacecraft angle, demonstrating the feasibility of a low-delta-V reconnaissance-and-impact planetary-defense mission.

16:55 [VI-2-4]

Flyby and Impact of NEAs for Assessment: pLanetary Defense, Evolution and Internal Structure (FINALEI)

Youngmin JeongAhn[1], Myung-Jin Kim[1], Hee-Jae Lee[1], Pureum Kim[2], Hong-Kyu Moon[2], Chae Kyung Sim[1,3], Eun-Jung Choi[1,3], Youngbum Song[1], Bongkon Moon[1,3], Sung-Joon Park[1], Dukhang Lee[1,3], Minsup Jeong[1], Dong-Goo Roh[1], Jiwoong Yu[1], Jin Choi[1], Sang-Young Park[2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Yonsei University*
[3]*University of Science and Technology*

We present FINALEI, a dual-target asteroid mission concept under study at KASI. The plan is to conduct a flyby of 2024 YR4 in December 2032 and a kinetic impact on 2021 PC7 in September 2033.
2024 YR4 is a 60 m fast-rotating asteroid that drew wide attention in early 2025, when it was briefly considered a possible Earth impactor. While that risk has been ruled out, current calculations still leave a small probability of a future lunar impact. The object was observed extensively through 2024–2025 and will be characterized again in 2028, making it a rare opportunity to explore this class of body. 2021 PC7 is larger, with an estimated mass about ten times that of Dimorphos, the DART target. A ~250 kg spacecraft will strike it at ~18 km/s, providing the first deflection test on a primary asteroid body.
The mission is designed to strengthen planetary defense readiness while also addressing key questions on the evolution and diversity of small bodies. FINALEI began as a KASI concept study in 2025 and is scheduled to enter full-scale development in 2028.

17:10 [VI-2-5]

Flyby Trajectory Design for Near-Earth Asteroids Using a Lunar Swing-By

Pureum Kim, Sang-Young Park

Yonsei University

Advancements in space situational awareness, driven by improved telescopes and real-time detection networks, have significantly enhanced the ability to identify near-Earth asteroids as they approach Earth, providing longer warning times and more precise trajectory monitoring. These asteroids pose potential impact risks, yet simultaneously offer rare scientific opportunities to investigate their physical properties, composition, and origins during their brief passages near our planet. While rendezvous missions to asteroids allow for comprehensive study, they are typically expensive. In contrast, flyby missions present a practical and cheap alternative for rapid data collection within limited observation duration. This study explores trajectory design strategies for asteroid flyby missions in the cislunar region. A focus is made on the potential of lunar swing-by maneuvers to reduce mission costs and thereby increase the scientific accessibility of these valuable targets.

17:25 [VI-2-6]

Ground-Based Observational Support for the FINALEI Mission

Hee-Jae Lee[1], Myung-Jin Kim[1], Youngmin JeongAhn[1], Hong-Kyu Moon[1], Haeun Kim[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*

The achievement of an asteroid space mission requires the careful selection of target bodies, the definition of science objectives, and the establishment of a feasible mission plan. A key element in this process is to obtain a sufficient understanding of the physical properties of potential targets from the earliest stages of mission design. Since the mission itself cannot provide this information in advance, astronomical observations remain

the only practical means of characterizing asteroids and thus play a central role in mission planning.
In this presentation, we present observational strategies for the mission targets, 2024 YR4 and 2021 PC7, in support of the FINALEI mission, and discuss the physical properties that can be constrained from these observations. We further point out how these results can guide the design of onboard instruments and contribute to the achievement of the mission's scientific goals.

Landing Ballroom C

VI-3 태양 및 우주환경 IV

Chair: 김효민(NJIT)

16:10 [VI-3-1]

Altitude-Dependent Contributions of Zonal and Meridional Winds to Sporadic E Layers

Jaewook Lee[1], Young-Sil Kwak[1,2], Hyosub Kil[1,3], Tae-Yong Yang[1], Jong-Yeon Yun[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA*
[4]*Korea Aero Space Administration*

The formation of sporadic E (Es) layers is primarily driven by the vertical shear in horizontal neutral winds, but the relative contributions of the zonal and meridional components remain a subject of debate. This study investigates the roles of zonal and meridional wind shears in Es generation over the Korean Peninsula using neutral wind data from the Michaelson Interferometer for Global High-resolution Thermospheric Imaging (MIGHTI) aboard the Ionospheric Connection Explorer (ICON) satellite and Es observations from two ionosondes (Icheon and Jeju) from 2019 to 2022. Our analysis reveals a consistent downward progression of both Es layers and wind shear structures over the course of the day reinforcing their direct physical link. We find that below approximately 115 km where the ion-neutral collision frequency is greater than the ion gyrofrequency both zonal and meridional wind shears are strongly correlated with Es occurrence. However, above this altitude, the influence of zonal wind shear diminishes, while the correlation with meridional wind shear remains strong. These results observationally confirm that meridional wind shear is effective across a broad altitude range, whereas the role of zonal wind shear is predominantly confined to lower altitudes. This suggests that meridional winds play a more dominant role in Es formation at mid-latitudes than often assumed.

16:25 [VI-3-2]

Comparative Evaluation of High-Latitude Electrostatic Potential Models in SD WACCM-X

Jiwoo Kim[1], In-Sun Song[1], Wonseok Lee[2,3], Ja Soon Shim[2,4], Nicholas M. Pedatella[5,6]

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[3]*Department of Physics, Catholic University of America, Washington, USA*
[4]*Science and Technology Institute, Universities Space Research Association, Huntsville, USA*
[5]*NSF National Center for Atmospheric Research, High Altitude Observatory, Boulder, USA*
[6]*COSMIC Program Office, University Center for Atmospheric Research, Boulder, USA*

The ionosphere-thermosphere (IT) system is highly sensitive to external forcings. Previous studies have shown that upward-propagating tides and gravity waves from the lower atmosphere influence the IT system even during geomagnetic storms. Errors in representing these forcings interact nonlinearly, complicating model improvement. To separate these effects, this study quantifies uncertainties in lower atmospheric and space environmental influences using SD WACCM-X v2.2, nudged with MERRA-2 reanalysis. Three high-latitude electrostatic potential models in WACCM-X (Heelis 1982, Weimer 2005, and the data assimilation –based AMGeO) are compared. Geomagnetic storm cases of moderate, strong, and severe intensity (April 2010, March 2013, November 2004) are analyzed against Madrigal TEC using correlation coefficient (r), variance difference, bias, and RMSE. All models show sharp drops in spatial and temporal r and large RMSE increases during severe storms, especially in the main phase. While Heelis and Weimer strongly overestimate, AMGeO underestimates but yields much smaller RMSE. In the moderate case, variance differences, mean bias, and RMSE are notably smaller than in stronger storms.
This research was supported by the KASI under R&D programs (2025-1-850-02) and G-LAMP and NRF grant (RS-2024-00442483).

16:40 [VI-3-3]

Automatic CME Detection Using Historical Trends in SOHO LASCO Solar Images

Jonglil Lee[1], Daeyoung Lee[1], Ryunyoung Kwon[2]

[1]*Chungbuk National University*
[2]*Korea Astronomy&Space Science Institute*

We have released an empirically constructed CME catalog derived from SOHO LASCO C2 images on a public catalog website. From this catalog, we selectively used only the events that matched our research objectives in terms of velocity and

density, and fine-tuned our CME detection algorithm accordingly. To achieve this, multiple preprocessing steps were applied, and CMEs were ultimately detected from running-difference images. This allowed us to extract key parameters such as velocity, density, position, and ejection angle.

16:55 [VI-3-4]

Prediction of Hp30 Geomagnetic Index Associated with CME Events Using Deep Learning

Jihyeon Son[1], Jeong-Heon Kim[1], Young-Sil Kwak[1,2], Seon-Young Kim[3], Gi-Jeong Kim[4], Seungheon Shin[4], Se-Heon Jeong[1], Woong Jeon[1,4], Rok-Soon Kim[1], Sung-Hong Park[1,2], Jungjoon Seough[1]

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[3]*Ewha Womans University*
[4]*Kyung Hee University*

Hp30 index is one of the geomagnetic storm indicators similar to Kp index, but it has a higher time resolution (30 minutes) and open-end scale, making it suitable for short-term storm monitoring and forecasting. In this study, we develop deep learning models to predict Hp30 index 12 hours in advance. For this, we use OMNI solar wind parameters (interplanetary magnetic field components, solar wind speed, density, temperature, and dynamic pressure) together with coronal mass ejection (CME) parameters (angular width, position angle, and speed) from 2000 to 2024. We consider CMEs with angular width greater than 30 degrees, focusing on their geoeffectiveness. Accordingly, two modeling approaches are investigated. The first is a single-step prediction model that directly forecasts the Hp30 profile from the input parameters. The second is a two-step framework that classifies future intervals as storm or non-storm, and then predicts the Hp30 profile separately for each class. Here, a geomagnetic storm is defined as an event where Hp30 $\geqq 5$ occurs in more than 25% of the 12-hour prediction window. This study is part of the SpaceAI program at KASI, and we present the initial results at this meeting.

17:10 [VI-3-5]

Denoising SDO/AIA Images Using Self-Supervised Deep Learning Method

Daeil Kim[1], Yong-jae Moon[1,2]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Astronomy and Space Science, Kyung Hee University*

In this study, we introduce a self-supervised deep learning model for denoising Solar Dynamics Observatory (SDO)/Atmospheric Imaging Assembly (AIA) images. Our model is based on the Self2Self method, which enables training on a single noisy image without a clean target. We train the model using only one SDO/AIA 94 Å image observed during a solar maximum period. Our preliminary results are as follows. First, while our model produces slightly smoother results than the stacking method, the images remain visually comparable. Quantitatively, our model outperforms 49-frame stacked images by achieving higher Peak Signal-to-Noise Ratio (PSNR), RMS contrast, and Structural Similarity Index (SSIM), with SSIM of 0.88. Second, although our model is trained on a single image from the solar maximum, it successfully denoises images from all phases of the solar cycle. This study shows the potential of self-supervised learning for denoising solar Extreme Ultraviolet (EUV) images. By removing false signals from coronal structures, our approach may help to determine more accurate physical quantities.

17:25 [VI-3-6]

Preliminary Results of Stereoscopic DEMs for L4 and L5 missions

Junmu Youn[1], Jeongwoo Lee[2], Hyun-Jin Jeong[1,3], Yong-Jae Moon[1], Daeil Kim[1], Mingyu Jeon[1]

[1]*Kyung Hee University*
[2]*New Jersey Institute of Technology*
[3]*KU Leuven*

In this talk we introduce determining the differential emission measures (DEMs) using Solar Orbiter/Extreme Ultraviolet Imager (EUI)/Full Sun Imager (FSI) and AI-generated EUV data. The FSI observes only two full-disk extreme UV (EUV) channels (174 and 304 Å), which poses a limitation for determining DEMs. We address this problem using deep learning models based on Pix2PixCC-UNet, trained using the Solar Dynamics Observatory (SDO)/Atmospheric Imaging Assembly (AIA) dataset. These models successfully generate five-channel (94, 131, 193, 211, and 335 Å) EUV data from 171 and 304 Å EUV observations with high correlation coefficients. We then apply the trained models to the Solar Orbiter/EUI/FSI dataset and generate the five-channel data that the FSI cannot observe. Here we use the regularized inversion method to compare the DEMs from the SDO/AIA dataset with those from the Solar Orbiter/EUI/FSI ones with AI-generated data. Our study demonstrates that DEMs using FSI with AI-generated data are consistent with those using AIA observed data (ground truth). With this methodology, we determine the DEMs when the two instruments are at various angular separations. For instance, our results indicate that a stereoscopic DEM analysis would be useful to derive a more precise derivation of physical parameters of coronal structures at various angles. Furthermore, we present a case study focusing on the L4 and L5 positions.

17:40 [VI-3-7]

Validation of IGS GIMs Over Oceanic Regions

Using Altimeter-Derived TEC

Woong Jeon[1,2], Woo Kyoung Lee[1,3], Yong-Jae Moon[2,4]

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[2]*School of Space Research, Kyung Hee University*
[3]*University of Science and Technology*
[4]*Department of Astronomy and Space Science, Kyung Hee University*

In this study, we validate the performance of the International GNSS Service (IGS) Global Ionospheric Maps (GIMs) over oceanic regions using Jason-3 altimeter-derived total electron content (TEC) observations from 2016 to 2024. Because GNSS ground stations are sparsely distributed, the accuracy of GIMs in remote oceans is often questioned. To assess this, we use fully validated NOAA GDR-F Jason-3 dual-frequency altimeter data and analyze the results as a function of distance from the GNSS stations used in GIM estimation. We calculate statistical metrics including correlation coefficient (CC), root mean square error (RMSE), normalized RMSE (NRMSE), mean absolute error (MAE), and bias to validate the agreement between Jason-3 and GIM TEC. Over the entire period, GIMs show stable performance, with CC ranging from 0.90 to 0.99, RMSE from 2.93 to 6.26 TECU, and NRMSE from 0.04 to 0.15. Although the average performance remains robust, further analysis by solar activity phase and finer distance binning suggests that GIM accuracy tends to deteriorate beyond ~3,000 km from the nearest stations. These results indicate that IGS GIMs are generally reliable over oceanic regions, but their accuracy can degrade under specific spatiotemporal conditions, which should be considered in practical applications.

17:55 [VI-3-8]

A Simple but Effective Way of Characterizing Coronal Mass Ejection Events for Space Weather Applications

Sung-Hong Park[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*

Coronal mass ejections (CMEs) are sudden and large expulsions of magnetized plasma from the Sun's outer atmosphere into interplanetary space. Fast CMEs, particularly propagating toward Earth, are known as one of the major drivers for severe space weather disturbances. Several different methods have been developed to identify and characterize CMEs conventionally with a sequence of white-light coronagraph images. Here I present a simple but effective way of characterizing CME events in comparison with other classical methods. An example of how this method can be used for space weather applications will be introduced with a huge dataset of total brightness images obtained by the Large Angle and Spectrometric Coronagraph (LASCO) onboard the Solar and Heliospheric Observatory (SOHO).

Halla Room

VI-4 SS: 우주망원경

Chair: 문봉곤(천문연)

16:10 [VI-4-1]

Formulating Korea's Roadmap for Space Telescopes

Bongkon Moon[1,2], Woong-Seob Jeong[1,2], Sung-Joon Park[1], Jongwan Ko[1,2], Ji Hye Baek[1], Dae-Hee Lee[1,2], Chae Kyung Sim[1,2], Jeong-Yeol Han[1,2], Chung-Uk Lee[1], Eun-Jeong Hwang[1], Kyoung Suk Lee[1], Young-Jun Choi[1]

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[2]*University of Science and Technology (UST)*

As the leading national institute for space science and technology development, the Korea Astronomy and Space Science Institute (KASI) is formulating a long-term roadmap for space telescopes. Space telescopes have long served as essential tools in astronomical research and are expected to play an increasingly critical role as future observational platforms. With a 20-year perspective, KASI is developing a detailed roadmap to establish competitive, Korea-led space telescopes.
The roadmap is being designed through a comprehensive analysis of multiple factors, including the long-term development strategies of the Korean Astronomical Society, the scientific demands of the Space Science Society, KASI's research capabilities, the current status of domestic technology development, and global trends in space telescopes. The current draft organizes the plan into three major categories: (1) a roadmap for Korea-led space telescope missions, (2) a roadmap for the development of core space telescope technologies, and (3) a roadmap for international collaborations in space telescopes. This presentation will provide an overview of these roadmap components and their strategic implications for the next two decades.

16:40 [VI-4-2]

Beyond Ground-Based LSB Observations: Space-Based K-DRIFT

Jongwan Ko[1,2], K-DRIFT Team

[1]*Korea Astronomy and Space Science Institute (KASI)*

[2]*University of Science and Technology (UST)*

The Korea Astronomy and Space Science Institute (KASI) launched the KASI Deep Rolling Imaging Fast Telescope (K-DRIFT) project in 2019 to address the persistent challenges of ultra-low-surface-brightness (uLSB; below ~0.01% of the ground-based night-sky level) imaging. The first prototype, the K-DRIFT Pathfinder, carried out on-sky tests at the Bohyunsan Optical Astronomy Observatory (BOAO) between 2021 and 2022, achieving a surface-brightness sensitivity of about 28.5 mag arcsec^{-2} with a two-hour integration. The main model, K-DRIFT Generation 1 (G1), implements substantial upgrades over the Pathfinder, including a field of view more than 20 times larger. G1 has recently completed development and undergone testing on the sky at BOAO.
Building on the experience from developing and operating the ground-based K-DRIFT, we are preparing a next generation space telescope designed to perform an all-sky survey of uLSB imaging across the near-UV to optical wavelengths. This space-based K-DRIFT will reach surface brightness sensitivities at least one magnitude deeper than the most sensitive measurements currently possible from ground-based instruments.
We present the optical performance of ground-based K-DRIFT and discuss future prospects for the project, emphasizing its role in advancing uLSB science.

16:55 [VI-4-3]
Development Strategies of Spectrographs Onboard the Korea-Led Space Telescope in Future

Sung-Joon Park[1], Jae Joon Lee[1], Sungho Lee[1], Woong-Seob Jeong[1,2], Yujin Yang[1], Bongkon Moon[1,2], Young-Jun Choi[1]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*

Spectrograph is one of the most important instruments in modern observational astronomy, and is being developed in various forms, optimized for both ground-based and space-based observatories. Recently, the Korea AeroSpace Administration (KASA) is establishing mid- to long-term policy frameworks for the development of a Korea-led space telescope. For the success of Korea-led space telescope, clear definitions of its scientific missions with the necessary spectroscopic instruments are inevitable. First of all, the types of spectrograph should be determined based on the scientific objectives in accordance with the specifications of the fore-optics (telescope part). Each spectrograph system should be effectively compact and well allocated as a focal plane instrument, and must be able to withstand the space environments. In this presentation, we briefly introduce the strategies for several candidates of spectrographs for the future applications to a Korea-led space telescope in terms of scientifically and technologically.

17:10 [VI-4-4]
High Contrast Imaging Technology

Ji-Hye Baek, Seonghwan Choi, Kyohoon Ahn, Yunjon Kim, Jihun Kim, Jongyeob Park, Sanghun Song

Korea Astronomy and Space Science Institute (KASI)

High-contrast imaging technology is recognized as one of the most critical capabilities in modern astronomy and space science, enabling the direct observation of faint celestial objects such as exoplanets in the vicinity of bright stars. As major countries continue to make concentrated investments in this field, it has become increasingly important for Korea to secure independent technological capabilities and strengthen its global presence. To achieve this, long-term and stable research and development are indispensable.
The Korea Astronomy and Space Science Institute (KASI) is leading efforts to advance the core technologies that underpin high-contrast imaging. These include adaptive optics for real-time correction of distortions, automated measurement and alignment of optical systems for precise instrumentation, and space edge artificial intelligence (AI) for efficient onboard data processing. Through the systematic development and integration of these technologies, KASI aims to establish technological self-reliance, enhance international competitiveness, and ensure readiness for future large-scale missions.
In particular, the outcomes of this research are expected to be applied to next-generation space telescopes, including the Habitable Worlds Observatory (HWO), thereby contributing not only to the advancement of Korean astronomical science and technology but also to the broader international effort to explore habitable exoplanets and deepen our understanding of the universe.

17:25 [VI-4-5]
Trade Space of Primary-Secondary Fore-Optics for a Korean Space Telescope

Jeong-Yeol Han[1], Bongkon Moon[1,2], Eunjung Hwang[1], Young-Jun Choi[1,2]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*

KASI is performing a feasibility study for a Korean space telescope. Focusing on the front-end optics, we survey two-mirror configurations defined by primary figure and radius of curvature and by secondary-mirror placement (on-axis/off-axis). Evaluation criteria include image quality, wavefront-error budgets, field uniformity, obscuration/stray light, and engineering factors such as packaging, stability, alignment complexity, and manufacturability.

We present representative configurations and highlight trade-offs that guide configuration down-selection and subsequent design work.

11월 1일(토) Halla Room

Ⅶ-1 SS: 달 착륙선을 위한 월면 탐사 임무

Chair: 심채경(천문연)

09:00 [Ⅶ-1-1]

Concept Study of Lunar Vision: Multiband Polarimetric Imaging for Space Weathering and Regolith, Mineralogy, and Plume-Effect Characterization

Jeong-Yeol Han[1,2], Chae Kyung Sim[1,2], Minsup Jeong[1], Dukhang Lee[1,2], Hyoung Kwon Lee[3], Jaehyeon Kyeong[3], Jiwoo Lee[1,2], Seungkyun Ryu[4], Nikolay Vedenkin[5]

[1]*Korea Astronomy and Space Science Institute*
[2]*University of Science and Technology*
[3]*LeO SPACE Inc.*
[4]*IM Technology Inc.*
[5]*KAIROSPACE Co., Ltd.*

Lunar Vision is a VIS-NIR multiband polarimetric camera concept for a lunar lander. The instrument supports: summarized mapping of surface physical/chemical properties; space-weathering assessment (optical maturity, mean grain size); mineral distribution for ISRU planning; landing-site environment imaging for rover/crewed route selection; and plume-induced change mapping to derive minimum stand-off distances between preservation areas and landing sites. The concept design addresses system integration, optics, opto-mechanics, control, and dust-mitigation, forming a coherent approach to robust polarimetric mapping on the lunar surface.

09:15 [Ⅶ-1-2]

Scientific Payload Concept for Lunar Surface Space Environment Observations: CLUSER

Seul-Min Baek, and CLUSER Team

Korea Astronomy and Space Science Institute

We present the conceptual design outcome of the Comprehensive Lunar Space Environment seonsoRs (CLUSER), a multi-instrument payload for lunar surface investigations. The design integrates fluxgate and search-coil magnetometers for high-precision measurements of temporal and spatial variations of the lunar magnetic field, together with complementary low-energy (few eV to tens of keV) and high-energy (tens of keV to tens of MeV) particle detectors to observe both electrons and ions in situ. By operating all instruments simultaneously, CLUSER enables coordinated measurements of magnetic fields and charged particles on the lunar surface. This integrated approach provides new capability to investigate the fundamental interaction between charged particles and local magnetic fields at the Moon. The conceptual design demonstrates the feasibility of achieving comprehensive lunar space environment monitoring, thereby contributing to fundamental science and offering a framework for extended exploration objectives within the Moon-to-Mars initiative.

09:30 [Ⅶ-1-3]

3D Topographic and Microscopic Hybrid Camera System for *In-Situ* Lunar Surface Exploration

Nayeon Kim[1], Sunwoo Lee[1,2], Seunghyuk Chang[3], I Jong Kim[2], Changgon Kim[1], Dohoon Kim[1], Jae Hyuk Lim[4], Ah-Jeong Seong[4], Jaesang Hyun[5], Geunhee Jo[5], Daewook Kim[6], Soojong Pak[1]

[1]*School of Space Research, Kyung Hee University*
[2]*Korea Basic Science Institute*
[3]*Center for Integrated Smart Sensors*
[4]*Department of Mechanical Engineering, Kyung Hee University*
[5]*Department of Mechanical Engineering, Yonsei University*
[6]*James C. Wyant College of Optical Sciences, The University of Arizona*

We propose an advanced optical payload comprising a 3D microscopic imaging camera and an auxiliary 3D surface profiling system, both targeting the lunar surface.
The microscopic camera features an off-axis reflective configuration and a spiral phase plate. This unique optical element twists the wavefront of the incident plane wave beam, imparting orbital angular momentum, which enables interferometric 3D observation of the microscopic structure of lunar regolith particles with a simple optical configuration. This optical design has been published in Optics Express and is currently being prepared for patent application.
Complementing this, the structured-light profiler delivers high-precision surface measurements of the surrounding terrain. By projecting and analyzing coded fringe patterns, it provides accurate height information for focus adjustment and extends the observation range from microscopic particles to local topographic features.
With its compact design and alignment robustness, this payload provides dual capability for interferometric and structured-light 3D measurements. It enables in-situ and multi-scale observation of lunar regolith and terrain, making it a strong candidate for future lunar surface exploration missions.

09:45 [Ⅶ-1-4]

Introduction to Mission Objectives for Lunar Surface Geology and Resource Exploration

Kyeong Ja Kim

Korea Institute of Geoscience and Mineral Resources

The upcoming Korean lunar lander mission, following the success of the Korea Pathfinder Lunar Orbiter (KPLO), represents a critical step toward advancing in situ lunar science. While orbital missions have significantly improved our understanding of the Moon's surface environment, composition, and geological processes, direct surface investigations remain essential to validate remote-sensing data and provide ground-truth measurements.
The mission objectives are centered on two key themes: lunar surface geology and resource exploration. For geology, the goal is to characterize the mineralogy, elemental composition, and stratigraphy of the landing site, thereby contributing to a deeper understanding of the Moon's crustal evolution. For resource exploration, the mission seeks to assess the presence and distribution of volatiles, particularly water, as well as other elements of potential value for future utilization.
Achieving these objectives requires payloads capable of identifying minerals, quantifying chemical abundances, and probing subsurface structures at both shallow and deeper depths. Candidate instruments under consideration include spectrometers, hyperspectral imagers, neutron and gamma-ray detectors, and ground-penetrating systems. These investigations will reduce the gap between orbital and surface measurements, laying the groundwork for both scientific discovery and the practical assessment of lunar resources to support future exploration.

10:00 [Ⅶ-1-5]

Preliminary Design of Radioisotope Power Systems for Lunar Science and Technology Missions

Sunjin Kim, Jong-Bum Kim, Jin-Joo Kim, Gilyoung Ko, Da-Hye Kim, Jintae Hong

Korea Atomic Energy Research Institute

Recently, spacefaring nations such as United States, China, and European countries have actively conducted lunar exploration since 2000 due to the Moon's significance as a base for space exploration. In particular, China has significantly enhanced its engineering capabilities for lunar missions over the past two decades through the Chang'e program. For the successful lunar exploration, Radioisotope Power Systems (RPSs) have been employed to supply lunar landers and rovers with thermal and electrical energy in the Moon's harsh environment. Here, we have recently designed a Radioisotope Heater Unit (RHU) and a Radioisotope Thermoelectric Generator (RTG) for use in Korea's lunar exploration mission. Several radioisotope candidates (Sr-90, Am-241, Pu-238) were considered as heat sources, and design concepts for RHU and RTG systems were developed accordingly. We believe that our design concepts will contribute to the development of Korea's survival systems on the Moon and its broader space exploration initiatives.

10:15 [Ⅶ-1-6]

lunar Surface Mission with Micro-Rover

Namsuk Cho, Junseok Lee, Jungwoo Shin, Jaeho Lee

Unmanned Exploration Laboratory

Lunar lander missions have been increasing rapidly worldwide, and many organizations are developing micro-rovers for mobility verification, component testing, and scientific investigations. Unlike Mars rovers, which have become larger and more complex, lunar rovers show a trend toward miniaturization and lightweight design, reflecting the limited payload capacity of landers and short mission durations. This study aims to analyze the mission scope and technological challenges of such micro-rovers, and to discuss their potential roles and contributions in future lunar exploration.

Baengnok Room

Ⅶ-2 우주천문/위성정보활용/우주정책

Chair: 정서영(항우연)

09:00 [Ⅶ-2-1]

Radiometric Cross-Calibration of Optical Payloads on KOMPSAT and CAS500-1 Satellites

Kyoung-Wook Jin[1], Jin-Hyeok Choi[2], Yungon Lee[2]

[1]*Korea Aerospace Research Institute Cal/Val & Image Quality Research Team*

[2]*Department of Atmospheric Sciences, Chungnam National University*

Absolute Radiometric Calibration of KOMPSAT and CAS500-1's Optical Payloads relies on a reflectance-based vicarious calibration after the satellite launch.The vicarious calibration needs an appropriate site for field campaigns using portable instruments such as a reflectance tarp target, land surface reflectance measurement devices and an automatic weather station. However, this field campaign-based technique has large limitation to obtain effective data for the calibration since many observation activities are required to get sufficient samples to compute an accurate calibration coefficient. To overcome this issue, a radiometric cross-calibration can be used. The cross-calibration is to estimate a calibration coefficient of the satellite of interest

based on reliable satellite data (e.g. Landsat 8/9, Sentinel2) using similar observation data in terms of time and space. This method can adopt transferred calibration credibility, which was already achieved calibration quality of the mother satellites. Verified effective calibration sites (e.g. dessert area) is preferable for the cross-calibration. In this study, the absolute radiometric calibration coefficients of KOMPSAT and CAS500-1 satellites were generated using the cross-calibration method. Data observed over the 48 m × 48 m size of the gravel target over Bautou site were used. The mid-resolution sentinel2 data were inter-compared with those of KOMPSAT and CAS500-1. The calibration coefficients from the cross-calibration were consistent with respect to those from the vicarious calibration within a certain limit of uncertainty.

09:15 [Ⅶ-2-2]

A Study on Intelligent Fault Detection Modeling Using Satellite Telemetry Data

Sunju Park[1], Jaehyung Park[1], Hyunchang Lee[1], JeongSik Choi[1], Jingi Ju[2], Mincheol Shin[2], Jiseung Ahn[2]

[1]*Korea Aerospace Reserach Institute*
[2]*IOPS*

As the number of operational satellites continues to increase, the need for technologies that can rapidly and accurately detect potential anomalies and failures during satellite operations is becoming more critical. In particular, research on telemetry-based fault detection using artificial intelligence (AI) has been actively conducted overseas, highlighting the urgency of domestic technology development. This study presents the research and development results of an intelligent fault detection model based on satellite telemetry data. The proposed model is designed to automatically distinguish between normal operational patterns and abnormal conditions, thereby improving the efficiency and reliability of satellite operations. The findings of this study are expected to serve as a foundation for the development of an automated reporting system that can analyze real satellite operation data and generate reports on faults and operational anomalies.

09:30 [Ⅶ-2-3]

Time-Series Photometry of Main-Belt Binary Asteroids: A Case Study of (7344) Summerfield

Haeun Kim[1,2], Myung-Jin Kim[2], Hee-Jae Lee[2], Youngmin Jeongahn[2], Hong-Kyu Moon[2], Young-Jun Choi[2], Yonggi Kim[1]

[1]*Chungbuk National University*
[2]*Korea Astronomy and Space Science Institute*

Asteroids preserve primordial records of the Solar System's formation and dynamical evolution, offering key insights into processes that shaped planetary bodies. Among them, binary asteroids are of particular importance because their mutual orbits allow estimates of bulk mass and density—fundamental parameters that are otherwise difficult to constrain. These systems also provide natural laboratories to test formation mechanisms such as rotational fission and collisional capture. The binary asteroid (7344) Summerfield, located in the main belt, is a representative system near the ~6 km threshold where both rotational fission and collisional formation are dynamically plausible. With a diameter of 6.25 ± 0.28 km (NEOWISE) and a rapid rotation period of 2.59 ± 0.05 h, close to the 2.2 h spin barrier, it serves as a crucial test case for evaluating binary formation scenarios. We conducted R-band time-series photometry in February and April 2025 using three facilities: the 1.8 m telescope at Bohyunsan Optical Astronomy Observatory (BOAO), the 0.6 m telescope at Sobaeksan Optical Astronomy Observatory (SOAO), and the 1.0 m telescope at Lemmonsan Optical Astronomy Observatory (LOAO). A total of ~64.3 hours of observations yielded consistent light-curves showing a primary rotation period of 2.59 h, amplitudes of 0.14–0.15 mag, and mutual events with depths of 0.07–0.10 mag. These mutual events imply a secondary orbital period of 17.4 ± 0.5 h and a radius ratio of 0.20–0.30, consistent with previous findings. The elongation ratio of 1.14–1.15 is a characteristic feature of binary asteroids formed through rotational fission. Furthermore, density estimates derived from the system's orbital configuration and a/Rp analysis yield values of ~2,700 kg m^{-3}, consistent with the expected density range of S-type asteroids. Our results highlight the importance of (7344) Summerfield as a benchmark system for testing binary asteroid formation scenarios. Future work will include multi-site photometric campaigns to improve orbital parameter accuracy, spectroscopic follow-up to probe compositional similarities, and refined modeling of eclipse/occultation geometries, with comparisons to other ~6 km binaries. These efforts aim to place new constraints on the formation and dynamical evolution of binary asteroids in the main belt.

09:45 [Ⅶ-2-4]

Risk of Space Tourism through Black Swan Theory: Applying Risk Management

Hyeona Jo[1], Yunkyoung Jo[1], Jinhye Park[2], James F. Petrick[3], Michael Hall[4], Myung Ja Kim[5]

[1]*Kyunghee University*
[2]*Korea AeroSpace Administration*
[3]*Texas A & M University*
[4]*Massey university*
[5]*Sejong University*

This study applies Black Swan theory to analyze risks in space tourism, identifying space weather as a critical threat. Solar

flares, coronal mass ejections, and solar energetic particles exemplify Black Swan events due to their unpredictability, severe impacts (e.g., radiation exposure, satellite failures), and retrospective explain ability. Unlike terrestrial tourism, space tourism faces unique extraterrestrial hazards, necessitating innovative risk management. The research proposes a multi-phase framework: pre-risk prediction and prevention, real-time monitoring and emergency protocols, and post-event recovery to restore trust and industry stability. Drawing on historical data (e.g., Carrington Event, SpaceX satellite loss) and expert interviews, the study underscores the need for advanced technology, international cooperation, and public awareness to ensure safety and sustainability. It offers a theoretical foundation and practical strategies for policymakers and industry leaders to mitigate space weather risks, fostering a resilient space tourism sector.

10:00 [Ⅶ-2-5]

The Reality of In-Space Pharmaceutical Manufacturing Industry

Hyeonjun Kim

Korea Aerospace Research Institute

Interest in manufacturing pharmaceuticals in space has been growing recently. Reentry missions, previously a topic of academic interest for a small group of experts, are now gaining significant traction. This shift is largely due to a recently published review paper on the space pharmaceutical industry. While many companies are interested in the space sector, generating revenue has been challenging. The satellite industry has traditionally thrived because it relied on selling valuable information acquired from satellites. Against this backdrop, the space pharmaceutical manufacturing business is currently seen as a highly promising, high-value-added market. With many companies actively exploring new markets, the space pharmaceutical manufacturing business is undoubtedly attractive. This presentation will explore the feasibility of the space pharmaceutical industry in Korea, drawing on a recently published review paper.

Olle Room

Ⅶ-3 태양 및 우주환경 V

Chair: 안준모(천문연)

09:00 [Ⅶ-3-1]

Prediction of Heavy Ion Charge State Ratios and Elemental Composition of Solar Wind Using Deep Learning

Jungjoon Seough[1], Jihyeon Son[1], Hyun-Su Lee[2], Ji-Yeong Kim[2], Kyoung-Sun Lee[3]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungnam National University*
[3]*Seoul National University*

The solar wind is primarily composed of protons and helium ions, with smaller yet significant contributions from heavy ions such as oxygen and carbon. The ionization states of these heavy ions are known to be governed by the temperatures in the source regions of the solar wind, providing crucial insights into their origins. In this study, we have developed deep learning models to predict the heavy ion charge state ratios and elemental composition of the solar wind. Here, we employ solar wind parameters (solar wind speed, density, temperature, and alpha particle ratio) measured by the ACE spacecraft at the L1 point, together with physical parameters (proton specific entropy, Coulomb number, and Alfvenicity) from 1998 to 2013, spanning one solar cycle. We present the initial results and discuss identifying the input parameters that play the most critical role in the prediction accuracy of the deep learning model. This work is part of the SpaceAI program at KASI.

09:15 [Ⅶ-3-2]

Deriving an Interpretable Model for Solar Wind Speed Prediction via Symbolic Regression

Seungwoo Ahn[1], Youngjae Kim[1], Mingyu Jeon[1], Daeil Kim[1], Junmu Youn[1], Yong-Jae Moon[1,2]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Astronomy and Space Science, Kyung Hee University*

In this study, we apply symbolic regression (SR) to solar wind data at 1 AU for deriving a data-driven equation as a function of coronal hole parameters. We use coronal hole (CH) parameters derived from Solar Dynamics Observatory/Atmospheric Imaging Assembly 193 and 211 Å images together with solar wind speeds prior to the prediction date as input data. We train the SR model using data spanning from May 2010 to December 2024, in view of different phases of solar activity and the entire period. The dataset is divided into a training set (January-September) and a test set (October-December) to consider the solar cycle effect. Using the PySR, an evolutionary algorithm-based SR library, we derive mathematical equations for solar wind speed, which are optimized via cross-validation. When we consider only the simplest CH parameter — the fractional CH area (A_{CH}) — SR model achieves an RMSE of 89.3 km/s and a correlation coefficient (CC) of 0.55. When adding CH brightness (P_{CH}) to A_{CH}, the SR model shows an RMSE of 75.1 km/s and a CC of 0.69, demonstrating superior performance. The resulting SR equation is expressed as

$\sqrt{A_{CH} \times P_{CH}}$ + constant, indicating that the combined effect of A_{CH} and P_{CH} serves as a key factor in determining the solar wind speed. We find that these results are much more clear in the declining phase of solar activity or its minimum. Our results show that the SR model would be useful for finding new empirical relationships between parameters.

09:30 [Ⅶ-3-3]

Interpretable Data-Driven Models for Solar Flare Forecasting through Deep Learning and Symbolic Regression

Youngjae Kim[1], Yong-jae Moon[1], Hyun-Jin Jeong[1,2], Gwangson Choe[1], Jihyeon Son[3], Mingyu Jeon[1]

[1]*Kyunghee University*
[2]*KU Leuven, Belgium*
[3]*Korea Astronomy and Space Science Institute*

Recently, deep learning models have been successfully used for solar flare forecasting, but lack interpretability. In this paper we present interpretable major-flare (> M) forecasting models that combine deep learning with symbolic regression using time-series magnetic field parameters of solar active regions. Our models achieved competitive TSS = 0.76 in 5-fold cross validation with simple mathematical formulae. A representative formula indicates that flare productivity peaks when total amount and asymmetry of current helicity, a proxy of magnetic twist and shear in solar active regions, are simultaneously high. This formula successfully forecasts first major flares in the most flare-productive active regions NOAA 12673 and 13664 where the conventional empirical models failed. Our investigation suggests that flare triggering is governed by the squared sum of current helicity at the largest scales. Our approach can be extended to other astronomy fields or related fields to find new physical relationships.

09:45 [Ⅶ-3-4]

Statistical Analysis of Solar Proton Events and Their Correlation with Solar Energetic Phenomena: Implications for Forecasting of Solar Radiation Storm

Haein Lee[1,2], Ryun Young Kwon[1], Dae-Young Lee[2]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk Naional University*

We present a statistical analysis of 173 solar proton events (SPEs) observed by GOES satellites, along with their associated solar phenomena - including solar flares, coronal mass ejections (CMEs), and EUV waves − during the period from January 1996 to March 2024. The temporal characteristics of SPEs were defined, and their correlations with solar activities were examined. Most SPEs were related to M1-class or stronger flares originating from the central or western solar hemisphere. The SPE-associated CMEs exhibited an average speed of about 1,525 km/s and were predominantly halo-type. EUV waves accompanied most of SPEs, indicating the frequent presence of coronal shocks in the low corona. Both the delay time and proton flux profile of SPEs varied systematically depending on the source location. From a forecasting perspective, we evaluated the performance of the binary model using only the X-ray flare data and contingency tables. Our analysis of the Critical Success Index (CSI), Bias, and False Alarm Ratio (FAR) indicates that the characteristics of the forecast model vary depending on the chosen flare intensity threshold. An X1.2-class flare threshold achieved the highest CSI and a Bias score closest to 1, representing the most balanced. An X6.6-class threshold yielded a FAR of 0, making it suitable for a high-confidence alert strategy that avoids false alarms. These results demonstrate that a simple, flare-based model can provide forecasting guidance, and the optimal threshold can be selected based on the specific operational need, such as maximizing overall accuracy or minimizing false alarms.

10:00 [Ⅶ-3-5]

Development of a Deep Learning Model for Predicting Earth-Directed Solar Energetic Particle Events

Seunghyeon Lee[1,2], Sung-Hong Park[1,2], Youngwoo Cho[3], Wonkeun Jo[4], Mingyu Jeon[5], Seohee Jang[1,2], Junmu Youn[5], Daeil Kim[5], Seungwoo Ahn[5], Juheon Kwak[6], Seungye Lee[6], Soomin Lee[7], Yeseul Choi[6], Ik Hyun Lee[8], Joongsun You[9]

[1]*Korea Astronomy and Space Science Institute (KASI)*
[2]*University of Science and Technology (UST)*
[3]*Kim Jaechul Graduate School of AI, Korea Advanced Institute of Science and Technology (KAIST)*
[4]*Asan Institute for Life Sciences, Asan Medical Center*
[5]*School of Space Research, Kyung Hee University (KHU)*
[6]*Division of Artificial Intelligence and Software, Ewha Womans University (EWU)*
[7]*Computer Science and Engineering, Chungnam National University (CNU)*
[8]*Department of Mechatronics Engineering, Tech University of Korea (TUKOREA)*
[9]*School of Aerospace Engineering, Gyeongsang National University (GNU)*

A signficant portion of the energy released during solar eruptive events such as flares and coronal mass ejections (CMEs) can be transferred to accelerate particles in the solar atmosphere and interplanetary space. These solar energetic particles (SEPs) then propagate into the heliosphere guided by interplanetary magnetic

field lines, and some of them may be observed *in-situ* as SEP events by particle detectors onboard satellites in various Earth orbits. Here we present the design and implementation of a deep learning model at a preliminary stage of development, which can predict earth-directed SEP events observed by the Geostationary Operational Environmental Satellites (GOES). The first primary goal of the model is predict whether there will be at least one SEP event (belonging to a certain class based on its peak proton flux) for a target prediction interval (e.g., 12 hours). In the case of "yes-event" predictions, the model provides the information about (1) event characteristics such as its onset and peak flux, and (2) the eventual time series of 5-min averaged integral proton flux with energies greater than 10 MeV. This project is being carried out with support from the SpaceAI program led by KASI in partnership with Kyung Hee University, Korea Advanced Institute of Science & Technology and private-sector companies.

10:15 [Ⅶ-3-6]

Toward a Forecast Model and Operational Alert Service for 2 MeV Relativistic Electrons in Geosynchronous Orbit

Ji-Hoon Ha, Jae-Hyung Lee, Jaehun Kim, Sang Cheol Han, Soojeong Jang, Wonhyeong Yi

Korea Space Weather Center, Korea AeroSpace Administration

Relativistic 2 MeV electrons in geosynchronous orbit pose a significant threat to geostationary satellites, which can lead to malfunctions or even complete failure. Accurate prediction of 2 MeV electron fluxes is therefore crucial for assessing radiation risks and implementing mitigation strategies for geostationary satellites. In this talk, we present Korea Space Weather Center's efforts toward developing a forecasting and alert system for relativistic electrons.

As a preliminary step toward a full forecast model, we have developed a prototype Monte Carlo simulation in momentum-pitch-angle space, where diffusion coefficients are scaled by the ratio of the particle gyro-radius to the turbulence injection scale, derived from wave-particle interactions. A Kolmogorov turbulence spectrum is employed to model the turbulent energy driving electron acceleration. Simulations show the formation of a nonthermal electron tail from an initial Maxwellian distribution, suggesting that, once properly calibrated to observed fluxes and solar wind conditions, the model could be applied to electron flux forecasting.

For the alert system, we monitor 2 MeV electron observations from GOES satellites and issue alerts when fluxes exceed 1000 counts and persist for at least 15 minutes. Once triggered, alerts are maintained or lifted depending on whether the threshold condition continues or falls below the limit during the following 24-hour period. We also outline plans for future enhancements to the operational alert service.

Yeongju Room

Ⅶ-4 SS: 우주교육유산

Chair: 민병희(천문연)

09:00 [Ⅶ-4-1]

AcuDA: Development and Validation of a Curriculum-Aligned Diagnostic Assessment of Astronomy Concepts

Gilgu Kang[1], Ahra Cho[1], Jiwon Park[1,2], Yonggi Kim[1,2]

[1]*Chungbuk National University*
[2]*Chungbuk Pro Maker Center*

AcuDA (Astronomy Curriculum-based Diagnostic Assessment) was developed in alignment with Korea's 2022 revised national science curriculum and the TIMSS 2023 science framework, providing a curriculum-anchored yet internationally comparable assessment tool. The 27-item instrument spans four content domains—Motions of Celestial Objects, the Sun and Solar System, Stars and the Interstellar Medium, and Galaxies and the Universe (Cosmology)—and was administered to N=503 participants (general adults, undergraduate non-majors, and astronomy majors). Exploratory factor analysis supported a coherent four-factor model. Subscales demonstrated acceptable internal consistency, given the brevity of the content scales, and classical item statistics indicated appropriate difficulty and discrimination. Cognitive diagnostic modeling revealed domain-level proficiency differences, and differential item functioning identified items that were particularly sensitive in differentiating majors from non-majors. Beyond education, AcuDA quantifies how different cohorts understand core astronomical ideas, providing baselines for international comparison, informing targeted public science communication, and supporting the pipeline for early-career researchers. By clarifying conceptual foundations and identifying persistent misconceptions, the tool supports not only instruction and evaluation but also broader participation and workforce development in astronomy and space science.

09:15 [Ⅶ-4-2]

Effectiveness of an HTE-STEAM Astronomy and Space Science Education Program: Focusing on Attitude Change toward Astronomy and Conceptual Restructuring across Major Learning Areas

Ahra Cho[1], Gilgu Kang[1], Jiwon Park[1,2],

Yonggi Kim[1,2]

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Astronomy deals with concepts that span vast scales of space and time, making appropriate educational materials and tools essential for supporting learners' understanding. However, astronomical observation in the Korean national science curriculum is difficult to implement effectively due to constraints such as weather, safety, and teachers' expertise, so most astronomy education remains theory-oriented and lacks a learner-centered approach. To address these limitations, this study applied the HTE-STEAM framework, which integrates the use of metaphor and analogy in the HTE (Here, There, Everywhere) model developed by NASA and Harvard University with STEAM education. Based on this framework, an astronomy and space science program was developed on three major topics—the solar system, space exploration, and astronomical observation—and implemented with 267 middle and high school students. Conceptual understanding was measured using astronomy diagnostic tests (ADT, TOAST), while attitudes toward astronomy were assessed with the Survey of Attitudes Toward Astronomy (ATA). The analysis revealed that HTE-STEAM instruction was more effective than general STEAM in improving both conceptual understanding and attitudes toward astronomy, and it demonstrated differentiated learning outcomes depending on the characteristics of each topic. Furthermore, the HTE-STEAM approach helped learners conceptualize effectively by linking them to everyday experiences, suggesting its potential as an effective tool not only in astronomy but also in other fields of science where hands-on practice is limited.

09:30 [Ⅶ-4-3]

Realization of the Heomsi-ui Operating Mechanism

Hong Soon Choi[1,2], Sang Hyuk Kim[1], Byeong-Hee Mihn[1,2,3], Kyoung-uk Nam[4], Kyeong-han Yoo[2,5], Yonggi Kim[2,5]

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This study examines the operational model of the Heomsi-ui (驗時儀), a time-telling instrument, from the late Joseon dynasty. Drawing from Nam Byeong-cheol (南秉哲, 1817–1863)'s work, *Uigijipseol* (儀器輯說), published in 1859, we identified the name of Heomsi-ui's components, its gear teeth counts, and its gear train configuration. The instrument comprises three primary sections: Sibyeon (時邊, timekeeping part), Jongbyeon (鐘邊, striking part), and Dongpan Jeonmyeon (銅板前面, front-plate). The front-plate assembly holds the hour, minute, and second hands and mechanically links the timekeeping and striking mechanisms. Our design was also informed by contemporaneous Chinese texts and historical clock artifacts. we incorporated three sections into a 3D design and then built a working prototype. Using the prototype, we examined the role of each component, the arbor arrangement, gear meshing, and power transmission. We will explain the detailed operating principles of the major components.

09:45 [Ⅶ-4-4]

The Celestial Cartography of Hong Dea-Yong's Honsang-ui (渾象儀)

Seon Young Ham[1,2], Byeong-Hee Mihn[2,3,4], Sang Hyuk Kim[3], Yong-Hyun Yun[5], Go-Eun Choi[1], Hongkeun Park[1], Eunyoung Choi[1]

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The Honsang-ui (渾象儀) is a water-powered, automatically rotating celestial globe created by Hong Dae-Yong (洪大容, 1731–1783) in the 18th century. In his book, the *Damheonseo* (湛軒書), Hong briefly described the specifications and power mechanism of the instrument. While he detailed the manufacturing process for the celestial globe (渾象, Honsang) itself, he did not provide precise information about the constellations depicted on its surface. Our study hypothesizes that the constellations on the Honsang-ui were based on the *Lingtai Yixiang Zhi* (靈臺儀象志) compiled by Ferdinand Verbiest (南懷仁, 1623–1688) in Qing China. Western- style star charts and catalogues, created by European missionaries in China since the 17th century, were introduced to Joseon, and it is likely that Hong Daeyong had access to these materials. We presume that he utilized these Western astronomical charts to implement the constellations on the globe's sphere. This research will explains the celestial cartography of the Honsang-ui.

10:00 [Ⅶ-4-5]

A Study on the Characteristics of Southern Hemisphere Horizontal Sundials: With a Focus on the Dunedin Botanic Garden Sundial

Sang Hyuk Kim[1], Byeong-Hee Mihn[1,2,3], Kyung Ha Lee[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

[3]*Chungbuk National University*
[4]*Kongju National University*

The most well-known sundials are those found in the mid-latitude regions (30°–60°) of the Northern Hemisphere. In contrast, in the mid-latitude regions of the Southern Hemisphere, the Sun culminates in the north, and the shadow cast by the gnomon moves in a counterclockwise direction. This study examines the characteristics of Southern Hemisphere sundials through the example installed at the Dunedin Botanic Garden (DBG) in New Zealand. Crafted in 1924 by James Stewart (1852–1933), a sundial maker from Invercargill, New Zealand, this sundial is one of over 200 sundials he produced across the country.

The DBG sundial was made for the 1925–1926 New Zealand and South Seas Exhibition and was later donated to the Dunedin Botanic Garden after the exhibition concluded. The sundial bears a poem, the signs of the zodiac, time offsets from London (Greenwich Mean Time) for various major cities, the latitude and longitude of the observation site, monthly correction values to be added or subtracted to convert sundial time to standard time, and other engraved features. In 2019, due to a known timekeeping error, the orientation of the gnomon was corrected.

10:15 [Ⅶ-4-6]
The Launch of the KAPPA Web Service: An Online Database of Korean Historical Astronomical Records

Byeong-Hee Mihn[1,2,3], Sang Hyuk Kim[1], Ki-Won Lee[4], Young-Sook Ahn[1], Do-Gyun Kim[5]

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[2]*Chungbuk National University*
[3]*Korea University of Science and Technology*
[4]*Daegu Catholic University*
[5]*Wecean Inc.*

The Center for Historical Astronomy at the Korea Astronomy and Space Science Institute (KASI) plans to launch a new web service, “Korean Astronomical Phenomena Packed in Annals” (KAPPA), in November 2025. KAPPA will provide a chronological compilation of records of astronomical phenomena spanning nearly 2,000 years of Korean history, covering the Three Kingdoms (54 BC–935 AD), the Goryeo Dynasty (918–1392), and the Joseon Dynasty (1392–1910). Since 2001, our research team has been investigating and collecting astronomical records based on Korean translations. The initial results were uploaded to KASI’s “Knowledge Information for Astronomy and Space Science” website. Since then, significant progress has been made in translating Korean classics, supported by national-level retranslation initiatives. In this context, since 2014, our team has been systematically re-examining and refining the translations of the original astronomical records found in Korean documents, which were written in Chinese characters. The KAPPA online service will present the outcomes of these 25 years of research.

포스터발표 논문 초록

발표시간 : 10월 31일(금)
집중발표 13:00~14:30

[P-1] Test Equipment and Methods for Transient Voltage Evaluation of DC Power Systems in Satellite Electromagnetic Compatibility (EMC) Tests

In-Sang Yu, Chang-Eun Lee, Jae-Woong Jang, Kyung-Duk Jang, Tae-Youn Kim, Sang-Rok Lee

Korea Aerospace Research Institute

This study proposes the configuration and setup method of test equipment for evaluating various transient voltage variations in DC power systems during satellite electromagnetic compatibility (EMC) tests. Conventional tests are difficult to perform due to equipment limitations, such as the inability to generate short outputs below 20 ms. Modern equipment enables the implementation of these conditions. The proposed approach enables flexible simulation of complex voltage fluctuation conditions, such as overvoltage and undervoltage phenomena that occur repeatedly on the order of several tens of microseconds, as well as specific Electrical Design Interface (EDI) requirements. Through this method, diverse waveforms can be systematically generated and immunity tests are effectively conducted, ultimately supporting the evaluation of stability and reliability in DC power systems.

[P-2] Impact of Temperature on Measurement Accuracy of EMI Receivers in Satellite Radiated Emission Testing

Chang-Eun Lee, Jae-Woong Jang, Kyung-Duk Jang, Tae-Youn Kim, Sang-Rok Lee, In-Sang Yu

Korea Aerospace Research Institute

Satellite electromagnetic compatibility (EMC) testing requires the measurement of radiated and conducted emissions, not only of the system but also of all electronic equipment within it. These measurements are typically performed using an spectrum analyzer, or EMI test receiver. This paper discusses radiated emissions testing, focusing on the impact of insufficient warm-up time on commonly used EMI receivers. In particular, it examines potential errors that can arise when operating equipment without adhering to the recommended storage and warm-up periods required to stabilize its thermal conditions. This study warm-up requirements, from storage conditions to the specified operating time before measurements. Furthermore, experimental results are presented comparing emission measurements obtained without receiver warm-up to those obtained under appropriate conditions. Analysis reveals significant discrepancies of up to approximately 3 dB between the two cases, indicating that failure to follow manufacturer instructions can lead to inaccurate results when testing satellite electronics. This paper shows the critical role of warm-up compliance in ensuring the reliability and validity of radiation emission test data.

[P-3] Research for Analysis Method of Launch Vehicle RF Compatibility

Jae-Woong Jang, Tae-Youn Kim, Kyung-Duk Jang, Sang-rok Lee, Chang-Eun Lee, In-Sang Yu

Korea Aerospace Research Institute

Korea Aerospace Research Institute (KARI) develops various types of satellites, including optical, radar, infrared, communications, meteorological, and environmental satellites. These satellites are transported into space by launch vehicles. These satellites have RF (Radio Frequency) links, such as TC&R (TeleCommand and Ranging) of S-band and GPS (Global Positioning System) of L-band, while the launch vehicles utilize tracking radar of C-band, GPS of L-band, and TC&R of S-band. Therefore, analysis of RF interference between the satellite and launch vehicle is required for ground operational conditions prior to launch, as well as for the short time after launch and satellite separation. RF compatibility verification between satellites and launch vehicles typically involves analyzing the compatibility between their RE (Radiated Emission) and RS (Radiated Susceptibility), respectively. This paper describes the launch vehicle RF compatibility analysis method using a case study of interference analysis between the KARI launch satellite and the Vega-C launch vehicle.

[P-4] Study on the Testing Methods to Reduce ESD Threat in Satellites

Kyung-Duk Jang, Tae-Youn Kim, Jae-Woong Jang, Sang-Rok Lee, Chang-Eun Lee, In-Sang Yu

Korea Aerospace Research Institute

Satellites experience various threats while operating in space, one of which is electrostatic discharge (ESD). Numerous charged particles in the space plasma environment impact a satellite, charging its surface. If the charge on the satellite surface exceeds a threshold level, discharge can occur, causing physical damage to the satellite or even malfunctioning. Therefore, satellites must be designed to prevent surface charging, and their electronic equipment must be resistant to ESD events. There are various methods for ESD testing, which verify the ability of satellite electronic equipment to operate properly under electrostatic discharge conditions. These include applying an ESD waveform directly to the unit, coupling an ESD signal to a cable, and applying an ESD current to the ground plane.

This paper compares and analyzes various ESD testing methods.

[P-5] GPT for Space Weather

Seungheon Shin[1], Yong-Jae Moon[1,2], Jihyeon Son[3], Ji-Hoon Ha[4]

[1]*School of Space Research, Kyung Hee University*
[2]*Department of Astronomy and Space Science, Kyung Hee University*
[3]*Center for Heliophysics Research, Korea Astronomy and Space Science Institute*
[4]*Korea Space Weather Center, Korea AeroSpace Administration*

In this work, we present SWA-GPT (Space Weather Assistant with GPT), a system designed to assist in space weather monitoring and forecasting. The assistant addresses the NOAA space weather scales: radio blackouts (R), solar radiation storms (S), and geomagnetic storms (G). We apply the ReAct method, as a form of context engineering, to retrieve real-time solar and geophysical data from web sources to generate accurate responses to user questions. To evaluate its effectiveness, we perform qualitative assessments to examine how the assistant operates in representative scenarios. We also perform human assessments with expert users through structured surveys focusing on factual accuracy, consensus alignment, reasoning quality and practical usefulness for operational decision-making. The evaluation shows that SWA-GPT improves the accessibility and reliability of space weather information, suggesting that SWA-GPT can serve as a practical tool for operational use.

[P-6] Seasonality Bias and Class Imbalance Mitigation of Machine Learning based Sporadic E Layer Prediction Model

Kyu-Cheol Choi, Dae-Kyu Shin, Seung-Jun Oh, Yong-Ha Kim

SELab. Inc,.

Sporadic E (Es) is a transient and localized enhancement of electron density occurring in the ionospheric E layer at altitudes of 90–120 km. The Es layer is a major factor influencing radio wave propagation in the HF and VHF bands. Es exhibits strong seasonality and local time (LT) variations, but day ahead prediction remains challenging. The events are rare, and highly variable. Es is associated with the convergence of metallic ions driven by vertical wind shear in the E region (≈90–120 km). These characteristics lead to class imbalance caused by seasonality and introduce prediction bias during model training. We propose a day ahead Es occurrence classification framework that applies season stratified resampling to mitigate imbalance while preserving the underlying climatology. The model incorporates ionosonde observations from East Asian stations together with physically motivated covariates, such as day of year (DOY), vertical ion convergence (VIC), and space weather indices (e.g., Kp index, sunspot number). In evaluation, our model maintained stable performance as measured by the Matthews correlation coefficient (MCC). Nevertheless, performance variability persisted in data sparse regimes, indicating residual uncertainty. Therefore, we suggest practical directions for operational application, including threshold calibration for decision making and targeted augmentation to better represent rare conditions, as future work.

[P-7] Substorm Effects on Polar Mesospheric Summer Echoes during High-Speed Solar Wind Streams

Young-Sook Lee[1], Geonwha Jee[2,3], Young-Sil Kwak[3,4]

[1]*Chungnam National University*
[2]*Korea Polar Research Institute*
[3]*University of Science and Technology*
[4]*Korea Astronomy and Space Science Institute*

We report the observation of polar mesospheric summer echoes (PMSEs), which correspond to recurring substorms during long-lasting high-speed solar wind streams.
At the Syowa Observatory (69.0°S, 39.6°E, and 66.6°MagLat), Program of Antarctica Syowa MST/IS radar (PANSY) is utilized to detect D-region and mesospheric echoes in the Southern Hemisphere summertime.
Existing literature has reported that cosmic noise absorption (CNA) can increase above the critical level indicating D-region ionization in the event of local and non-local substorms.
Southern Hemisphere summer and winter CNA increases not only in the midnight time zone, but also in other local time zones. In summer, the occurrence rate and integrated echo power of PMSE is in the majority correspondingly enhanced at the CNA peak.
This study focuses on the following three points: First, PMSE reacts strongly to substorms in the midnight sector; second, Substorm effects play a significant role in PMSE generation even during the daytime; and third, differences in CNA responses to summer and winter substorms may be due to the presence of PMSE.

[P-8] Characteristics of Ionospheric Parameters Observed by Digisonde at Icheon and Jeju, South Korea

Wonhyeong Yi, Jae-Hyung Lee, JaeHun Kim, Ji-Hoon Ha, Sang Cheol Han, Soojeong Jang

Korea Space Weather Center, Korea AeroSpace Administration

The Korea Space Weather Center (KSWC) re-established a Digisonde (an ionosonde) in 2023 and has been producing

continuous ionospheric observation data. We introduce the Digisonde operated by the KSWC and present an analysis of time-series variations and slab thickness. The primary data in this study are fundamental ionospheric parameters such as the F2-layer critical frequency (foF2), F2-layer peak height (hmF2), and Total Electron Content (TEC), which were observed from Digisondes located at I-cheon and Jeju. We downloaded and analyzed a long-term dataset from the Global Ionospheric Radio Observatory (GIRO) website. To ensure high confidence for observation, we filtered the data to include only observations with a Confidence Score (CS) of 100. The analysis reveals several key trends. The TEC clearly follows the solar cycle, with higher electron density observed during Solar Cycle 25 than during Solar Cycle 24. The F2-layer electron density (NmF2) increases around noon and begins to decrease from lower altitudes at midnight, consistent with recombination effects. Furthermore, the slab thickness is larger at noon and smaller at midnight. As the slab thickness was calculated from the Digisonde-derived TEC, this finding confirms that the electron distribution below the F2 layer is more spread out during the noon than at midnight. In conclusion, the ionospheric data from the KSWC's Digisondes accurately reflects the general, well-understood trends of the ionosphere. While the strict data filtering for reliability may limit the continuity needed for short-term event analysis, it is sufficient to confidently assess long-term trends, including the solar cycle.

[P-9] Comparative Study of MHD- and WEIMER-Derived Cross Polar Cap Potential (CPCP) as Inputs to Thermosphere-Ionosphere Model

Jeong-Heon Kim[1], Kyungsun Park[2], Jihyeon Son[1], Young-Sil Kwak[1,3]

[1]*Korea Astronomy and Space Science Institute*
[2]*Chungbuk National University*
[3]*University of Science and Technology*

Implementing a more accurate representation of high-latitude ionospheric potential in the near-Earth space environment is one of the key issues in magnetosphere–ionosphere (M-I) coupling studies. As part of the development of an integrated space weather model, we are attempting to improve the calculation of high-latitude electric potentials for realistic M-I coupling, and this study represents one such effort. In this work, we employ the TIEGCM model to represent the ionospheric potential. While the model by default computes high-latitude potentials using the WEIMER or HEELIS options, we modified this module to ingest external space environment inputs. The overall coupling framework is as follows: (1) solar wind parameters and IMF Bz are taken either from ACE *in-situ* observations or AI-based predictions (Son et al., 2023, 2025); (2) these inputs are applied to an MHD model (Park et al., 2021) or to the WEIMER model to derive the cross polar cap potential (CPCP); and (3) the resulting CPCP values are subsequently coupled to the TIEGCM model. As a test case, we selected the G4-class geomagnetic storm that occurred on October 10–11, 2024. To evaluate the accuracy of the high-latitude potentials obtained from this simplified M-I coupling approach, we used CPCP values derived from the SuperDARN radar network as a reference. The preliminary results suggest that AI-based solar wind predictions can be effectively utilized in geospace modeling, and that differences between MHD- and empirical-based potential models provide important implications for the performance of thermosphere–ionosphere simulations.

[P-10] Influence of Tropospheric Variability on Migrating Semidiurnal Tide in the Mesosphere and Thermosphere

Kyeongsoo Kim, In-Sun Song

Department of Atmospheric Sciences, Yonsei University

The influence of tropospheric Notrhern Annular Mode (NAM) on the migrating semidiurnal tide (SW2) in the mesosphere and lower thermosphere (MLT) is investigated using the Specified-Dynamics version of the Whole Atmosphere Community Climate Model with thermosphere and ionosphere extension (SD-WACCM-X). Six distinct periods, including sudden stratospheric warming (SSW) events and strong polar vortex (SPV) events, are analyzed to examine the impact of tropospheric variability at different stratospheric polar vortex conditions. The correlation between the tropospheric variability and SW2 variations, as well as the contribution of individual Hough modes is presented in this study.

[P-11] Moon-Originating Ions Observed Over a Broad Range of Latitudes on the Lunar Far Side

Jaehee Lee[1], Khan-Hyuk Kim[1], Yewon Hong[1], Seul-Min Baek[2], Ho Jin[1], Junhyun Lee[2]

[1]*Kyung Hee University*
[2]*Korea Astronomy and Space Science Institute*

We analyzed data obtained by the Kaguya satellite on 22 June 2008, when the Moon was in the solar wind region to investigate the acceleration of Moon-originating ions. The Moon-originating ions with energies below ~300 eV were detected across a broad latitude range from −50° to 90° on the lunar far side, where the surface is directly exposed to the solar wind. Previous studies have shown that Moon-originating ions are released from the surface and accelerated by the solar wind's motional electric field. However, the ions observed near the equatorial region cannot be attributed to surface emission alone, and analyses of the ion composition and pitch angle distributions indicate additional contributions from the exosphere. The

detection of these Moon-originating ions by a lunar orbiter can provide valuable insights into the chemical composition of lunar surface materials, as well as the interaction processes between the solar wind, the exosphere, and the lunar surface.

[P-12] Effects of Radial Nonuniformity in Global Reconstruction of Coronal Magnetic Fields

Sibaek Yi, Gwangson Choe

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Information on coronal magnetic fields is essential for understanding solar eruptive phenomena. However, due to observational limitations, these fields must be inferred from numerical simulations. We developed an NFPT (nonlinear force-free code in poloidal-toroidal formalism) in a Cartesian coordinate system, and recently extended it to spherical coordinates, which we call NFSP (NFPT in spherical coordinates). NFSP has been tested against an analytic force-free field model and shown to perform comparably to another existing code.
In this paper, we incorporate a nonuniform radial grid into the NFSP code. Radial nonuniformity allows us to reconstruct larger domains while achieving higher resolution near the solar surface, all with reduced computational cost. We tested several formulations of the nonuniform scheme to identify the most effective one. The nonuniform NFSP code is validated against the analytic force-free field model and compared with the uniform-grid NFSP. Finally, we apply the nonuniform NFSP code to a solar active region and compare the results with those of the uniform-grid NFSP to evaluate which approach is more effective for global reconstruction of coronal magnetic fields.

[P-13] Determination of CME Three-Dimensional Parameters Using Deep Learning

Hyeonock Na[1], Yong-Jae Moon[1,2]

[1]*Department of Astronomy and Space Science, Kyung Hee University*
[2]*School of Space Science, Kyung Hee University*

We develop two deep learning models to determine three-dimensional parameters of coronal mass ejections (CMEs), using convolutional neural network (CNN) methods and synthetic CME images. Model 1 estimates four parameters (radial height, angular width, latitude, and longitude) from a single synthetic CME image. Model 2 estimates two parameters (radial height and angular width) from a single synthetic CME image and its source location (longitude and latitude). We generate 380,000 synthetic CME images with different three-dimensional parameter sets: 304,000 for training, 38,000 for validation, and 38,000 for testing. The root mean square (RMS) errors of the parameters from the model 1 with test data sets are 0.7Rs for radial height, 1.8° for angular width, 0.9° for latitude, and 2.0° for longitude. For the model 2, the RMS errors are 0.7Rs for radial height, 0.9° for angular width. We apply these models to SOHO/LASCO C3 CME events and compare them with the parameters from the full ice-cream cone model. The parameters from the models are similar in some cases, but in other cases show large differences, particularly in angular width. A possible reason for this is the degeneracy problem. In addition, we develop a deep learning model that uses two synthetic CME images as input, assumed to be observed from Lagrangian points L1 and L4. The preliminary tests show that the RMS errors are significantly reduced.

[P-14] AI-Based Improvement of Spatial and Temporal Resolution of SUVI/EUV Data Using SDO/AIA

Sumiaya Rahman[1], Bendict Lawrance[2], Ashraf Siddique[3], Hyun-Jin Jeong[1,4], Yong-Jae Moon[1]

[1]*Department of Astronomy and Space Science, Kyung Hee University*
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[3]*Department of Computer Science Engineering, Kyung Hee University*
[4]*Center for mathematical Plasma Astrophysics, Department of Mathematics, KU Leuven, Belgium*

The Solar Ultraviolet Imager (SUVI)/ extreme ultraviolet (EUV) provides larger field of view extending out to ~2 solar radii but lower spatial and poorer temporal resolution than SDO/AIA data. In this study, we present AI-based approach to improve both spatial and temporal resolution of SUVI/ EUV data. First, we generate synthetic SUVI/EUV L2 HDR data from SDO/AIA data with the same spatial and temporal resolution of SDO/AIA. Next, we train an AI-based super-resolution model using SUVI/EUV L2 HDR (1 k × 1 k) as input and synthetic SUVI/EUVI L2 HDR as output. 1440 pairs of SDO/AIA data and SUVI/EUVI L2 HDR are considered for training, validation, and testing from 2020 January to 2024 December. Our results from this study are as follows. First, our AI-model generated synthetic SUVI/EUV L2 HDR from SDO/AIA data exhibits higher correlations with the temporal resolution of SDO/AIA. Second, the AI-based super-resolution model enhances the spatial resolution of low-resolution SUVI/EUV L2 HDR data 4 times both on the solar surface and the limb area up to 2 solar radii. Third, the AI-generated high-resolution SUVI/EUV L2 HDR data are evaluated using not only quantitative image quality metrics (RMSE, SSIM, correlation coefficients) but also differential emission measure (DEM) comparisons, providing a physically motivated validation. In the future, we will use AI-based models to denoise and enhance

the spatial resolution of SUVI/EUV L1b using SDO/AIA data.

[P-15] Spectral Analysis of Jet-Like Features Observed at 8542-0.4 Å in FISS

Hana Kim[1,2], Heesu Yang[2], Maria S. Madjarska[2,3,4]

[1]*University of Science and Technology*
[2]*Korea Astronomy and Space Science Institute*
[3]*Max Planck Institute for Solar System Research*
[4]*Space Research and Technology Institute*

We report on tiny jet-like features in the active region, AR 13784, using Fast Imaging Solar Spectrograph observations taken on August 19, 2024. These are only visible in the Ca II 8542 Å line with no signature in the Hα line. We analysed the spectra along seven tiny jet-like features. We calculated their Doppler velocities using the lambda meter method. In this presentation, we suggest possible formation mechanisms of these jet-like features.

[P-16] A Multi-Layer Constant Gradient Approach to Alfvén Wave Transmission in the Solar Atmosphere: Application to FALC and FALP

Kyoung-Sun Lee, Jongchul Chae

Seoul National University

Previously, Chae & Lee (2023) presented an analytical solution for Alfvén waves in a constant gradient layer where the Alfvén speed varies linearly along magnetic field lines. In the present work, using that solution, we construct a multi-layer constant gradient model, formulated in a transfer-matrix framework, for the solar atmosphere in which both density and magnetic field strength vary arbitrarily with height. An arbitrary Alfvén speed profile is approximated piecewise by constant gradient layers and matched across interfaces. The method takes density and magnetic field stratifications from standard atmospheres as input to return the frequency dependent transmission across the transition region. Applying this multi slab constant gradient model to quiet Sun/coronal hole (FALC) and plage/active region (FALP) profiles, we find the following. Increasing the number of layers suppresses artificial interfacial ripples, and the curves approach the continuous profile solution. Steep transition region gradients raise the effective cutoff and push the transmission threshold to higher frequencies. At the same time, with finer layering the high-cutoff region becomes effectively thinner along the wave's path, so low-frequency transmission increases. The total Alfvén travel time across the atmosphere converges quickly (~15 seconds for CH, ~11 seconds for AR) and sets the width and steepness of the S-shaped rise. At the same absolute frequency, the CH atmosphere transmits more than the AR, while AR curves reach unity at higher frequencies. This multi-layer constant gradient scheme provides a practical tool to predict Alfvénic transmission through the solar transition region for diverse atmospheric conditions.

[P-17] Backward Tracing of Solar Energetic Particles with MHD Simulations (WSA-ENLIL model): Implications for Space Weather Prediction

Seung-Ju Yang[1], Dae-Young Lee[1], Ryun-Young Kwon[2], Kyung-Chan Kim[1], Ji-Hyeon Yoo[1,2]

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[2]*Korea Astronomy and Space Science Institute*

Large Solar Energetic Particle (SEP) events are associated with shocks driven by Coronal Mass Ejections (CMEs). These particles can cause communication disruptions, satellite malfunctions and radiation hazards for astronauts and flight crew on polar routes. In space weather forecasting, the arrival of 10MeV protons at Earth is classified as a Solar Radiation Storm (S). For now, global monitoring of SEPs is limited to reporting their occurrence as a nowcast. If the development of a Solar Radiation Storm Forecast model is successful, it would represent a significant advancement, e.g., enabling adjusting satellite attitudes, rerouting polar flights to prevent or minimize damage caused by these events.

We present a test particle simulation to find the source location along the shock front for observed SEPs. Using the particle energy, flux, pitch angle obtained from *in-situ* observations of e.g., SOHO, ACE, WIND, and SolO, we perform backward tracing of particles from the observer's sites through magnetic field lines given by a Magnetohydrodynamic (MHD) simulation. This allows us to identify the source locations of the observed SEPs at the CME's shock front. By analyzing various plasma parameters along these origin points, we can derive a distribution function.

In future work, we will combine MHD simulation data with our derived distribution function to initiate a forward tracing of particles from the CME's shock toward Earth. The results of this forward tracing model will be continuously compared and validated against *in-situ* data. This process will allow us to refine the model's parameters, physical assumptions, and ultimately its predictive accuracy.

[P-18] Determination of Small-Scale Current Sheets Embedded within the Large-Scale Heliospheric Current Sheets as Observed by Parker Solar Probe

Dooyoung Choi, Dae-Young Lee

Chungbuk National University

We used Parker Solar Probe magnetic field measurements to compile a set of 109 heliospehric current sheets (HCSs) from 2018 to 2024, and a catalog of small-scale current sheet (SCS) candidates embedded within them. The selected HCSs are evaluated in terms of heliocentric distance, existence of plasma flow jet, and orientation of the HCS planes, and SCS properties are analyzed. The readial distribution of HCS encounter locations shows no pronounced bias with heliocentric distance. Among the HCSs with available plasma data (71 HCSs), 73.2% exhibit a flow jet signature consistent with magnetic reconnection, and such reconnection-like events are more frequently observed closer to the Sun. A bifurcated current sheet structure is identified in 25% of all 109 HCSs. The HCS normal vectors are generally perpendicular to the Parker spiral field, as expected, but HCSs identified at r $\leq$ 0.1 AU do not show a clearly perpendicular orientation. In total, we identified 5,944 SCS candidates. Theri durations are predominantly $\leq$ 3 seconds, and SCSs occurring within HCSs ten to be oriented mostly randomly relative to the corresponding HCS normal vectors. Future work will assess how well these SCS candidates satisfy current sheet diagnostics and to what extent they represent genuine reconnection-related structures.

[P-19] Statistical Study of Solar Energetic Particle Events and Their Relation to Ground Level Enhancements Using ACE/SIS Data (1997-2023)

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Ground Level Enhancement (GLE) is one of the phenomena detectable by neutron monitors on the ground. It is characterized by a sudden increase in cosmic ray intensity caused by solar energetic particles (SEPs). Because the origin of GLEs is still not well understood, many researchers continue to study their characteristics. We also analyzed the characteristics of GLEs by utilizing ACE/SIS data and comparing SEP events accompanied by GLEs and those without. We analyzed a total of 122 SEP events, including 16 events associated with GLE and 106 events without, over the period from 1997 to 2023. In addition, we used proton flux and X-ray data from the GOES satellites. The results of this study contribute to a better understanding of solar wind composition associated with SEP events, GLE-associated mechanisms, and their relevance to space weather forecasting and radiation hazard assessments. We present these results in this presentation.

[P-20] A Statistical Study of Solar Energetic Particle Events Observed by Geostationary Operational Environmental Satellites

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Solar energetic particle (SEP) events have been observed in-situ by particle detectors onboard the Geostationary Operational Environmental Satellites (GOES) since 1976 as transient enhancements of high-energy particles, primarily protons (up to a few GeV) and electrons (up to tens of MeV). SEP events are of great relevance for space weather because they can cause large increases in radiation levels in the space environments of the planets and in the interplanetary space, potentially harmful for human space exploration (spaceflights) and space-based technology. Here we present a statistical analysis of SEP events identified from time series of 5-min averaged integral proton flux with energies greater than 10 MeV. With a total of 314 SEP events observed during 1976–2025, we first find that the majority (~70%) of the SEP events are associated with flares that occurred in the western side of the Sun when viewed from Earth. As the location of flares is toward the western solar limb, relevant SEP events tend to be detected on Earth sooner with larger peak flux values. It is also found that in some SEP events there are significant differences in the onset and peak flux values between two identical detectors (one directed eastward and the other westward) onboard each of GOES 13–15. In addition, we introduce a method for intercalibration of integral proton flux data obtained by GOES 7–15 (1996–2020).

[P-21] The Basic Data Processing for KPLO Gamma-Ray Spectrometer (KGRS)

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On August 2022, South Korea's first lunar probe, the Korea Pathfinder Lunar Orbiter (KPLO, DANURI) was launched and successfully entered lunar orbit in December of the same year. KPLO is currently conducting a mission with the KPLO Gamma-Ray Spectrometer (KGRS), developed by the Korea Institute of Geoscience and Mineral Resources (KIGAM). The primary objective of KGRS is to collect gamma-ray spectral data from the lunar surface and generate elemental maps. Here, we describes the basic processing steps of KGRS data acquired lunar orbit and presents the results. KGRS data are maintained in three categories: TM2, TM3, and calibrated data. In the TM2 stage, time conversion and correction are performed, while the TM3 stage utilizes the SPICE (Spacecraft Planet Instrument C-matrix Events) system to obtain satellite positional information. TM3 and calibrated data are currently available to the public through the KARI Planetary Data System (KPDS) website as

Raw and CAL data. All KGRS data transmitted to KIGAM are monitored daily. The monitoring system tracks both engineering data (e.g., instrument temperature) and science data. Monitoring gamma-ray counts enables the detection of events such as solar flares or gamma-ray bursts, which may affect data quality. We briefly report the monitoring results of the data. With these monitoring results, we confirmed that the data are being collected without any major problems.

[P-22] Cable-Driven Parallel Robot Requirements for Lunar Lander GNC Sensor Navigation Tests

Eui-Keun Kim, Seung-Yong Min

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Cable-driven parallel robots (CDPRs) are parallel mechanism actuated by multiple cables in space, offering high flexibility and applicability as research and test platforms. This study investigates the applicability of a CDPR as a test environment for evaluating the performance of guidance, navigation and control (GNC) sensors for lunar landers. The platform consists of multiple cables and a end-effector capable of mounting GNC sensors. Since cables can only transmit tensile forces, their tensions must be actively controlled by the actuation system. In navigation tests, the robot can operate along a predefined trajectory, whereas guidance tests require active control in real time based on sensor feedback. Building on this approach, the paper presents the requirements and design considerations for using a CDPR to perform navigation test for lunar lander GNC sensors.

[P-23] Onboard AI for Space Exploration: Extending Raspberry Pi Validation toward Mission Scenario Applications

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Recent space exploration missions increasingly integrate artificial intelligence (AI) onboard spacecraft to mitigate communication speed limitations and latency. Such missions require onboard AI systems that can operate reliably under strict power and environmental constraints.
In this work, we implemented the object detection model YOLO v5n on Raspberry Pi and demonstrated real-time object detection using live camera input. The result confirms the feasibility of utilizing AI in small, low-power embedded platforms. Based on this initial validation, we are now focusing on model optimization and acceleration, as well as inference on raw and intensity-only image to develop object detection capability suited for space exploration mission.

[P-24] Rapid, Lightweight Attitude Screening for Early Mission Design of LAE Burns in GTO/IGSO Transfers

Jin-Hyung Kim

Korea Aerospace Research Institute

This research presents a lightweight, operation oriented method to rapidly screen feasible spacecraft attitudes (yaw/pitch) for liquid apogee engine (LAE) burns at apogee during GTO/IGSO transfer. From nominal orbital elements and date, we construct the ECI-to-LVLH frame at the burn epoch, map Earth and Sun direction vectors into LVLH, and evaluate a yaw-pitch grid using payload boresight and field-of-view cones. Feasibility is determined by binary geometric checks that enforce two mission-driven constraints: S-band link geometry and star-tracker sun-exclusion. For each date, viable yaw sets (aggregated across pitch) are summarized as date-wise bar timelines, with daily yaw-pitch heatmaps to support window selection and operations planning. Case studies (without numerical results) indicate that seasonal solar geometry, argument-of-perigee choice, and eccentricity level can materially reshape the availability and continuity of feasible attitudes. The workflow is simple to implement and computationally inexpensive, enabling early trade studies and on-console “what-if” analysis without full mission propagation. Limitations include a Keplerian snapshot assumption (no perturbation propagation), simplified antenna/optical thresholds, and omission of additional operational constraints (e.g., thermal limits, structural occlusions, ground-station elevation). Further research is needed to incorporate averaged-J2 or high-fidelity propagation and to calibrate thresholds with measured payload patterns and operational margins.

[P-25] Thermal Environmental Conditions of Thermal Analysis for Planetary Explanation Mission

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The primary objectives of space exploration are the investigation of the origin of the universe and the identification of potential sites for human habitation. Among these candidates, Mars, along with the Moon, has been regarded as the most feasible location for future human settlement, and unmanned exploration missions have been conducted for several decades. Through Mars orbiters, landers, and rovers, diverse scientific data have been collected, enabling the assessment of habitable regions, environmental conditions, and the identification of essential technological requirements for future missions. In Mars missions,

accurate prediction of landing-site environmental factors, particularly the surface thermal environment, is essential for mission design. Unlike the Moon, where surface thermal conditions can be relatively well defined due to the absence of an atmosphere, Mars possesses a CO_2 dominated atmosphere that causes significant meteorological variability, complicating prediction.

Nevertheless, extensive Mars exploration missions have provided valuable observational datasets, facilitating ongoing studies of Martian surface and atmospheric environments and leading to the development of predictive meteorological models. Among these, the Mars Climate Database (MCD) developed through international collaboration led primarily by French and European research institutions offers parameterized atmospheric and surface environmental data based on a General Circulation Model (GCM). The MCD provides a wide range of meteorological parameters depending on landing site and mission configuration, thereby serving as a practical tool for mission design.

The present study investigates the applicability and utilization of the MCD for acquiring the thermal environmental parameters required in the thermal analysis of Mars surface landers. Specifically, the numerical results derived from the MCD are compared against previous measurements from Mars exploration missions. Based on this comparative analysis, practical approaches are proposed for integrating MCD-based predictions into the thermal environment conditions required for engineering-level thermal analysis of Mars surface missions.

[P-26] Overview on STM and LSTM of Lunar Lander

Seung Yong Min, Eui-Keun Kim

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Korea Pathfinder Lunar Lander (KPLL) is currently in development to be launched in early 2030s. Diverse test models will be developed in order to perform ground tests and verification of KPLL. Structural and Thermal Model (STM) is a typical test model to be developed to qualify the complete lander structure and thermal design, to verify the lander mechanical assembly concept and procedure, to validate Mechanical Ground Support Equipment (MGSE), and to correlate the structural and thermal mathematical models. Landing Stability Test Model (LSTM) is a distinctive model to test landing stability of the lunar lander caused by touchdown conditions and landing environments. In this study, summarized overview and brief development plan on STM and LSTM of Lunar Lander are described.

[P-27] New Insights into Magnetic Anomalies Associated with the Moon's Oldest Geologic Features: South Pole-Aitken and Dirichlet-Jackson Basins

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The origin of the lunar crustal magnetism is mostly unknown. If the origin and age were known at some magnetized regions, we could infer new information about the timing, strength, and origin of the Moon's ancient dynamo. Here we present two magnetic anomalies associated with the Moon's oldest geological features: South Pole-Aitken (SPA) and the pre-Nectarian Dirichlet-Jackson (DJ) basins. At the SPA basin, we have found that basin formation may have divided a large magnetized region in the northeast into two sections, interior and exterior of the basin rim. In particular, we find a weaker and incoherent magnetized region at the interior of the northeastern rim, and a stronger and coherently magnetized region at the exterior of the northeastern rim. We are currently investigating what portion of this correlation may be due to the large elevation change between the inside and outside of the basin. If it is true that the basin rim divides the anomaly, it could imply the magnetized terrain pre-dates SPA formation. For the DJ basin, we find that the Descartes magnetic anomaly is part of a quasi-circular magnetized region that is located within ~6 degrees of the DJ basin antipode. We are currently using geologic relationships at the Descartes anomaly to investigate the hypothesis that the magnetized material at Descartes is comprised of DJ basin ejecta. A counter hypothesis we are also investigating is that Nectaris basin ejecta formed the Descartes anomaly. All of these observations have the potential to provide insight into the Moon's magnetic field at ages that pre-date most paleomagnetic analyses of lunar samples.

[P-28] Lessons from Lunar Node-1: Considerations for Developing a PNT Payload on Lunar Landers

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Lunar Node-1 (LN-1), developed by NASA and flown on the IM-1 mission, is a small S-band navigation beacon that provided the first demonstration of navigation beacon signals from the lunar surface. Designed to demonstrate Multi-spacecraft Autonomous Positioning System (MAPS) packet broadcasts, and to conduct PN-based one-way ranging and Doppler tracking, LN-1 transmitted about 4.5 hours of data during cruise and 30 minutes after landing. Despite the lander's non-nominal landing, LN-1 achieved a meaningful demonstration by transmitting MAPS packets and PN-based one-way ranging signals from the

lunar surface. Data from LN-1 enabled analysis of clock drift and thermal effects on a PNT payload at the cis-lunar and lunar surface environment. In this work, we summarize LN-1's mission and results, and outline considerations and directions for developing PNT payload on lunar landers.

[P-29] Analysis of Landing Conditions Including Mission Duration at International Lunar Lander Sites

Jonghee Bae, SeungBum Hong, Jun Bang, Kiduck Kim

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Since the first lunar lander of the 20th century, numerous missions have been developed and continue to be developed to achieve lunar surface exploration. Since the 2000s, various nations, including the United States, China, India, Japan, and Russia, have developed lunar landers and attempted lunar landings. In South Korea, the lunar lander program was initiated in 2024 with the goal of launching a lunar lander in the 2030s. A lunar lander must depart Earth, traverse the Earth–Moon transfer trajectory, enter the lunar sphere of influence, and perform a safe descent to the designated landing site. After landing, the spacecraft generates power through solar arrays and conducts scientific missions using its onboard payloads. The mean length of a lunar day is 29.5 Earth days, with the daylight period lasting approximately 14.75 days. Accordingly, the nominal operational duration of a lunar lander on the surface can be assumed to be about 14 days. However, this daylight duration varies depending on the latitude of the landing site. In this study, the landing conditions of previously developed international lunar landers are analyzed. The results are expected to provide valuable insights for the selection and assessment of landing sites for future lunar lander missions of Korea.

[P-30] Proof Load Test Results of Lifting System and Approach Fixture for a Large Thermal Vacuum Chamber

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Korea Aerospace Research Institute

The Korea Aerospace Research Institute (KARI) utilizes the Large Thermal Vacuum Chamber (LTVC) for thermal vacuum testing of large satellite systems, such as Multi-purpose Practical Satellite (KOMPSAT) series and Geostationary KOMPSAT (GK) series. After completing all preparations, satellites are moved into the LTVC for testing with lifting system. The lifting system, which is part of the satellite loading system, is used to move and install the satellite inside the chamber. And the Approach Fixture (AF) is employed to access the satellite for final setup procedures.

To ensure the safe movement of the satellite into the chamber and subsequent access for operations, the lifting system and the AF should perform the proof load test to verify their operational capability and structural integrity.

In this paper, we describe the proof load test method and procedure using lifting system and AF. And we also explain the anaylsis methodology based on the measurement results obtained from an KOMPSAT and GK series.

[P-31] Topographic Features of the Lunar Surface with Water-Ice on the Sub-Surface

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Water-ice on the Moon would be on the lunar sub-surface or below that, if it exists on the Moon. Water is a representative volatile material, so even if it was created on the lunar surface, it would not exist on the lunar surface because it would have completely evaporated due to low lunar gravity. This means that LROC/LRO, LUTI/KPLO, and Shadow Cam/KPLO with visible wavelength range can't directly observe water-ice on the lunar surface.

In Earth's case, if the sub-surface has water, the surface has unique topographic features like Collapse pits near lava tubes, and Cracks/fissures in regolith. We re-analyze the images of LROC and ShadowCam using other optical parameters, because the features like Collapse pits near lava tubes, and Cracks/fissures were not found in the LROC, and Shadow Cam images of PSR. We expect that water-ice is a lunar sub-surface, if the features are found among the PSR images of LUTI and ShadowCam. And we can plan to do target observation with the area using IIRS/Chandrayaan-2.

[P-32] Study of the Lunar Environment Affecting the Lunar PNT Signal

Haingja Seo, Hyewon Park, Jin Bae

Korea Aerospace Research Institute

The researchers keep trying to attempt a lunar surface landing using the satellite navigation system of Earth, and studying to develop a Lunar navigation system. Lunar navigation satellites data are expected to be affected by lunar gravity and the position of Earth's magnetic field. The Moon has a gravity anomaly, it has not yet fully been interpreted. And the size of the Earth's magnetic field is influenced by solar activity, and the Moon's position relative to the Earth determines whether the Moon enters that area of the Earth's magnetic field. We investigated lunar environments that can affect the lunar PNT signal and determine whether they can cause signal distortion.

We will then use lunar environmental data to analyze how much the lunar PNT signal is distorted. The development of Lunar PNT is expected to lay the foundation for using satellite navigation not only for lunar landers but also for other planetary landers. In particular, it can enable autonomous driving of exploration rovers.

[P-33] Instrument Kernel Update for the KPLO LUTI Camera: Methodology and Product-Level Improvements

Seunghee Son

Korea Aerospace Research Institute

The Korea Pathfinder Lunar Orbiter (KPLO) Lunar Terrain Imager (LUTI) is a high-resolution pushbroom camera designed to acquire detailed lunar surface images for scientific analysis and mission support. Accurate geometric processing of LUTI data requires a well-characterized Instrument Kernel (IK) within the SPICE framework, which encodes camera design parameters such as focal length, field of view, pixel pitch, and boresight geometry. On-orbit performance assessments and cross- comparisons with reference lunar datasets revealed systematic geometric discrepancies, necessitating refinement of the pre- launch IK. This study presents a comprehensive methodology for updating the LUTI IK through control point matching against high-precision lunar basemaps and statistical analysis of geometric residuals. The update process quantifies systematic pointing and optical distortion effects, resulting in improved geometric accuracy across the mission dataset. The revised IK demonstrates enhanced consistency with co-registered data from other KPLO instruments and significantly reduces residual errors in map-projected products.

Product-level improvements are evident in key applications including image mosaicking, digital elevation model generation, and multi-temporal change detection. Geometric uncertainties in orthorectified images are reduced, enabling more reliable photogrammetric analyses and facilitating integration with global lunar reference frameworks.

The methodology and lessons learned from this IK refinement effort provide a practical framework for similar calibration activities in current and future planetary imaging missions, contributing to the delivery of high-fidelity data products that maximize scientific return.

[P-34] Preparations of the On-Orbit Servicing System Specification Document

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Korea Aerospace Research Institute (KARI) has been carrying out ‘Base Technology Development for On-Orbit Servicing (OOS)’ project since 2022. Prior to the system development to be operated in low earth orbit (LEO), a mission of the OOS system is to be derived and corresponding performance of the OOS prototype in laboratory configuration is to be demonstrated. In this article, preparation results of the OOS system specification document are described which is based on KARI’s heritages of satellite development.

[P-35] Toward Korean Space Exploration Raman Spectrometer

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Currently, NASA’s Perseverance rover on Mars is equipped with a Raman spectrometer called SHERLOC, which has been actively operating to this day. Remarkably, Raman spectroscopic data played a key role in NASA’s recent announcement of the first potential biosignatures on Mars, highlighting the significant advantages of Raman spectroscopy for space exploration. In fact, beyond the United States, many other leading spacefaring nations are planning or developing Raman spectrometers as strong candidates for future exploration missions.

However, in Korea, research and development of Raman spectrometers specifically designed for space exploration remain almost nonexistent. In this presentation, I will review the current status of domestic research on space-oriented Raman spectrometers and discuss future plans in this field.

[P-36] Differential Amplifier Based Inner Controller for the Dual-Loop Control of DC-DC Converters

Jeong-Hwan Yang

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DC-DC converters typically consist of an inductor and a capacitor, resulting in two state variables and two controllable points. Typically, the control point of DC-DC converters is the output voltage, capacitor voltage. However, for stability improvement, response speed, and protection, Dual-loop control is implemented, controlling the inductor current with an inner controller and the capacitor voltage with an outer controller. In dual-loop control, the inner controller which controls the inductor current consists of an integrator, poles, and zeros implemented with an OP-amp. However, conventional controllers have different transfer functions from the sensed inductor current to the controller output and from the control reference to the controller output. When designing the outer voltage controller, the transfer function from the control reference to the capacitor voltage is used. The different transfer functions

between the sensed inductor current to the controller output and the control reference to the controller output make the outer voltage controller design more challenging. In this paper, a controller based on a differential amplifier is proposed. The proposed controller makes transfer functions from the sensed inductor current to the controller output and from the control reference to the controller output identical. As a result, the design of the outer voltage controller is simplifed.

[P-37] Strategies for Efficient Signal Processing in Next-Generation Space Particle Detectors

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Space missions face tight constraints on instrument size, weight, and power availability, making efficiency a central requirement for detector system design. To address these needs, next-generation particle detectors utilize dedicated electronics capable of high-performance data processing within limited resources. Two key devices are central to this approach: ASICs (Application-Specific Integrated Circuits), which are custom-designed chips built to process detector signals rapidly with minimal power, and FPGAs (Field-Programmable Gate Arrays), which are reconfigurable chips that provide flexibility to control and adapt the detector's functions in real time.

This study presents an experimental platform that integrates ASIC-based signal readout with FPGA-based control and data handling. Beyond simple storage, the platform enables event selection, noise reduction, and system performance characterization, ensuring reliable evaluation under simulated space radiation conditions. Moreover, the work highlights strategies to mitigate limitations of ASICs, including their inherently slow serial communication, by leveraging FPGA modules for faster parallel control and adaptive system response.

By combining the precision of ASICs with the flexibility of FPGAs, this framework establishes a pathway toward compact, low-power detector payloads optimized for space environments. Such a balanced system architecture not only supports rigorous instrument validation but also accelerates the transition of detector technologies into practical space applications.

[P-38] Roll-Out Solar Array Development for Scalable and Reusable Autonomous Spacecraft

Sung-Hyun Woo, Dae Yeong Kim, Dae Jun Jung

Korea Aerospace Research Institute

Korea Aerospace Research Institute (KARI) is currently conducting research on the development of a scalable and reusable autonomous spacecraft system for mission/lifespan extension of satellites, safe disposal of space debris, in-space manufacturing, and multi-asset transport between Earth and a lunar gateway. As a part of this research, environmentally friendly, high-thrust electric propulsion systems and roll-out solar arrays to support them are being considered as core technologies. This paper presents the overseas development trends of roll-out solar arrays, which are gaining prominence due to recent trends in light weighting and high efficiency of space systems, and identifies key technologies for developing a self-deploying mechanism of roll-out solar arrays applied with Carbon Fiber Reinforced Polymer (CFRP) composite slit booms. Furthermore, it presents a conceptual design and a 3-meter class prototype development plan for application to the scalable autonomous spacecraft.

[P-39] Electrical Interface Test for the Electric Propulsion System of Geostationary Communication Satellite

Young-Jin Won

Korea Aerospace Research Institute

The Korea Aerospace Research Institute is developing a next-generation geostationary communication satellite to provide public satellite communication services starting in 2021. The next-generation geostationary communication satellite applies a hybrid propulsion system applying a chemical propulsion system and an electric propulsion system to maintain a geostationary orbit for the first time in Korea. The electric propulsion system consists of a Propulsion Power Unit (PPU) for supplying power, a Propellant Management Assembly (PMA) for delivering krypton fuel from a tank to a thruster, an electric propulsion thruster, and a tank for storing fuel.

This paper is about an electrical interface test using an Engineering Model (EM) of an actual Propulsion Power Unit (PPU). An electric propulsion system load simulator to simulate a Propellant Management Assembly (PMA) and a thruster was developed and applied to this interface test and the test plan and test results are summarized. Considering the test results, it was confirmed that the developed electric propulsion system load simulator is suitable for the electrical interface test and will be applied to the Flight Model (FM) test later.

[P-40] Design of Test Scheme using Flight model for On Board Computer of GEO satellite

Joo Ho Won

Korea Aerospace Research Institute

Function Test for Flight Model has been performed in order to check the health status of hardware during AIT for GEO Satellite. Even though a unit has a number of connectors for the test to check the function of hardware, test, conducted at system level, has many constraints caused by a flight model,

and access to that connector. There are many criteria to activate a reset or reconfiguration, for example battery voltage, under voltage condition of internal supply for OBC, and watchdog for GEO Satellite. It is impossible to make a situation of failure for battery voltage, because of FM battery. At unit level, it is possible to make a battery failure using EGSE for OBC. This paper describes the efficient test scheme using Flight model for GEO Satellite, at system level, to check the correct reset, reconfiguration and hand-over function throughout watchdog criteria.

[P-41] MTF Characteristics Analysis and Performance Evaluation for High-Resolution Imaging Systems

Youngchun Youk, Shinwook Kim

Korea Aerospace Research Institute

This study investigates the Modulation Transfer Function (MTF) characteristics of a high-resolution imaging system utilizing a bar target with multiple edges. MTF was measured via a knife-edge scanning method with an electro-optical camera equipped with a linear detector. Data was acquired across multiple edge transitions, focusing on a central region encompassing all edges for robust analysis. Various data processing techniques were employed to evaluate system performance. Comparative analysis of these methods, including combined ESF from individual edges and combined ESF from selected pixels, provides insights into optimizing the imaging system for enhanced resolution and contrast. The results demonstrate the effectiveness of these analytical approaches for characterizing and improving high-resolution imaging systems.

[P-42] 코페르니쿠스 충돌구 분출물과 그 주변 지역의 광물 분포 조사

이응석, 헤스 마셀, 김경자, 임재수

한국지질자원연구원

달 앞면에 있는 Copernicus 충돌구 분출물(crater ejecta)은 바다 지역 주변을 포함하여 광조(crater rays)를 생성하였다. 특히, 광조는 Sinus Aestuum과 Rima Bode와 같은 주변의 바다 지역에 분포되었다.
본 연구는 이들의 광물 분포가 어떻게 되는지 살펴보고 이 지역에 대한 기원 중 일부를 추정하고자 한다.
광물 분포는 인도 달 탐사선 찬드라얀-1 위성에 탑재된 M3 (Moon Mineral Mapper) 장비의 데이터를 사용할 예정이며, 이 데이터들은 IBD(Integrated Band Depth)라는 도구를 이용할 예정이다. IBD는 기존의 스펙트럼 흡수선을 보다 더욱 선명하게 볼 수 있는 장점이 있으므로 광물 분포 조사에서 필요한 도구이다.
또한 이들은 RGB 합성영상으로 가공하여 광물 분포를 분석하면, 고원 지역과 바다 지역의 흡수선 패턴을 구분할 수 있으며, 특히 바다 지역에서 보이는 흡수선 중 하나인 단사휘석(clinopyroxene) 및 사방휘석(orthopyroxene)을 볼 수 있으며 이를 통하여 충돌구 분출물과 구분이 가능할 것으로 예상된다.

[P-43] Analysis of the Emergency Response of Air Management System from the Perspective of Life Support System

Joo-Hee Lee, Youn-Kyu Kim

Korea Aerospace Research Institute

The air management system for life support of crew used in an enclosed environment must stably supply oxygen and remove carbon dioxide. In case of abnormal operation due to critical damage or failure of the oxygen generator system or the carbon dioxide removal system, an emergency system should be used to maintain the respiration of the crew. In the case of emergency system used in emergency situations, it must be able to be used immediately and stably until the time of crew rescue is completed. In this paper, we intend to analyze countermeasures and scenarios according to the emergency situation of the air management system used for the underwater platform.

[P-44] Survey of the Lunar Surface Environment Related to Orbital Missions

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Recent orbital missions have investigated the near-lunar space environment and its interaction with the solar wind. These observations provide key insights into the charged particle distributions, magnetic field structures, and electric field disturbances around the Moon. Therefore, in the future, lander missions are expected to include high-precision magnetometers, plasma instruments, and electric field sensors for detailed surface studies. These instruments aim to reveal new information on lunar magnetism, surface–plasma interactions, charging and discharging phenomena, and the Moon's internal structure. Multi-point surface measurements will enable spatial comparisons and real-time monitoring of responses to solar and space environmental changes. During the 1960s and 1970s, Apollo's Lunar Environment Experiments demonstrated that surface measurements are effective in linking orbital conditions to surface-level responses. Several future international missions plan to carry out in-situ plasma and magnetic field observations at multiple landing sites. In this study, we survey future science missions targeting surface variations of the lunar space environment and discuss how these investigations can be connected to

existing and ongoing orbital observations.

[P-45] Concept Study of a VLEO Satellite for High-Resolution Earth Observation

Hyunsu Lim

Korea Aerospace Research Institute

Very Low Earth Orbit (VLEO, 150–300 km) offers unique opportunities for Earth observation, including improved spatial resolution and reduced latency. At the same time, severe atmospheric drag, atomic oxygen erosion, and strict subsystem requirements present critical challenges. This work presents a system-level concept study of a ~500 kg class optical satellite designed for VLEO operations. Aerodynamic effects, orbit dynamics, and material considerations under atomic oxygen are examined. Propulsion and power subsystems are addressed in terms of their ability to support orbit maintenance and continuous payload operation. The study outlines key design considerations and provides a framework for future research on the feasibility of sustainable Earth observation missions in the VLEO regime.

[P-46] Seasonal Particle and Molecular Contamination Measurement for Precise Space Experiments

Ji-Hoon Choi, Seon-gi Baek, Geun-sik Kim, Gyu-min Oh, Seung-mo Hong

Korea Aerospace Research Institute

Since January 2019, satellites scheduled for launch have been stored and assembled in the laboratory. Our goal is to ensure the successful operation of these satellites in orbit. Currently, many satellites have been stored or have completed assembly within the lab. We maintain cleanliness using an air conditioning system and contamination sampling. We analyze the contamination measurement results to determine if seasonality has an impact on contamination levels. Finally, we briefly present potential improvements for the space experiment environment.

[P-47] Improvement of Process Monitoring Functions for Neonsat Monitoring

Guhyeok Kim, Min-A Kim

Korea Aerospace Research Institute

The Korea Aerospace Research Institute (KARI) currently performs monitoring of KOMPSAT and CAS500-1 through Process Monitoring (PM). It is necessary to extend PM to include the currently operating NEONSAT-01 as well as its follow-on satellites. Since the operation of these satellites involves certain differences from the existing operational flow, a new design is required to accommodate these changes.

[P-48] Super-Resolution Image Reconstruction Using a Nonuniform Interpolation Approach for Remote Sensing Satellite Camera

Youngsun Kim, Haeng-Pal Heo

Korea Aerospace Research Institute

Spatial resolution, which reflects the information content and geometric accuracy, is one of the most critical performance parameters of an electro-optical camera, particularly in remote sensing satellite systems. Focal plane in camera can be designed and configured with stagged detector lines to enhance spatial resolution through super-resolution image reconstruction. This technique employs signal processing methods to generate a high-resolution image from multiple observed low-resolution images. This paper presents a super-resolution image reconstruction method based on a nonuniform interpolation approach. The procedure consists of several steps, including image registration, interpolation onto a high-resolution grid, and noise and blur reduction. The interpolation step can be implemented using different schemes such as nearest-neighbor, bilinear, and bicubic methods. Furthermore, various restoration techniques can be applied to suppress noise and reduce blurring effects. Finally, the paper shows implementation results with various input examples and compares the performance of different methods.

[P-49] Satellite Image PRNU Verification for Payload Performance Monitoring Using Spacelook and Lunar Observations

Jun-Ho Kim

National Meteorological Satellite Center (NMSC)

Photo-Response Non-Uniformity (PRNU) is a key performance metric for satellite payload detectors, quantifying pixel-to-pixel sensitivity differences under uniform radiance conditions. Excessive PRNU introduces artificial patterns, such as banding and striping, in satellite imagery, thereby degrading the quality of meteorological and remote sensing applications.

PRNU verification is a critical requirement throughout the satellite mission lifecycle. On-orbit assessments rely on uniform Earth targets like deep oceans, deserts, and snowfields, as well as stable external references including lunar images and global Spacelook observations. The PRNU metric is calculated by deriving pixel-level radiance values from these uniform scenes, with non-uniformity estimated as the ratio of the standard deviation to the mean.

This metric is used for payload performance monitoring, flat-field correction coefficient derivation, and long-term stability analysis, with specifications typically requiring 3σ. This study

outlines the methodology for PRNU estimation using satellite imagery, highlights the use of lunar and Spacelook observations for on-orbit validation, and demonstrates how time-series analysis can be employed to evaluate detector degradation and the need for recalibration.

[P-50] Ritchey-Chrétien Telescope Design for Small-Satellite VLEO Missions

Jeeyeon Yoon, Goeun Kim

Korea Aerospace Research Institute (KARI), Space Optics Team

This work presents the conceptual design of a Ritchey-Chrétien (RC) imaging telescope optimized for very-low Earth orbit (VLEO, ~300 km) small-satellite missions. Based on the VLEO environment and mission requirements—ground sampling distance (GSD), swath width, and platform/packaging constraints—we establish optical performance goals and explore the corresponding design parameter space. At the mission level, Korsch and three-mirror anastigmat (TMA) configurations were also considered; however, this paper focuses on the RC solution due to its implementation practicality and fitness to the target performance. The RC architecture employs hyperbolic primary and secondary mirrors to cancel spherical aberration and coma to first order, while its all-reflective nature minimizes chromatic effects and enables compact packaging suitable for small satellites. To respect envelope and opto-mechanical efficiency, we conducted a layout case study (2–3 candidates) varying primary-secondary separation, field-flattener lens module, and folding mirror placement. For each candidate, we quantitatively assess optical performance, including full-field MTF and distortion.

[P-51] Plan for Public Satellite Tile Image Service Through Next-Generation KSATDB

Myung-Jun Lee, Jaeung Han, Gap-Ho Jeun, Min-A Kim

Korea Aerospace Research Institute

The KSATDB (KompSAT DataBase) online service, launched in 2017, is planned to undergo an upgrade in its functions and performance between 2025 and 2028. The original KSATDB is utilized for two main services: satellite image ordering and tile image release. One of the key focus areas of the upgrade is to expand the public satellite tile image service. The public will be able to perform tile image comparison, band selection, and combination. According to the plan, the subjects of the satellite tile images for public service will include global weather-related issues such as floods, wildfires, and droughts, as well as scientifically significant areas like polar regions and global landmarks. In this paper, we will briefly present the plan for the public satellite tile image service in the KSATDB upgrade blueprint.

[P-52] Enhanced Processing Workflow for Rapid Modification Satellite Imagery

Jaeyeol Lee, Jihyeon Yim, Min-A Kim

Korea Aerospace Research Institute

This study proposes an improved processing procedure for the rapid modification of satellite imagery. Directly editing the entire image is limited by large file sizes and the processing of coordinate information, which slows down the workflow. To address this, a rectangular region around the target is first cropped, and modifications are performed within this smaller image using pixel x and y positions. The modified region is then reintegrated into the original image. This approach enables faster processing by working with smaller data segments and enhances the efficiency of satellite image modification.

[P-53] A Study on the Development of a System for Enhancing the Efficiency of Satellite Imagery Requests

Eunsook Lim, JungNam Jun, Min-A Kim

Korea Aerospace Research institute

As the utilization of satellite imagery data continues to expand, the demand for satellite imagery requests has also increased rapidly.
However, several issues have arisen due to inefficient request procedures and the absence of a user-accessible function to predict acquisition feasibility based on satellite orbit analysis. At present, users must contact the person in charge individually via email or phone, and it takes considerable time to receive feedback on whether imagery acquisition for the area of interest is feasible. To address these limitations, this study aims to enhance the efficiency of satellite imagery request processes by enhancing the user interface through integration with existing systems such as the order management subsystem and improving the performance of the existing imagery request system.

[P-54] Incremental Learning and Error Correction for Enhanced Automated Cloud Detection in LEO Satellite Imagery Catalogs

JiHyeon Yim, GuHyeok Kim, Min-A Kim

Korea Aerospace Research institute

The LEO satellite imagery catalog serves as a key information framework for pre-assessing the usability of satellite data, and the accuracy of cloud information directly affects both image selection and practical applicability. However, automated cloud detection systems may experience degraded performance due to

spectral and morphological confusion between clouds and non-cloud features caused by regional factors such as surface reflectance characteristics, marine environments, haze, and fog. To address these challenges, this study proposes a cloud detection method that combines error correction with incremental learning. The proposed approach is designed to continuously improve model performance by correcting errors that occur during automated cloud detection and incorporating the corrected information into the incremental learning process. In addition, the method is structured to integrate data updating, learning linkage mechanisms, and operational workflows in a manner suitable for systems based on LEO satellite imagery catalogs. This approach enhances both the reliability of cloud information and the efficiency of data utilization, and it can be applied to environments involving real-time operation and the expansion of multi-satellite data sources.

[P-55] Development of a Web-Based Ordering and Distribution System to Enhance Accessibility of Satellite Data

Gabho Jeun, Myungjun Lee, Jaeung Han, Mina Kim

Korea Aerospace Research Institute

To enhance the utilization of satellite information, it is necessary to develop innovative infrastructure that improves the accessibility of the satellite information database.
This study systematically examined the key components required for implementing a web-based system for multi-satellite image search, ordering, and distribution, identifying core functionalities such as catalog search, tasking requests, and product distribution. In this paper, we present findings that contribute to the development of an open-access satellite imagery service framework, enhancing data accessibility and usability.

[P-56] Analysis of the Secondary Mirror Despace Sensitivity for the CAP-W Payload of CAS-4 Satellite

Dae-Jun Jung[1], Jong-Un Kim[2], Sang-Gyu Lee[1]

[1]*Korea Aerospace Research Institute*
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The CAP-W (Compact Advanced Payload with Wide Swath) is an electro-optics camera that is installed on the CAS-4 (Compact Advanced Satellite-4) satellite. The CAP-W payload is equipped with five multispectral channels and has the capability to capture images with a wide range of swath width. The payload is specifically designed to capture images related to national agriculture, water resources, and forests.
The secondary mirror despace in a space camera is one of the most critical alignment parameters, as it primarily causes defocus with significant amplification due to the secondary's optical power. This type of defocus reduces contrast at higher spatial frequencies and enlarges the image spot size. Consequently, the modulation transfer function (MTF) and resolution are significantly degraded. Therefore, precise alignment, high thermal stability, and an active focus correction mechanism are essential.
In this paper, we outline the analysis of the secondary mirror despace sensitivity and describe the test specification / setup for the CAP-W payload of the CAS-4 satellite. including result of secondary mirror alignment. This process is critical for achieving accurate remote sensing data, supporting applications such as environmental monitoring, climate studies, and resource management.

[P-57] A Comparative Analysis of Spatio-Temporal Processing Capabilities in Temperature Prediction Models Using GK2A Satellite Imagery: LSTM vs. Transformer

Jun-Yeob Choi

National Meteorological Satellite Center (NMSC)

This study aims to advance the performance of short-term temperature prediction models by integrating big data from Geo-Kompsat-2A (GK2A) satellite imagery with state-of-the-art artificial intelligence (AI) techniques. Recognizing the structural limitations of conventional Long Short-Term Memory (LSTM) models in fully leveraging the spatial features of satellite imagery, we propose and comparatively analyze a Transformer-based model as a novel alternative capable of effectively learning complex spatio-temporal interactions. GK2A satellite imagery and Automatic Weather Station (AWS) data from the summer seasons (June-September) of 2022 to 2024 were utilized for training. The predictive accuracy of both models was rigorously evaluated using R-squared (R^2) and Root Mean Square Error (RMSE) metrics through 10-fold cross-validation. The results demonstrate that the Transformer model, through its attention mechanism, effectively captures the extensive and complex spatio-temporal patterns influencing temperature variations, leading to a significant reduction in prediction error and enhanced explanatory power compared to the LSTM model. This research empirically validates that modern Transformer architectures can substantially improve the accuracy of satellite imagery-based meteorological forecasting and presents a new direction for the future development of AI-driven weather prediction systems.

[P-58] Analysis of Seasonal Variations in GK-2A AMI MWIR Channel-to-Channel Image Registration Over Two Years

Sungsik Huh

Korea Aerospace Research Institute

The GK-2A meteorological payload's three mid-infrared water

vapor channels (WV063, WV069, WV073) exhibit limited land-sea contrast, posing challenges for automated computation using high-resolution landmark chips. To address this challenge, channel image registration pairs were established utilizing the MWIR reference channel (SW038) and the land-visible channel (IR087), and sub-pixel level channel-to-channel registration accuracy was assessed. This has improved image registration accuracy, with channel values approaching zero in both the East-West and North-South axes. Furthermore, this study demonstrates that seasonal variations in the solar angle relative to the satellite/payload induce thermal deformation, leading to slight seasonal variations in MWIR channel image registration. These variations exhibit a sinusoidal pattern, and monitoring over a two-year period confirms the presence of seasonal repeatability.

[P-59] Airflow Analysis Study on Oxygen Supply to Air Conditioning and Ventilation Unit in Subsea Structures

Younkyu Kim, Joohee Lee

Korea Aerospace Research Institute

This study investigates oxygen supply and concentration uniformity in an underwater habitat platform designed for human occupancy. The platform consists of seven compartments - equipment room, electrolysis room, living quarters, chamber room, electrical room, data room, and compressor room - separated by bulkheads and watertight partitions. Oxygen is generated by a water electrolysis system at a rate of approximately 43.5 mL/sec, while air circulation within the structure is maintained through an air conditioning system with a flow rate of 2,400 m^3/h. A one-week continuous oxygen supply was simulated to analyze the variation of oxygen concentration in each compartment, including a scenario that considered crew oxygen consumption in the living quarters. The results demonstrated that oxygen distribution remained relatively uniform across all compartments due to circulation by the air conditioning system. This finding suggests that complex individual control devices for oxygen distribution to each compartment may not be strictly necessary. The outcomes of this study provide valuable baseline data for the design and operation of oxygen supply systems in underwater habitat platforms.

[P-60] System Design of Lunar Infrared Spectrometer, Gamma-Ray Spectrometer and Neutron Spectrometer for Future Korean Lunar Exploration

GyeongRok Kwon[1,2], Kyeong Ja Kim[1,2]

[1]*Korea Institute of Geoscience and Mineral Resources*

[2]*Resource Engineering, Korea National University of Science and Technology*

This preliminary experiment investigates how the chemical and physical properties of lunar regolith affect plant growth, with particular focus on the previously overlooked physical characteristics of lunar soil. While previous plant cultivation experiments using actual lunar regolith samples or simulants were conducted over short periods [1, 2], this study employed a plant cultivation system and KIGAM-L7 lunar regolith simulant [3] to grow red leaf lettuce (*Lactuca sativa* L.) through one complete generation.

The experiment utilized a commercial plant cultivation system adapted for lunar regolith simulant. Red leaf lettuce was cultivated in KIGAM-L7 simulant as a treatment condition and both standard culture medium and manual condition (hydroponic) as control conditions. After cultivation, seeds were successfully secured from the first-generation offspring, and these seeds are planned to be replanted for a long-term multi-generational experiment. The above-ground vegetative weight of each plant, the number and total weight of flowers, and the total seed weight were measured to calculate growth metrics and reproductive allocation ratios.

Results from the first generation showed that plants grown in lunar regolith simulant exhibited consistently lower growth metrics compared to control conditions. Vegetative dry mass, flower dry mass, and fresh seed mass were all lower in the simulant environment, with the same negative trend observed in qualitative indicators such as overall plant condition. Critically, excessive moisture retention due to poor drainage and reduced aerationassociated with fine particle size distribution of the lunar regolith simulant was observed, which appeared to be a primary factor contributing to poor plant performance.

Previous studies have primarily highlighted the toxicity of lunar regolith's reducing environment caused by solar wind particles and resulting reactive oxygen species stress [1, 2]. While these chemical toxicity issues can potentially be addressed through chemical treatment methods, the physical properties of lunar regolith present distinct challenges that require different solutions. This study demonstrates that the physical characteristics of lunar regolith—particularly particle size distribution and porosity, which lead to water retention problems and impose significant constraints on plant growth independent of chemical toxicity.

These findings provide crucial insights for optimizing plant incubator configurations, particularly regarding drainage systems, moisture control, and substrate modification to accommodate the unique physical properties of lunar regolith. The results will inform the design of future full-scale lunar cultivation systems and equipment development for sustainable plant growth in lunar environments.

[1] Paul, A. L., Elardo, S. M., & Ferl, R. (2022). Plants grown in Apollo lunar regolith present stress-associated transcriptomes that inform prospects for lunar exploration. Communications biology, 5(1), 382.

[2] Duri, L. G., Caporale, A. G., Rouphael, Y., Vingiani, S., Palladino, M., De Pascale, S., & Adamo, P. (2022). The potential for lunar and martian regolith simulants to sustain plant growth: a multidisciplinary overview. Frontiers in Astronomy and Space Sciences, 8, 747821.
[3] Kwon, G., Kim, K., & Yi, E. (2024). Development of a New Lunar Regolith Simulant using an Automated Program Framework. Journal of Astronomy and Space Sciences, 41(2), 79-85.

[P-61] System Architecture and Preliminary Results of the Module Operational Test for the KEPLER System

Hye-Young Kim[1], Eun-Jung Choi[1,2], Jung Hyun Jo[1], Ki Pyoung Sung[1], Hosik Kam[1]

[1]*Korea Astronomy and Space Science Institute*
[2]*Korea University of Science and Technology*

The KEPLER system is being developed to support nine mission-oriented operational concepts: system operation, SpaceBook management, artificial space object reentry risk, artificial space object collision risk, natural space object impact risk, observation infrastructure, early warning services, national space object registration, and visualization display system. Currently, KEPLER is transitioning from the design stage to the implementation stage. During this process, detailed system designs, including wireframes and user interface prototypes, have been produced to reflect the representative functions derived from the operational concepts for all nine missions. In this presentation, we introduce the design outputs that serve as a blueprint for implementation, bridging conceptual planning and practical development, together with preliminary results from module operational tests.

[P-62] A Study on the Impact of Artificial Satellites on Astronomical Observations

Sang Hyun Lee[1,2], Inyeong Jang[3], Eunbi Yi[3], Eunsoo Jung[4], Yejin Choi[4], Jiwan Woo[4]

[1]*Korea Astronomy and Space Science Institute*
[2]*Department of Semiconductor Physics and Engineering, University of Ulsan*
[3]*Department of Physics, University of Ulsan*
[4]*Busan Science High School*

In recent years, the rapid increase in the number of artificial satellites, including Starlink, has raised growing concerns about the degradation of ground-based optical astronomical observations. In this study, we analyzed night-sky images obtained in the Busan and Ulsan regions to quantify the temporal distribution of satellite appearances and to assess their impact on astronomical observations. The observations were conducted using a wide-field lens and a CMOS camera with continuous exposures at fixed intervals. An algorithm was developed to automatically detect satellites in the images, identify their trails, and count their occurrences, thereby producing time- and direction-dependent statistics. This presentation quantitatively demonstrates the trends and severity of contamination in astronomical images caused by artificial satellites. Furthermore, the results are expected to serve as a foundation for developing long-term strategies to mitigate the impact of satellites on ground-based astronomical observations.

[P-63] Introduction to the Hosted Payload Program of a Satellite Navigation System for Space Domain Awareness

Deok Won Lim, Dea Ho Ko, Jung Pyo Kim

Korea Aerospace Research Institute

The QZSS Hosted Payload (QZSS-HP) program is a U.S.-Japan initiative where the U.S. Space Force places Space Domain Awareness (SDA) sensors on Japan's Quasi-Zenith Satellite System (QZSS) satellites to expand sensing capabilities and strengthen integrated deterrence in the Indo-Pacific. Designed by MIT Lincoln Laboratory, these optical sensors will improve the tracking and characterization of objects in orbit, complementing existing SDA assets and providing crucial data for national security. The program represents a significant step in U.S.-Japan space cooperation and is considered a key component of the U.S. strategy for integrated deterrence. In this paper, the purpose and goals of QZSS-HP are introduced and the technical aspects and program status are also summarized.

[P-64] Aircraft and Satellite EMP Requirements and Test Overview

Hyung-Uk Kim, Yun-Goo Huh, Dong-Chul Chae

Korea Aerospace Research Institute

EMP is a general term for Electromagnetic Pulse. Nuclear EMP (NEMP) refers to all types of EMP generated by a nuclear explosion. Nuclear EMP is also called NEMP or simply EMP, and because its amplitude level is usually very high, it is also referred to as "high-power electromagnetic wave."
Legally, according to the Notice of the National Radio Research Agency, Ministry of Science, ICT and Future Planning (Notice No. 2014-20), Chapter 1, Article 3 of "Standards and Methods for Safety Evaluation of High-Power and Leakage Electromagnetic Waves" defines "high-power electromagnetic waves" as high-altitude nuclear EMP generated by nuclear explosions above 30 km and high-power non-nuclear electromagnetic waves that can intentionally damage or malfunction information devices. Thus, nuclear EMP is limited to high-altitude nuclear EMP (HEMP). On the other hand, SGEMP is caused by harmful X-rays

generated by nuclear explosions outside the atmosphere, which can lead to failures in satellite systems that provide essential information functions, including modern critical communication and navigation services.

[P-65] Applying Zero-Trust Architecture to Satellite Flight Software

Hyun-Kyu Shin

Korea Aerospace Research Institute

Cyber threats against satellite systems are steadily increasing, revealing the inadequacy of traditional security measures that focus primarily on encryption of telecommand and telemetry (TC/TM) links. This study presents an approach for applying Zero-Trust Architecture (ZTA)—built on the principle of “never trust, always verify”—to satellite flight software (FSW). In a Zero-Trust model, every access request is continuously authenticated and authorized, and strictly controlled under the principle of least privilege. This proposes a reference architecture spanning ground systems, satellite systems, and TC/TM links. The ground segment is secured through multi-factor authentication, digital signatures, signed builds, and fine-grained access control, protecting both operator interfaces and development pipelines. The TC/TM link employs CCSDS Space Data Link Security (SDLS) and anti-replay mechanisms to ensure confidentiality, integrity, and freshness of mission data. Onboard the spacecraft, separation kernels and middleware are leveraged to enforce process isolation, topic-level authorization, and dual approval procedures for safety-critical commands. In addition, continuous monitoring of spacecraft state enables anomaly detection, adaptive policy enforcement, authenticated updates, and resilient key management tailored to the space environment. This study concludes that applying Zero-Trust Architecture to satellite flight software significantly enhances the security and resilience of satellite systems, while also establishing a secure operational foundation for future multi-satellite constellations and cooperative missions.

발표시간 : 10월 31일(금)
집중발표 14:30~16:00

[P-66] Establishment of Early Operation Procedure for Low Earth Orbit Satellite

Chiho Kang

Korea Aerospace Research Institute

After the launch, the satellite wakes up, activates and checks functions of its major subsystems such as flight software, communication, power, thermal control and attitude control subsystems and finally enters into standby mode for normal mission operations. At this time, functional checks and performance verification are proceeded based on the pre-determined procedures on ground. This early operation procedures consist of a series of TM/TC processes, which contain activities such as satellite telemetry check, evaluation of the satellite's SOH and transmission of commands for next activities. These procedures should be established and verified under an ETB or simulator environment for ensuring the safety of early operations for satellites. In this paper, early operation procedure for low earth orbit satellites is addressed.

[P-67] Surface Charging in Low Earth Orbit: A CubeSat-Based Preliminary Study

Go Woon Na, Jongho Seon, Seo Hyun Park, Dong-Hun Lee

Kyung Hee University

Among the various environmental threats in space, spacecraft charging is one of the most frequent and potentially mission-threatening phenomena, primarily caused by interactions with space plasma and space weather. Previous research has mainly focused on geostationary orbit (GEO), where charging effects are more pronounced. However, the advent of the New Space era has led to a surge in small satellite deployments, most of which operate in low Earth orbit (LEO), highlighting the need to revisit spacecraft charging studies in this relatively understudied region. In this study, we perform simulation-based analyses of spacecraft charging in LEO using the Spacecraft Plasma Interaction System (SPIS), under operational conditions typical of small satellites. The simulation results are validated against data from PICASO, a satellite developed by the European Space Agency (ESA) and launched in 2023. Particular attention is given to severe charging conditions observed in the polar regions. We analyze variations in spacecraft charging within a single orbit, identifying distinct patterns and regional differences.

[P-68] Routing Strategy for Satellite Constellation Networks

Sangseob Park, Inkyu Kim, Hyun-Su Lim

Korea Aerospace Research Institute

Traditional global networks, reliant on terrestrial infrastructure such as submarine cables, are limited in their ability to provide comprehensive global coverage. Communication using inter-satellite links (ISL) is emerging as a viable alternative, prompting research into various routing methods for satellite constellations. This paper compares static and dynamic routing approaches, along with algorithms based on traffic and Quality of Service (QoS). Furthermore, it discusses the "Satellite Constellation Routing Decision Strategy" for achieving efficient routing.

[P-69] Review on the Preliminary Design of Electrical Power Subsystem for Scalable Test Platform

Sungwoo Park, Sangman Moon, Sangtaek Lee

Korea Aerospace Research Institute

The usage of secondary launch vehicle adaptor such as ESPA (Evolved Secondary Payload Adaptor) has been steadily increasing in recent years, as seen in the application of STP-1, SHERPA, LCROSS, SSO-A and LANDSAT-9. These adapters enable the integration of multiple small satellites into a single launch vehicle, thereby reducing mission costs and enhancing launch efficiency. In particular, the ESPA-class ring has become a standardized platform across military, commercial, and scientific missions, facilitating payload modularization and expanding launch opportunities. This growing adoption of adapter-based architectures supports the rapid development of CubeSats, micro-satellites, and satellite constellations, while also contributing to greater efficiency in the launch service industry and the broader satellite market. In this paper, the preliminary design results of the electrical power subsystem for a 'Scalable Test Platform' utilizing the adaptor ring of the Korean Space Launch Vehicle (KSLV) is summarized and presented.

[P-70] Autonomous Relay-Based Navigation System for Satellite Constellations

Sang-Youn Shin, Yee-Jin Cheon

Korea Aerospace Research Institute

Small satellite constellations are increasingly used for Earth observation, communication, and scientific missions, but precise relative navigation and synchronization remain major challenges. Conventional GPS-based methods have limitations in signal availability, antenna constraints, and power demand, particularly for cubesats. In order to manage them, we propose a autonomous

navigation relay satellite concept that provides exclusively as a navigation hub within the constellation. Similar to a wi-fi repeater, this navigation relay system collects inter-satellite ranging and timing data, performs centralized navigation computations, and broadcasts correction signals to all satellites. This approach minimizes the computational and energy burden on individual spacecraft, reduces system complexity, and enhances scalability for larger clusters. Equipped with inter-satellite links and a high-precision clock, it can provide autonomous navigation services even in GNSS-nonavailable environments such as cislunar or deep space. Also it improves synchronization, mitigates resource distribution issues, and strengthens overall constellation resilience.

[P-71] Considerations on Launch Early Operation Phase of Synthetic Aperture Radar Satellite

Jae-Min Shin

Korea Aerospace Research Institute

The Launch on the development of Satellite should be a very important activity in order to put it on the planned orbit. However even though the Launch was successful, it is also very important image acquisitions and product generations for the defined Missions performed by not only the space segment, but the ground segment. Therefore during LEOP, both segments shall be checked and pre-operated ion order to prepared the normal operation phase. In the case of a SAR satellite, LEOP activities of Spacecraft bus and SAR payload for the space segment give directly a critical impact to final products of the ground segment including SAR Processing and Calibration. also it increase the duration of LEOP activities for segments. In order to optimize the relevant activities, all LEOP tasks shall be parallelled according to each proper timeline. so, a plan for LEOP phase shall be prepared and rehearsed in advance under the systemically organized sequence.

[P-72] Feasibility Study on Small Satellite System Design Sustainable in VLEO Environment

Choon Woo Lee

Korea Aerospace Research Institute

Since Very Low Earth Orbit (VLEO) satellites operate at altitudes of approximately 200–450 km, their system design requirements differ from those of conventional Low Earth Orbit (LEO) satellites. In order to systematically derive the design requirements for small satellite systems sustainable for more than one year in VLEO, it is essential to clearly define the mission objectives and concept of operations (ConOps) scenario, comprehensively considering VLEO environmental constraints such as atmospheric drag, atomic oxygen erosion, and radiation effects exposed in VLEO. In particular, during the solar maximum of the 11year solar cycle, the atmospheric density in VLEO increases significantly, leading to a sharp rise in aerodynamic drag and erosion caused by atomic oxygen. Therefore, to minimize aerodynamic drag in VLEO as much as possible, small satellite should be optimally designed with aerodynamic configurations to overcome atmospheric drag, and surface treatment resistant to atomic oxygen erosion must be applied to VLEO satellite. In addition, to counteract the natural orbital decay by aerodynamic drag, a electric propulsion system is required, along with large solar arrays to support high power consumption. This purpose of study is to review the design requirements for VLEO satellite systems and to present analytical methods for optimized system design such as aerodynamic parameter, drag compensation and the electrical power estimation for VLEO small satellite.

[P-73] A Study on the Development Plan for Space Tug with Autonomy and Reusability (STAR)

Yee-Jin Cheon[1,2]

[1]*Korea Aerospace Research Institute*
[2]*University of Science and Technology*

To acoomodate and offer various space in-situ servicing such as life extension service, relocation service, upgrade service, logistics service, delivery service, clean-up service, space fueling service, in-situ seplacement service, in-orbit assembly and manufacturing, etc, we stuied the development plan for space transportation service operated by a new class of genuine spacecraft, known as STAR (Space Tug with Autonomy and Reusability) and HYSEP (High-Yield Solar Electric Propulsion) system. Basically, the STAR has to be easily expandable and lightweight space tug. This can be achieved by applying roll-out solar array (ROSA) for lightweight and *in-situ* replacement design for critical modules for reusability, and by developing cartridge type modules or units for expandability and lightweight and mechanical structure for maximizing cargo capacity. The HYSEP system has 10kW class high power, high thrust level (~1 N) and high efficiency (> 50%) with long lifetime and reusability. We newly introduced 'Add-On-The-GO' design into solar electric propulsion system for various mission application (e.g., LEO, GEO, space exploration). It is anticipated that applying various newly developing technique such as 'cartridge type' or 'Add-On-The-GO' design for expandability and lightweight will maximize cargo capacigy. Also, the STAR have a great ripple effect on the related technologies such as advance robotics, vision based navigation, rendezvous, artificial intelligence. etc.

[P-74] Design and Implementation of a Software-Defined Ground Station for Small Satellite Communications in VHF, UHF, and S-band

Myung-Gil Kim, Kang Toi Yoon, Je Guen Lee
SpaceK Inc

With the rapid expansion of the small satellite market, the need for a domestic ground station system tailored for small and nanosatellites has become increasingly critical. This study presents the development of a compact, high-performance ground station utilizing VHF, UHF, and S-band frequency bands to enable real-time satellite monitoring and high-speed data downlink capabilities. Unlike most current domestic solutions that rely heavily on imported components or modular foreign systems, this project aims to establish a fully localized ground station platform, thereby overcoming operational limitations imposed by top-down satellite development approaches.
The ground station is designed with mobility and ease of assembly in mind, making it suitable for both permanent installations and field deployment. A cross-Yagi antenna array is implemented for VHF/UHF bands, while the system is designed to be expandable to include S-band antennas for high-data-rate applications. A pan-tilt motorized tracking mechanism enables automatic satellite tracking by pre-calculating orbital passes and initiating communications when the satellite reaches an appropriate elevation. This autonomous tracking system ensures optimal communication windows are fully utilized without manual intervention.
A key feature of the system is its Software-Defined Radio (SDR)-based transceiver, which provides high flexibility in modulation/demodulation schemes and allows real-time adjustment of RF parameters to adapt to different satellite mission requirements. This software-based approach also compensates for hardware limitations and paves the way for future upgrades without significant hardware modifications. The mechanical structure has been optimized to allow seamless integration of additional frequency bands and antennas, particularly for S-band expansion.

[P-75] The Current Status of Korea LandSat (CAS500)

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The Korea LandSat, so called Compact Advanced Satellite 500 (CAS500) program is a research and development program to develop two identical optical satellites having GSD 0.5 m and to be used for Korean land and resources monitoring and disaster monitoring around the world. We are proud to have been able to localize 98.6% of the key components such as mirrors, high stability telescope structure, focal plane electronics, image data handling unit, X-band transmitter and X-band Antenna which have been dependent upon overseas vendors so far. The first satellite (Korea LandSat-1) in the series was launched on 22 March 2021 and has successfully completed its mission life (4 years) as of 22 March 2025 and extended its mission further. Korea LandSat-1 has not only provided complete images of Korean territory but also provided satellite image services for International Charter Space and Major Disasters in an effort to assist restoration of relief in the disaster area around the world. The second satellite (Korea LandSat-2) is expected to launch in the first quarter of 2026. We expect more additional products with the two satellites in constellation.

[P-76] A Study on the Application of DevSecOps for Space Applications

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In general, software applications in the space fields are mission-critical and very complex in structure. In their software component supply chain, data supply chain, software integration and testing process, and deployed software application (i. e., satellite in space), there are several points of possible security vulnerabilities where malicious code injection, insider attack, and man-in-the-middle attack can happen. The aforementioned chains and process are potentially vulnerable to single point of security failure which a single component within a application whose failure would cause the entire space system to stop working. Software development life cycle in space application is a process which is divided into distinct steps such as project planning, design, development, integration/verification and testing, and software release which happen in series over long periods of time. The last four phases can be integrated and automated using specialized tools and practices for IT industries which is widely adopted practice and known as DevSecOps (development, security, and operations) by putting emphasis on security within the DevOps process. For a successful DevSecOps, the process includes continuous integration with which engineers release their code to a repository multiple time and continuous delivery based on continuous integration to automate the process of variable code from the build environment to a integration environment. Also it includes continuous security into the entire software development phases, which is a key component of DevSecOps. Finally, the process includes collaboration and communication between individuals in the working team.

[P-77] Specific Applications of Storable Bipropellant Propulsion Engine

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The storable bipropellant propellant propulsion engine is widely adopted in space applications. It is applied to orbit transfer,

attitude control and trajectory correction for various spacecrafts, including LEO as well as GEO satellites and space probes. Additionally, most commercial launchers employ it for upper stage control. Representative applications include the Chollian and KPS satellites. It is also incorporated into the main propulsion system of the future Korean moon lander. In terms of SpaceX, the bipropellant engine using MMH and N_2O_4 is used for Falcon9 and the Dragon space cargo. In the case of the Russian Soyuz launcher, such kind of bipropellant system is utilised to accomplish multiple missions. X-37, an American orbital test vehicle, and the Japanese Resilience moon lander also operate using this type of engine. This study investigates the specific applications of the storable bipropellant engine and suggests features for appropriate preparation for future purposes accordingly.

[P-78] Comparison of North-South Station-Keeping Strategies and Inclination Control Performance in Geostationary Satellites

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Geostationary Earth Orbit (GEO) satellites experience inclination growth from lunar-solar perturbations and Earth's gravity field asymmetry, requiring periodic North–South Station-Keeping (NSSK). This study compares two operational strategies: GK2 (GEO-KOMPSAT2) executes weekly chemical-thruster corrections (concentrated control), while GK3 (GEO-KOMPSAT2) performs twice-daily electric-propulsion maneuvers (distributed control). Over 1 month, GK2 shows larger inclination-vector excursions (max ix=0.0149, max iy=0.0262) than GK3 (max ix=0.012, max iy=0.0173). Over 10 years, the trend reverses: GK2 exhibits a narrower distribution (max ix=0.0172, max iy=0.0343) than GK3 (max ix=0.0226, max iy=0.0358). Both missions maintained inclination within the 0.05° station-keeping box.
These results reveal a clear trade-off: distributed EP achieves finer short-term precision and automated efficiency, whereas concentrated chemical burns provide superior long-term stability despite higher ground-operation demands. The selection of NSSK strategy therefore has direct implications for orbital stability, operational architecture, and ultimately mission lifetime.

[P-79] Analysis of the Characteristics of Line Impedance Stabilization Network (LISN) for EMC Testing of Satellite Electrical Components

Sangrok Lee, Tae-Youn Kim, Jae-Woong Jang, Kyung-Duk Jang, In-sang Yu, Chang-Eun Lee

Korea Aerospace Research Institute

In this study, we derived key parameters for a Line Impedance Stabilization Network (LISN) for electromagnetic environment testing to simulate the power supply system of an actual satellite. The power environment of a satellite is formed through the interaction of various parameters, including the internal resistance of the battery, the capacity of the bus capacitor, the resistance of the power distribution board, the input filter circuit of the low-voltage converter, and the resistance and inductance of the harness interfaced with the power control and distribution unit. Based on these parameters, equivalent circuit models for each component were constructed and numerically reflected to simulate the actual environment. The analysis results confirmed that battery and harness resistance dominate at low frequencies, while harness inductance dominates at high frequencies. This study is expected to contribute to improved reproducibility between unit-level standalone test results and system-integrated results by simulating a more realistic power environment for EMC testing of satellite electrical components.

[P-80] Design Considerations for Focal Plane Units in High-Resolution Wide-Swath Satellite Camera

Youngyun Kim, Youngsun Kim, Kihoon Seo, Il-seop Lee, Jinkwang Kim

Korea Aerospace Research Institute

Due to the need to identify small structures like roads, buildings, vehicles, and ships resulting from urban concentration, and to monitor detailed urban and social infrastructure – including traffic analysis and illegal structure detection – as well as to identify disaster and environmental responses such as wildfires, floods, and collapsed buildings, distinguish between people and vehicles, create high-resolution maps, update smart city and autonomous driving maps, and analyze agricultural conditions for economic and industrial value, ultra-high-resolution wide-area observation satellite cameras are gaining prominence. Unlike conventional focal plane units, these ultra-high-resolution cameras possess a wide focal plane area. Acquiring information from such a large area requires the deployment of 10 or more detectors. Using conventional CCD detectors would generate a significant amount of heat and result in a very bulky structure, making it difficult to construct the camera system. This paper considers the mechanical and thermal aspects of constructing a focal plane unit to meet these optical requirements.

[P-81] Design of Solar Array Simulator System for Testing Satellite Power Systems

Seung-Won Cho, Yun-Goo Huh

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This paper presents the design and development of a Solar Array Simulator (SAS) system for testing satellite power systems.

The proposed system provides stable and precise power supply to the spacecraft power subsystem, while incorporating a second level protection function to safeguard against overvoltage, overcurrent, and abnormal conditions that may occur during testing. In addition, it is designed to flexibly emulate the electrical characteristics of solar arrays under various orbital environments and mission conditions, enabling verification of the power subsystem in conditions similar to actual operation. The SAS developed in this study enhances the reliability of pre-launch power system integration tests and contributes to performance validation and improved operational efficiency of satellite power systems.

[P-82] A Case Study on Integrated Design and Visualization of a Web-Based Satellite Operations Support Platform

Seo-Yoon Jeong, Yeong-Ju Park, Yeong-il Kim, Geun-Seok Song, Kyung-Ju Min

Intelligent Operations, I-OPS

This study proposes an integrated web-based satellite operations support platform.
The platform comprises a user interface for satellite management and operation, real-time visualization of satellite orbits and ground stations with SGP4-based planning, antenna control and monitoring, as well as real-time monitoring and data reception/ management functions.
It was designed and implemented to provide integrated satellite operations and data management within a single platform.

[P-83] Assessment of MTF Loss in Electro-Optical Cameras Induced by Optical Distirtion

Jeoung-Heum Yeon, Young-Sun Kim

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TDI (Time-Delayed Integration) is a commonly used technique in electro-optical cameras to enhance the signal-to-noise ratio (SNR). TDI pixels consist of multiple linear arrays, where the electrons generated in one line of exposure are transferred and accumulated in the subsequent lines. As a result, the number of collected electrons increases, leading to an improvement in SNR. To avoid mis-match effects, the orientation of the TDI pixels must align with the scanning direction. However, optical distortion may cause a mis-match effect even under optimally aligned scanning directions. In this study, the relationship between optical distortion and TDI mis-match effects is examined. The influence of optical blurring and its impact on MTF are investigated with respect to the TDI step size and the degree of optical distortion. These findings can be applied to the estimation of TDI MTF and to the overall MTF budget of the camera.

[P-84] Assembly and Alignment Configuration Design of the Earth Observation Camera for the Next Generation Medium Satellite

Won-Beom Lee, Deog Gyu Lee

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The next-generation medium satellite camera consists of an optical structure, mirrors, an image sensor module, and thermal control components. For camera assembly, the optical structure, mirrors, and image sensor module undergo optical alignment and integration. First, the optical structure and mirrors are assembled and aligned according to the designed mirror assembly sequence, while the image sensor module is aligned at the camera level. To perform optical alignment of the camera, the design must consider various factors within a controlled environment that ensures low cleanliness class and minimal vibration. These factors include the measurement range of the optical alignment equipment, the focal properties and interferometric distances of the mirrors, the field of view of the alignment mirrors, the flexibility of equipment layout, and the sequence of assembly and alignment.
Therefore, this paper presents the configuration design for the assembly and alignment of the Earth observation camera for the next-generation medium satellite.

[P-85] Design Modifications to the Next-Generation SAR Satellite Resulting from Launch Vehicle Change

Hong Won Park

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The Pre-Ship Review (PSR) for the next-generation Synthetic Aperture Radar (SAR) satellite was successfully completed on September 3, 2025. However, transportation to the launch site for the launch campaign has been temporarily suspended due to delays in the development of Platino-1, the co-passenger satellite scheduled for a joint launch. Originally, the next-generation SAR satellite was intended for a dedicated launch aboard the Russian Angara 1.2 launch vehicle. However, due to the impacts of the Russia-Ukraine war, in April 2024, the launch vehicle was changed to the Vega-C, operated by Arianespace, and the launch configuration was modified to a co-launch arrangement. Platino-1 is an experimental X-band Earth observation SAR satellite under development by the Italian Space Agency (ASI), with the Payload developed by TASI and the Bus by SITAEL SpA, and is intended to operate in a Dawn-Dusk orbit. Consequently, the next-generation SAR satellite's operational orbit had to be adjusted from the originally planned Dusk-Dawn orbit to match the Dawn-Dusk

orbit of Platino-1. Achieving successful mission completion in this altered orbital environment necessitated comprehensive design modifications to the next-generation SAR satellite.
This paper analyzes the changes in Mean Local Time of Ascending Node (MLTAN) resulting from the launch vehicle change, assesses the impacts on operation, power budget, payload, and Spacecraft Bus, and presents a finalized outline of design solutions to address these impacts.

[P-86] Research on the Efficient Operation Design and Verification Method of an Acquisition Data Transmission System for the Effective Mission Performance of Satellite Payloads

Jong-Euk Park, Haeng-Pal Heo

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Satellite payloads, which carry out various missions in space, including acquiring high resolution images, are composed of various units and each unit performs its own role. In order to transmit the data acquired from the sensor unit to the ground station for use, it goes through various stages of processing. For the lossless transmission, it is required to minimize and optimize the possible transmission capacity and to achieve reliable transmission. Among the various data transmission processes, the effective transmission of the initial original data between the unit responsible for data processing and the sensor control unit responsible for acquiring data is a very important first step. A variety of protocols are used as reliable information transmission protocols on satellites, and various application methods are applied to utilize them. Various methods are added to ensure reliable transmission of data acquired from sensors. In the case of acquired data containing a lot of information, the data transmission speed management is also an important factor due to its large capacity. Data transfer between payload units is very important in design, and verification of the designed and manufactured system is also very important. Ground verification is also an important intermediate process to support reliable operation in space environments. Effective verification work during the pre-launch ground test of a satellite can greatly contribute to the reliable performance of satellite missions.
In this paper, we propose and analyze the design, development, and ground testing of a satellite payload acquisition data transmission system.

[P-87] A Method of Processing Satellite Electrical Test Data based on Probability Theory

Kyung-Keun Kim

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All satellites are tested on ground for validation of space environment moving. Satellite test engineer should process to know if this satellite test data is right or not. To re-confirm this process, this paper proposes a probabilistic based data processing method for satellite electrical test. This method is based on satellite electrical test data, It tells us how far the input data is far from the average, what probability this data can be recorded in the data distribution.

[P-88] Contamination Measurement and Verification of Black Anodized Specimens in Thermal Vacuum Test

KyuMin Oh, Sung-Wook Park, SunKi Baek, Sung-Wook Park, KeunShik Kim, Hee-Jun Seo, Ji-Seok Kim, Ji-Hoon Choi, KyuMin Oh, SeungMo Hong

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Black anodized aluminum specimens were evaluated for contamination characteristics in a thermal vacuum environment (less than 5×10^{-5} Torr). The specimens underwent bakeout in a chamber heated to 85℃. Outgassing behavior and contaminant mass release were monitored using TQCM (Thermoelectric Quartz Crystal Microbalance), while volatile and particulate deposition was measured via witness plates. To enhance reliability, supplementary outgassing data—including TML (Total Mass Loss) and CVCM (Collected Volatile Condensable Materials)—were obtained from Vacuumex, a specialized company (Anyang City, Korea) providing ASTM E595-based contamination measurement services. The results indicate that contamination levels and outgassing properties are sufficiently low to ensure the safe use of these materials in thermal vacuum conditions. Therefore, black anodized aluminum components are experimentally verified as reliable for application in space and high-vacuum environments.

[P-89] Preparation and Verification Method at ETB/FM Test Level for Establishing Satellite IAC Procedures

Bosung Kim, Junho Lee, Juhwang Kim, Jongjin Jang, Hyunseok Seo

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When the satellite is separated from the launch vehicle and settled in the mission orbit, the test is performed for the last time before normal operation. This is called Launch and Early Orbit Phase (LEOP). The LEOP is largely divided into Initial Activation and Checkout (IAC) and system In-Orbit Test (IOT), and the IAC is again divided into spacecraft (S/C) bus IAC and payload IAC. Since empirical LEOP cannot be performed with real satellite, procedural verification for S/C bus IAC is performed before launch at the completion of S/C bus and its subsystems

verification at the Electrical Test Bed (ETB) test level. This is the only test for S/C bus IAC. Since the ETB tests are performed before and after Preliminary Design Review (PDR), the S/C bus IAC will be around the middle of the development. Since it is in the middle of the development cycle, even if the verification for the S/C bus IAC is completed, many changes and unexpected variables may occur at the time of LEOP. In addition, since the S/C bus IAC is a test after launch, it is necessary to simulate the state in which the ground station (G/S) is linked to the satellite. However, in the end-to-end test, which is a satellite and G/S integration test on the ground, the S/C bus IAC is not a test item. In this paper, we propose a preparation and verification method at the ETB and FM test level in the G/S inter-operating states to establish satellite IAC procedures.

[P-90] A Study on the Design of Payload Data Transmission System for CAS500-5

Eun Su Kang, Sang Burm Ryu, Sang Gyu Lee

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Compact Advanced Satellite 500-5 (CAS500-5), equipped with a Synthetic Aperture Radar (SAR) sensor, is primarily developed for water resource monitoring and management. The high-volume SAR data generated by the satellite's onboard receivers is formatted according to CCSDS standards and transmitted to the ground station. This paper presents the design of a Payload Data Transmission System (PDTS) aimed at ensuring the reliable and efficient transmission of SAR data to the ground station. To guarantee transmission stability and reliability, Quadrature Phase-Shift Keying (QPSK) modulation and Reed-Solomon (RS) codes are employed, optimizing the communication link efficiency between the satellite and the ground station. This design allows for the rapid processing of high-volume SAR image data with minimal delay, thereby effectively supporting missions that require fast information utilization, such as water resource management and disaster response.

[P-91] GEO-KOMPSAT-3 Launch Window Analysis

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The GEO-KOMPSAT-3 (GK3) satellite will be launched by a SpaceX Falcon 9 rocket from a launch site in Florida. To accommodate unsteady weather and SpaceX's heavy launch schedule, the Falcon 9 requires a daily launch window longer than 2.5 hours.
After separation, the GK3 satellite reduces its spin rate and attempts to acquire the Sun. If the satellite is in an eclipse at separation, this Sun acquisition will fail, leading to excessive attitude maneuvers that consume a large amount of propellant. Therefore, avoiding an eclipse at separation is highly desirable. A significant challenge is the conflict between the desired launch time (dictated by the Falcon 9's small true anomaly at separation) and a thermal constraint during the liquid apogee engine firing. This conflict severely shortens the daily launch window. To solve this problem, this paper proposes a delayed Sun acquisition to prevent the maneuver from occurring during an eclipse. Additionally, this study presents an analysis of the launch window, considering a normal burn sequence derived from the initial separation orbit parameters.

[P-92] Analysis of ETB Results for AOCS FDIR of the GEO-KOMPSAT3

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GEO-KOMPSAT3 (GK3) is currently under development with a target launch date set for the second half of 2027. As a communications satellite, GK3 must maintain uninterrupted mission operations to ensure continuous service delivery to users. Any failure that prevents the satellite from fulfilling its mission could result in significant financial losses due to service disruption. To minimize such risks, the satellite has been designed with a strong emphasis on mission continuity, and this design is currently being validated through Electrical Test Bed (ETB) evaluations.
In particular, from the perspective of Attitude and Orbit Control System (AOCS), the satellite has been designed to meet mission requirements even in the event of failures in attitude sensors or actuators. This paper presents the ETB test procedures and results related to fault scenarios involving attitude sensors and actuators, demonstrating the robustness of the system's Fault Detection, Isolation, and Recovery (FDIR) capabilities.

[P-93] Low-Resolution Image Generation Method Using MTF-Based Filter for Super-Resolution Image Reconstruction of Electro-Optical Payloads

Ki-Hoon Seo, Youngsun Kim, Youngyun Kim, Ilseop Lee, Jin Gwang Kim

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To reconstruct super-resolution (SR) images from the remote sensed images of electro-optical payloads, two images with half-pixel shifted offsets for the same ground target are required. Therefore, the study of SR image reconstruction needs two low-resolution(LR) images, which are generated from the ground truth image. This paper presents an LR image generation method using MTF-based filter for the study of SR image

reconstruction. To simulate the operation of electronic camera systems including optical components and detectors, the LR image generation method consists of step-by-step processes which are optic blurring, dawn-sampling and noise addition. The blurring process involves the application of a MTF-based Gaussian filter which has the target MTF value being set at the Nyquist frequency. And down-sampling can be implemented in a variety of ways. These include bi-cubic, bi-linear, area, nearest and Lancoz4. Gaussian noise can be added after down-sampling. The results of implementation and simulation are presented and verified by using the slanted-edge method for MTF.

[P-94] Introduction to the Fault Management Test Plan Using the Electrical Test Bed (ETB) for the Geostationary Public Multipurpose Communication Satellite

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The Geostationary Public Multipurpose Communication Satellite is currently in the Flight Model (FM) assembly phase. Once the assembly of the flight model is completed, functional tests of the satellite will be carried out. However, no matter how perfect the design may be, functional tests are not conducted directly on the flight model. Instead, tests are performed on an equivalent model which maintains electrical performance characteristics identical to those of the FM. Likewise, fault management tests are conducted using the Electrical Test Bed (ETB) prior to performing them on the flight model. There are several reasons for utilizing the ETB in terms of fault management testing. First, it enables evaluation of whether a fault in a specific subsystem can propagate to other subsystems or potentially impact the overall spacecraft system. Second, the ETB-based tests allow for prior validation of the test procedures as well as the satellite operation procedures (SOP) employed in the Integrated Test and Operations System (ITOS), thereby reducing risk before FM-level testing. Third, while the independent functionalities of each subsystem have already been validated via the ETB, fault management testing provides opportunities to confirm compatibility with the onboard software and to identify omissions in logic testing of critical systems such as the Attitude Orbit Control System (AOCS) and the Electrical Power System. Accordingly, the objectives and test items of the planned fault management test are defined within this paper. Furthermore, the test configurations to be employed and the success criteria for each item are presented, thereby establishing a systematic framework for ensuring the reliability and robustness of the FM prior to launch and operational service.

[P-95] Performance Analysis Using DQM/DQE and MLBD (Maximum Likelihood Bit Detection) in NARO Space Center Telemetry Environments

Na-Gyun An[1], Chun-Won Kim[1], Doug-Hyun Kim[1], Young-Kyun Cho[2]

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Using telemetry RF communication technology is essential for tracking aerospace launch vehicle and receiving telemetry signals. It it necessary to select the optimal signal from each ground station in order to combine into a single stream. Before MLBD technology, best source selector of telemetry system selects sources after decommutation. Therefore, BSS was able to select one source depending on frame sync, CRC, etc. However, MLBD creates bits output with the highest probability from it's input streams. We explore difference between BSS and MLBD and how MLBD works depending on conditions. In this paper, using MLBD basic principles, I analyze performance of conventional best source selector and MLBD best source selector in NARO Space Center telemetry environments.

[P-96] Performance Validation of the Ground Telemetry System at Naro Space Center through Integrated Interoperability Test

Jina Ma, Nagyun An, Soonho Kwon, Donghyun Kim

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An integrated interoperability test was conducted at the Naro Space Center to verify the range system for launch vehicle tracking in preparation for the 4th launch of KSLV-II. Through this test, the ground telemetry system verified the performance of its subsystems, including antenna tracking using slaving data, real-time data processing and quick look message (QLM) distribution by the decommutation & processing system (DPS) using playback of launch simulation data, and best QLM selection and distribution by the best source selector (BSS). The test also confirmed the system's interoperability with the mission control system. This paper presents the generation of test telemetry data, testing of the ground telemetry system deployed in Goheung, and the analysis of the obtained results.

[P-97] Analysis for Rubidium Atomic Frequency Standard Frequency Stability of the End of Life through Initial RF Signal

Su-Hyeon Kim

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To operate satellite navigation systems such as GNSS, RNSS, and LEO PNT, navigation satellites generate and broadcast navigation signals. These navigation signals are transmitted via

RF signals generated based on the reference frequency provided by a Rubidium Atomic Frequency Standard (RAFS). The more accurate and stable the reference frequency provided to the navigation signal generator by this RF signal, the more the navigation signal error within the generator can be reduced. However, over time, the stability of the reference frequency provided by the RAFS gradually degrades. Consequently, the navigation signal can also degrade. In general, the stability of the RAFS reference frequency is calculated using Allan Deviation, and the Signal-to-Noise Ratio (SNR) is calculated by analyzing the rubidium control loop within the RAFS. To apply these calculation results, the Allan Deviation for the End of Life (EOL) can be estimated, enabling analysis of the frequency stability degradation. Therefore, this paper describes the necessary considerations for calculating Allan Deviation and SNR in RAFS, thereby providing information for predicting the degradation of the RAFS frequency stability.

[P-98] KARI's Medium-Sized Thermal Vacuum Chamber Failure Case Study

Sung-wook Park

Korea Aerospace Research Institute

A thermal vacuum test is essential to verify the function of the satellite on the ground. KARI is operating a medium-sized thermal vacuum chamber for small satellite and subsystem thermal vacuum tests. This paper describes the cause analysis and consideration for the failure of the chamber that occurred during the subsystem thermal vacuum test to prevent recurrence.

[P-99] BIRD: Build It Right, Dude (Flight Software Build Script)

Su-Hyun Park

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BIRD (Build It Right, Dude) is an automatic build script for spacecraft flight software. Flight software is embedded on spacecraft computer to operate the spacecraft. Currently, VxWorks 5.4 is being used by Korea Aerospace Research Institute as a real-time operating system. The initial output of BIRD scripts is a vxWorks downloadable image, which can be downloaded to the processor RAM (Random Access Memory) via Ethernet. Flight software engineers are able to execute a main function of the flight software from WindShell, one of VxWorks Development environment. The final product of BIRD script is a vxWorks bootable image, which is to be written to the processor Non Volatile Memory (NVMEM). For the final product build, a link script is required to locate the objects generated from the first phase. BIRD scripts consist of three steps: bird-glide, bird-nest, bird-hatch. bird-glide is a TCL script which generates the initial output, a VxWorks downloadable image. bird-nest is a python script to write a link script automatically. bird-hatch is another TCL script which generates the final product, a VxWorks bootable image. In this paper, we introduce how BIRD scripts build the spacecraft flight software with some user input.

[P-100] Design Concept of EGSE for Verification of Selected Satellite Avionics

MinJun Kim, Seung-Won Cho, Yun-Goo Huh

Korea Aerospace Research Institute

Satellite bus electronics, consisting of essential units for power, propulsion, attitude control, and mission operations, must be thoroughly verified in ground environments before launch. For this purpose, Electrical Ground Support Equipment (EGSE) provides power supply, signal interfacing, load emulation, data acquisition, and safety protection functions. This study proposes a design concept of an EGSE dedicated to selectively verifying specific units such as Pyro devices, Gyro sensors, and propulsion control units rather than the entire avionics system. The paper will define test requirements tailored to these units and present design considerations for power and signal handling, safety interlock mechanisms, and data acquisition methods. The proposed approach aims to establish a reliable and efficient verification environment that supports satellite development and enhances system reliability.

[P-101] Development Results of a Low Earth Orbit (LEO) Satellite Mission Planning Verification and Operation Situation Display System

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This paper presents the research results on the design and development of a Mission Planning Verification System (vMPS) and a Satellite Operation Situation Awareness Module for LEO satellite systems. The vMPS generates and manages mission requests, which serve as input for mission planning systems. The Satellite Operation Situation Awareness Module visually represents the satellite's operational status and provides detailed information based on the generated mission plans, utilizing a 3D map module. This study details the system architecture, component specifications, and database design. The results confirm the potential of this system as an integrated platform capable of simultaneously operating multiple satellites. This research is expected to improve the efficiency of LEO satellite mission operations and contribute to the advancement of related technologies.

[P-102] A Study on the Establishment and Operation of a Satellite Development Data Management System Based on the Zero Trust 2.0 Model

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The escalating sophistication of cyber threats and the growing prevalence of insider risks necessitate a new security paradigm for safeguarding technical documents generated during large-scale development programs. This study investigates the establishment and operation of a Satellite Document Management System (SDMS) based on the Zero Trust 2.0 model. The proposed approach incorporates the core principles of Zero Trust 2.0—continuous verification, least privilege enforcement, context-aware access control, and real-time monitoring with automated response—into the design and operation of the SDMS. Implementation strategies are outlined for applying these principles at appropriate stages of system construction and operation, thereby ensuring the integrity of system components, preventing unauthorized modifications, and enabling timely detection and mitigation of abnormal activities. The findings demonstrate that the Zero Trust 2.0-based framework can provide a robust security architecture for managing highly sensitive development data. This research is expected to contribute to the establishment of a practical and reliable document management framework for organizations engaged in development programs with stringent security requirements.

[P-103] Input Load Analysis of Sinusoidal Vibration Testing of Satellite Systems Using Force Sensors

Hee-Kwang Eun, Nam-Jin Moon, Seon-Je Jo, Jin Park, Chang-Rae Cho, Sung-Hyun Woo

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Sinusoidal vibration testing is an essential process for the successful launch of satellite systems. Typically, the first natural vibration frequency of a satellite system exists within 100 Hz, and applying excitation according to the launch vehicle's requirement results in excessive input loads compared to the actual launch environment. Therefore, a process called notching is performed to reduce the excitation level. In conventional tests that control and analyze using only acceleration, it is impossible to calculate the exact input force and moment, so the notching level was selected using response accelerations and analysis results.

In this study, we introduce test results where tri-axial force sensors were installed between the satellite system and the shaker to directly measure input forces and moments, which were then used for real-time control. By eliminating the effects of the fixture used for force sensor installation, we expect to calculate more accurate input forces and moments for the satellite system and minimize over/under testing.

[P-104] Conceptual Design of an Adjustable Satellite Shock Test System

Jong-Hyub Jun, Jong-Min Im, Hee-Kwang Eun, Nam-Jin Moon, Seon-Je Jo, Jin Park, Chang-Rae Cho, Tae-Seok Oh, Sung-Hyun Woo

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Shock qualification of satellite components requires flexible test methodologies to reproduce varying conditions associated with different specimens and qualification levels. At the Korea Aerospace Research Institute (KARI), dedicated facilities employ a pneumatic resonator system as the core excitation mechanism. While this configuration provides robust performance, its adaptability to diverse input requirements remains limited. This study explores a conceptual improvement to the shock test system, retaining the pneumatic resonator structure while introducing modifications to the interface plate and fixture. Through tailored design adjustments, the input transmission characteristics can be tuned to represent different target levels and boundary conditions. Preliminary analyses suggest that this approach can extend the functional range of existing infrastructure while maintaining reliability. The results highlight the feasibility of achieving controlled input variability through structural design strategies, offering a potential pathway toward more versatile shock testing of space hardware.

[P-105] Container Internal Monitoring System for K6/K7 Shipping

Ji-Seok Kim, Sang-Hoon Lee, Sang-Won Lee, Ju-Hyun Kim

Korea Aerospace Research Institute

For the launch of large satellites, international transportaion to overseas is often unavoidable. In such cases, continuous environmental monitoring is critical to prevent contamination and ensure system integrity. To maintain cleanroom-level conditions during the transport of the Korea Multi-Purpose Satellite 6 and 7 (KOMPSAT-6/7, K6/K7) to the Guiana Space Center (CSG), an integrated environmental control and monitoring system was implemented inside the shipping container. The environmental control system comprises an Automatic Temperature Control Unit (ATCU), auxiliary heaters, and GN2 supply, all configured to maintain temperature and humidity within cleanroom standards. To ensure cleaniness, HEPA filters and activated carbon filters were incorporated into a custom-built filtration system. An internal monitoring system was developed to verify and log the container's environment in

real-time. MSR sensors were installed to record temperature, humidity, vibration (acceleration), and pressure. In parallel, a particle counter was used to monitor airborne particulate levels and validate ISO class compliance throughout the transport process. In this paper, we presents the system architecture and deployment method of the monitoring system and analyzes recorded envrionmental data over the course of the shipping operation. Events such as aircraft takeoff/landing, ground handling, and air conditional activation were observed to assess their impact on the container's internal conditions. The results demonstrate the system's effectiveness in preserving a stable and clean environment for satellite safety.

[P-106] Modeling and Analysis of Transient Phenomena During Satellite Power-On

Suwan Bang, Yungoo Huh

Korea Aerospace Research Institute

This paper presents an investigation of satellite power-on behavior with multiple input sources, including solar array, main power, battery, and LV power, where relay devices are essential. An internal circuit model was developed and simulated using PSpice to illustrate transient surges at startup that may induce semiconductor breakdown or fuse activation. Furthermore, analog protection methods such as Zener, TVS, and surge diodes are examined through simulation. The results show both the effectiveness and the limitations of these devices, particularly under rapid voltage rise conditions. By demonstrating the mismatch between target voltage and diode threshold, this work highlights the challenges of relying solely on analog methods.

Overall, the study shows how transient phenomena can be interpreted during satellite initial operation and provides an internal modeling approach as a useful tool for evaluating protection strategies and guiding the development of more reliable satellite power systems.

[P-107] Proposal for Witness Plate Installation Location Criteria for Satellite Thermal Vacuum Test Contamination Measurement

Seungmo Hong, Sungwook Park, Gyumin Oh, Jihoon Choi

Korea Aerospace Research Institute

This study analyzes the differences in contamination measurements according to witness plate installation locations during satellite thermal vacuum testing, based on the observation that contamination is concentrated in the direction of the vacuum pump's suction (cold plate direction). Experimental results using witness plates installed at various locations inside the chamber show that contamination collected at the door position is lower than that collected near the specimen or at the vacuum pump/cold plate position. These results highlight the necessity of position criteria for representative and quantitative contamination measurement. This study proposes practical guidelines for selecting witness plate installation locations to improve reliability in satellite cleanliness evaluation during thermal vacuum testing, and provides a foundation for future standardization and contamination management practices.

[P-108] Influence of Circulating Nitrogen Density on Shroud Surface Temperature Uniformity under High Vacuum Conditions

Keun-Shik Kim, Ji-Seok Kim, Sung-Wook Park, SunKi Baek, Hee-Jun Seo, Ji-Hoon Choi, KyuMin Oh

Korea Aerospace Research Institute

Spacecraft and space components are required to operate under extreme thermal and vacuum conditions, making thermal vacuum testing an essential ground-based evaluation method. This study focuses on the thermal characteristics of a shroud that surrounds the test article and facilitates heat exchange, with particular attention to the influence of circulating gaseous nitrogen density on surface temperature uniformity. The experiment will be carried out under high vacuum conditions ($\leq 1.33 \times 10^{-3}$ Pa), with the shroud surface temperature set to cooling mode (−100℃) and heating mode (+100℃). By adjusting the nitrogen density and measuring the temperature distribution through thermocouples mounted on the shroud surface, the effect of density variation on thermal uniformity will be assessed. The expected outcome of this study is to provide fundamental data for establishing operational guidelines to secure uniform thermal conditions in thermal vacuum testing, thereby contributing to the reliability of high-fidelity space environment simulations.

[P-109] A Study on AI-Based Operation Methods for Thermal Vacuum Chamber

Hee-Jun Seo

Korea Aerospace Research Institute

A thermal vacuum chamber is an essential facility that simulates extreme temperature and vacuum conditions to validate the performance and durability of space equipment. However, their operation typically requires complex multi-variable systems, prolonged test cycles, and heavy reliance on skilled operators, which limit efficiency and reliability.

This study investigates AI-based operation methods for thermal vacuum chambers (TVACs), focusing on automatic optimization of test conditions, early anomaly detection, and predictive control of chamber states. Preliminary thermal simulations analyze the correlation between the temperature variations of

the test article and the chamber shroud. Based on these results, a machine learning model is trained to develop a predictive control model for shroud temperature regulation. When integrated into the TVAC control system, the model enables adaptive temperature regulation to meet the requirements of satellite components. Furthermore, an AI-based control algorithm is expected to enhance the precision of temperature control, while real-time data analysis minimizes risks during testing. The proposed AI-driven operation method is applied to representative thermal vacuum test scenarios, and the results demonstrate the potential to reduce test duration and improve reliability compared to conventional approaches.

[P-110] Comparative Analysis of Integration Strategies for Satellite Ground Stations

Gyeoul Lee, Hyunchul Baek

Korea Aerospace Research Institute

Satellite ground stations are essential infrastructures for reliable space mission operations. However, the current distributed system has limitations, including redundant investment, operational inefficiency, and complex security management. This study proposes several integration scenarios that redefine the roles between existing ground stations and a newly established integrated ground station, and comparatively analyzes their advantages and limitations. The findings are expected to provide valuable insights for improving efficiency, ensuring mission continuity, and meeting national security requirements in future ground system operations.

[P-111] Privacy-Preserving Centralized Learning Framework for Satellite Data Across Multi-Ground Station Environments

Jaehyoung Park, Hyunchang Lee, Jungsik Choi, Hyunchul Baek, Okchul Jung

Korea Aerospace Research Institute

In the new-space era, as the importance of ground station technologies for the safe and efficient operation of multiple satellites is increasingly recognized, the demand for automation and intelligence using artificial intelligence is also growing. Achieving these objectives requires large-scale training data; however, the data collected from satellites is inherently limited, which underscores the necessity of centralized learning systems. Nevertheless, centralized learning approaches can raise serious privacy and security concerns during the transmission and integration of satellite data. To address these challenges, this paper proposes a privacy-preserving centralized learning framework based on homomorphic encryption. In the proposed system, each ground station transmits encrypted satellite data to a central server, which performs learning directly on the encrypted data without decryption, thereby maintaining data confidentiality while enabling collaborative model training.

[P-112] A Study on Necessity of Integrated Satellite Control through Overseas Cases

Hyun-Chul Baek, Gyeoul Lee

Korea Aerospace Research Institute

In an environment where multiple public-purpose satellites and private satellites are mixed, an integrated control system has become an important factor in improving operation efficiency, cultivating collision threat responds capbilites, and securing mission contiuity and reliability.
Looking at overseas cases of integrated control, the United States is an organization the conducts global space operations in the CSpOC (Combined Space Operation Center), protecting them from threats and collisions form other countries or organizations. Europe is carrying out various missions such as satellite operation, global tracking, and space safety at ESA ESOC (European Space Operations Centre).
In addition, many countries are using the integrated control system to strengthen the stable operation and clustering of increasing satellites, space situation awareness, cost reduction, and civil-military cooperation.
In particular, the Unites States recognized that military dominance in the space domain had increased and formalized it as a fifth combat zone to respond to the threat of potential competitos.
In this paper, we will present that the integrated control method is more efficient than the individual control through overseas cases and is suitable for preotecting and responding to potential threats.

[P-113] Comparision of the Advantages and Disadvantages of Integrated and Individual Controls for Operating Multi-Satellites

Hyun-Chul Baek, Gyeoul Lee

Korea Aerospace Research Institute

Multi-satellites developed at the request of each institution have various missions according to their respective purpose. In order to operate these satellites efficiently, it can be divided into an integrated control method and an individual control method for each institution.
The advantages of integrated control is that all satellites can be integrated and operated to avoid duplication and respond systematically to space threats. The advantages of individual control is that it operates the satellite directly, so it can respond immediately and can be operated to meet the requirements of each institution.
The disadvantage of integrated control is that it is difficult to

provide customized support specilalized for each institution, and the procedure is complicated, so the response to emergency requests from the sites may be delayed. The disadvantage of individual control is that similar satellites may be developed separately, resulting in wasted budgets, and it is difficult to respond to space threats.
In this paper, we will present an opinion to solve problems such as securing expertise and wasting resources by comparing the advantanges and disadvantages of integration and individual control as a method for operating satellites developed according to the needs of each institution.

[P-114] Development of an Integrated Image Collection Planning Function for LEO Optical Payloads

Jung-Nam Jun, Eun-Suk Lim, Min-A Kim
Korea Aerospace Research Institute

The integration of image collection planning system is currently underway to enable the sustainable operation of multiple and constellation satellites. The system is designed for low Earth orbit satellites that are either currently in operation or scheduled for launch. The functions were organized into modules by analyzing and identifying those common to all satellites and those specific to individual satellites.
This paper introduces the development of the imaging planning system for the optical satellites KOMPSAT-3, KOMPSAT-3A, and CAS500-1. In particular, satellite-specific module functions have been described in detail.

[P-115] Comparative Analysis of FDIR in Geostationary Satellites

Taehyun Kim[1], Chang-Kwon Cho[2], Sujeong Kim[1]
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Geostationary satellites carry out missions such as meteorological observation, communications, and Earth monitoring, which require stable long-term operations. Therefore, when failures occur, on-board Fault Detection, Isolation, and Recovery (FDIR) functions are essential to respond without ground intervention autonomously. Over the past several decades, geostationary meteorological and communication satellites have applied diverse FDIR techniques reflecting their distinct mission requirements and operational frameworks. This study compares the mission characteristics, FDIR architectures, and operational strategies of previously operated geostationary satellites. The analysis reveals differences in FDIR approaches depending on mission type and operational demands. These findings contribute to establishing mission-oriented fault management strategies for the design of next-generation satellites.

[P-116] Reliability Prediction of Satellites Considering Ground Operations and Storage

Seoyoon Lee, Guen-Young Park
Korea Aerospace Research Institute

Satellite reliability prediction typically calculates the probability of mission success over the design life in orbit. During the satellite development phase, environmental and functional testing are performed to ensure high reliability. However, Unexpected failures may occur during these tests, occasionally extending the development timeline as corrective actions are implemented. Additionally, launch delays for various reasons can result in extended storage periods for the satellite. This study aims to assess the impact of extended ground operations and storage durations on satellite mission reliability, which is essential for improving mission success rates and refining satellite design and operational strategies.

[P-117] Design and Results of the Ground Segment Integrated Test for KOMPSAT Operation

Jun-Yeong Bok, Dong Oh Kim
Korea Aerospace Research Institute

This paper presents the design and integrated testing of the ground segment developed for the operation of the Korea Multi-Purpose Satellite (KOMPSAT). KOMPSAT is a high-resolution Earth observation satellite that provides imagery with a spatial resolution of 30 cm or better. The ground segment was developed to support satellite operations, and the Korea Aerospace Research Institute (KARI) designed and implemented the mission control, data reception, and image processing systems. To ensure the stable operation of KOMPSAT, system verification was conducted on the ground prior to launch. This paper describes the verification methods and presents the results of the integrated ground segment tests.

[P-118] Study on Automated Management Methods for Requirements Discrepancies in the Aerospace Industry

Cheol-Su Shin, Dai-Ho Ko, Joong Pyo Kim
Korea Aerospace Research Institute

Aerospace products present diverse requirements including functionality, safety, reliability, environmental compliance, and EMC/ESD. An RFD (Request for Deviation) is a critical quality management procedure submitted to the customer for approval when product or component requirements are not met, thereby assuring usage permission. While development organizations manufacturing/testing products implement robust quality management through digital twins and QMS (Quality Management

System), public institutions not directly involved in manufacturing manage RFDs manually using Excel files. This leads to issues such as data duplication, manual errors, inconvenient searches, and significant management time expenditure. This study analyzes these issues and proposes the development of an RFD management program to address them. The proposed system provides an efficient and reliable RFD management environment through database-based automation, a user-approachable interface, and search optimization features.

[P-119] Measurement of Cosmic-Ray Neutron Spectrum on the Ground Using a High-Sensitive Neutron Spectrometer

Young Soo Yoon, Joong Hyun Kim, Jungho Kim, Hyeonseo Park, Sinchul Kang

Korea Research Institute of Standards and Science

We developed a hig-sensitivity ^{3}He tube-based neutron spectrometer for cosmic-ray neutron energy measurement from thermal neutrons to several hundred MeV. The presentation reports on the measured cosmic-ray neutron spectra. The spectrometer comprises nine ^{3}He tube detectors, each coupled with one of eight different-sized moderators, two of which are integrated with a copper layer to enhance neutron detection in the tens of MeV range. The spectrometer with battery power modules were install on the truck, which enable to perform measurement on any sites. We have performed measurements at seven different sites with different altitude in Korea. Using the measured count rates, neutron fluence for thermal and fast neutrons were estimated The raw count rate data will be compared across different locations.

[P-120] Towards Realistic Lunar Rover Exploration: An Integrated Rover-Simulator Framework

Sumin Lee, Minseok Song, Suwan Lee, Seokju Lee

Korea Institute of Energy Technology

We present an integrated rover–simulator framework to support realistic lunar exploration. A rocker-suspension four-wheel drive rover is designed and fabricated, reflecting the characteristics of existing planetary rover platforms for efficient mobility. Concurrently, the physical rover is integrated with the Isaac Sim simulation environment, enabling synchronization of key parameters such as motor angular velocities and joint angles. Future work will involve incorporating a high-resolution digital elevation model to facilitate enhanced precision in experimental validation. The proposed framework is designed to provide a robust testbed for verifying mission scenarios and evaluating the performance of lunar rovers.

[P-121] Emerging Power and Electrical System Technologies for Lunar Exploration Rovers and Landers

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This paper reviews emerging power and electrical system technologies for lunar rovers and landers. It highlights key trends in energy generation, storage, and power management under the Moon's extreme environment. Current lunar missions are compared, focusing on solar arrays, batteries, and advanced electrical and electronic subsystems. Challenges such as long lunar nights and dust mitigation are discussed. This study provides insights into current technology trends and explores future directions for sustainable lunar exploration.

[P-122] Lunar Science Exploration Mission Concept for Lunar Landers

Chae Kyung Sim[1,2], Sunjin Kim[3], Sunghwan Kim[4], Woojin Kim[1,2], Uk-Won Nam[1], Dongseok Ryu[2,3], Sung-Joon Park[1], Jaeheung Park[1,2], Nikolay Vedenkin[5], Seul-Min Baek[1], Bongkon Moon[1,2], Woohyeong Seol[1], Sung-Joon Ye[6], Seungkyun Ryu[7], Sukwon Youn[6], Dae-Young Lee[8], Dae-Hee Lee[1,2], Eunji Yi[1,2], Janggeun Lee[2,9], Jaeho Lee[10], Hyung-Kwon Lee[11], Minsup Jeong[1], Taeil Chung[9], Namsuk Cho[10], Young-Jun Choi[1], Jeong-Yeol Han[1,2], Jintae Hong[3]

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[5]*Kairospace*
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[9]*Korea Institute of Civil Engineering And Building Technology (Kict)*
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[11]*Leospace*

The lunar lander mission is an important opportunity for Korea to carry out direct scientific exploration on the Moon. This study sets the scientific goals and proposes a mission concept, based on the Conceptual Design Study of Payloads for Lunar Surface Missions from Oct. 2024 to Jul. 2025, granted by Korea AeroSpace Agency (KASA). Candidate landing sites are pyroclastic deposits, pit craters, and lava tubes, with the purpose of understanding their formation and evolution.

Several instruments are considered: Comprehensive LUnar Space Environment sensoR (CLUSER), Advance Particle Dosimeter and Neutron Spectrometer (APDNS) and Korea Active Dosimeter (KAD), Lunar Surface Infrared Spectrometer (LSIS), Electron gun Experiment packaGe (E2G), polarimetric stereo camera (Lunar Vision), and Deep Abyss Lunar cAve multiband camEra (DALAE). We also include the operation concept of a four-wheeled rover and a small two-wheeled rover. In addition, testing in lunar analogue environments and possible use of nuclear power for long-term mission extension are studied.
This presentation introduces these concepts and gives direction for future lunar lander science exploration in Korea.

[P-123] Concept Design of Lunar Surface Infrared Spectrometer (LSIS) for Lunar Landers

Chae Kyung Sim[1,2], Sung-Joon Park[1], Woojin Kim[1,2], Dae-Hee Lee[1,2], Bongkon Moon[1,2], Minsup Jeong[1], Young-Jun Choi[1], Dukhang Lee[1,2]

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[2]*University of Science and Technology*

The Lunar Surface Infrared Spectrometer (LSIS) is proposed as a payload for Korea's lunar surface mission in the early 2030s. LSIS will conduct near- and mid-infrared spectroscopy (2–4 μm) to examine water and hydroxyl, key volatiles for understanding hydration processes and validating models of lunar water dynamics. The absorption feature near 3 μm enables clear distinction between ice and hydroxyl, supporting in-situ resource utilization (ISRU) for future explorations and base developments. In the conceptual optical design study, various types of spectrographs were evaluated, and the liquid crystal tunable filter (LCTF) is being considered as a dispersive element for its compactness, low power consumption, suitability for domestic introduction and possible joint development. Structural robustness has also been assessed using finite element method (FEM) simulations, confirming survivability under launch, landing, and thermal environment conditions. LSIS is designed as a versatile and reliable spectroscopic instrument that can be deployed on various lunar landers or rover platforms.

[P-124] Multi-Criteria Evaluation of Lunar Pit Craters as Landing Site for Future Missions

Eunji Yi[1,2], Chae Kyung Sim[1,2], Minsup Jeong[1]

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Landing site selection is a critical factor that determines both the success and the scientific value of lunar missions. Recent surveys of domestic researchers indicated a preference for pit craters as potential landing sites. In this study, 278 pit craters identified to date were assessed using multi-criteria methods. The evaluation metrics were derived from 21st-century lunar landing missions and included terrain type, slope, latitude, longitude, pit morphology, and wall orientation. Through a two-stage analysis, North Procellarum 1 pit was identified as the best landing site, while Lacus Mortis pit and Sinus Iridum pit were selected as backup candidates. North Procellarum 1 pit lies within the Procellarum KREEP Terrane and provides an opportunity to investigate volcanic stratigraphy and the magmatic evolution of Oceanus Procellarum. This study presents a systematic assessment of pit craters as landing sites and provides reference data to support future mission planning.

[P-125] Predicting Electron Cutoff Energies for LUSEM Pre-Landing Observations at Reiner Gamma Using Geant4 Simulation

Sung-Jin Kim, Jongho Seon, Ensang Lee, Go Woon Na, Dongseok Yun, Hyeonhu Park, Beom-Su An

Kyung Hee University

Reiner Gamma, located in Oceanus Procellarum on the lunar nearside, represents a canonical lunar swirl characterized by strong localized magnetic anomalies and high-albedo curvilinear patterns. As part of NASA's Commercial Lunar Payload Services (CLPS) program, the Lunar Space Environment Monitor (LUSEM) is confirmed to be aboard Intuitive Machines' Nova-C lander for a targeted landing in this region. The LUSEM measures fluxes of high-energy electrons and positive ions to provide critical physical constraints on the origin of lunar swirls and their space weathering processes. This instrument will operate from prior to touchdown through the landing sequence, enabling particle observations throughout the descent. In this study, we used the Geometry and Tracking (Geant4) simulation to investigate electron access to the lunar surface along LUSEM's landing trajectory. The magnetic field environment around Reiner Gamma was represented using two approaches: a simplified two-dipole model and a surface vector mapping (SVM) spherical harmonic model derived from Lunar Prospector and Kaguya magnetometer data. Using these models, we predicted the electron cutoff energies observable by LUSEM during the descent of Nova-C. Although this study is still in an early stage, the results offer valuable guidance for interpreting LUSEM's pre-landing data and for improving predictions of the lunar particle environment. They are also expected to advance our understanding of how magnetic anomalies influence surface processes on the Moon.

[P-126] SurfCam Data Processing: Initial Tests with the Engineering Qualification Model

Mingyeong Lee[1], Minsup Jeong[1], Woojin Kim[1,2],

Yunjong Kim[1,2], Bongkon Moon[1,2], Jihun Kim[1,2], Sung-Joon Park[1], Seonghwan Choi[1], Dae-Hee Lee[1,2], Dukhang Lee[1,2], Chae Kyung Sim[1,2], Seul-Min Baek[1], Jehyuck Shin[1], Sungsoo S. Kim[3], Young-Jun Choi[1]

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[3]*Kyung Hee University*

As part of the Commercial Lunar Payload Services (CLPS) initiative, GrainCams is one of the candidate instrument designed to observe levitated lunar dust (LevCam) and the microstructure of the upper lunar regolith (SurfCam). Specifically, SurfCam is a microscopic light field camera, which records information about a scene's light rays pixel by pixel using a microlens array (MLA) positioned at the focal plane of the main optics. To achieve the requirement for its space mission, SurfCam requires a data processing algorithm optimized for its specific optical characteristics.

In this study, we analyzed actual images acquired from the SurfCam engineering qualification model (EQM) to verify image characteristics and the data processing performance. While previous tests relied on simulator-generated imagery, this study uses images acquired with the actual SurfCam for the first time. In this presentation, we introduce the process of generating a disparity map from the SurfCam EQM test images. Based on these results, we also propose future work.

[P-127] Operational Overview of K-RadCube in the Launch and Early Orbit Phase (LEOP)

Donguk Song[1], Chae Kyung Sim[1,2], Dukhang Lee[1,2], Jehyuck Shin[1], Young-Jun Choi[1], Seul-Min Back[1], Uk-Won Nam[1], Woo-Hyeong Seol[1], Won-kee Park[1], Kwangwon Lee[3], Hyojeong Lee[3], Seongwhan Lee[3], Taewan Kim[4], Hyeonggu Kim[4]

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K-RadCube is a CubeSat scheduled for launch as a secondary payload on NASA's Artemis II mission. Its main goal is to measure the space radiation environment and evaluate its biological effects across different altitudes of the Van Allen belts around Earth. Notably, the K-RadCube mission is Korea's first attempt to operate a CubeSat in High Earth Orbit, making it a highly challenging mission with technical and operational hurdles, as it must secure communications and perform thrust control within a limited time immediately after deployment. Consequently, thorough preparation for Launch and Early Orbit Phase (LEOP), including detailed scenarios and contingency plans, is crucial to ensure mission success and enhance K-RadCube operation capabilities. In this talk, we present an operational overview of the LEOP scenarios and contingency plans prepared to date for the K-RadCube mission.

[P-128] Assembly and Performance Verification of the GrainCams Optical System

Woojin Kim[1,2], Bongkon Moon[1,2], Dukhang Lee[1,2], Dae-Hee Lee[1,2], Minsup Jeong[1], Jihun Kim[1,2], Sung-Joon Park[1], Yunjong Kim[1,2], Seonghwan Choi[1], Jehyuck Shin[1], Seul-Min Baek[1], Mingyeong Lee[1], Chae Kyung Sim[1,2], Young-Jun Choi[1]

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GrainCams is under development as a candidate payload for NASA's Commercial Lunar Payload Services (CLPS) initiative and is currently in the Flight Model (FM) development phase, led by the Korea Astronomy and Space Science Institute (KASI). GrainCams incorporates two imaging cameras: SurfCam and LevCam. SurfCam is designed to capture high-resolution images of micro-scale surface features, including so-called "fairy castle" structures of the lunar regolith. In contrast, LevCam is intended to monitor lofted or levitating dust particles above the lunar surface.

Ensuring reliable optical performance is critical for the success of the GrainCams mission. To achieve the required performance, careful optical assembly with strict adherence to alignment tolerances is essential. In this study, we present the assembly process of the SurfCam Flight Model (FM) optical system and report the results of alignment measurements obtained using a depth gauge. The measured assembly data are compared with the design specifications of the SurfCam flexure to verify its mechanical stability. Furthermore, we evaluate the optical performance of GrainCams through modulation transfer function (MTF) analysis and wavefront error.

[P-129] Development of a Portable Long-Slit Spectroscopic System for Faint Astronomical Sources

Dohee Kim[1], Yeojin You[1], Chanmin Park[1], Dayoung Byun[1], Heesu Yang[2]

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[2]*Korea Astronomy and Space Science Institute*

We developed a low-dispersion long-slit spectrograph optimized for faint-object spectroscopy. The system adopted a 180 mm aperture telescope, an F/2.5 optical design, and a 300 groove/mm diffraction grating. In addition, an auxiliary optical system with a reflective slit was implemented, enabling simultaneous targeting and guiding.

To verify its performance, we carried out test observations of

the Wolf-Rayet star WR 136, the results of which are presented in this presentation. Future observations of the microquasar SS 433 are planned using this spectrograph, and expected observational outcomes and analysis goals are also discussed. We expect this to become a versatile tool for future studies of unpredictable astrophysical phenomena.

[P-130] Development of a Viewer Program for Imaging Spectrograph Data

Taejun Kim[1], Heesu Yang[2]

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We develop a lightweight, browser-based viewer program for 3D (x, y, λ) FITS data obtained with the full-disk solar imaging-spectroscopic telescope, CHALLAN. Since the size of each data file is several gigabytes, the data are divided into multiple subsets on the server, and only the part of the data are transferred according to user requests. When a user selects a specific pixel from the full-disk image on the client side, the app interactively extracts the pixel information and requests the corresponding subset from the server. After downloading, the client app displays a wavelength–slit (λ–y) plot. If the user then selects a specific pixel in the λ–y plot, the app displays the corresponding spectrum in a subpanel (λ–intensity plot). This app is also applicable to other types of 3D data cubes and can be used both for educational purposes and as a quick-look for the research.

[P-131] Development of a Portable Single-Slit Spectrometer

Yoo-Chan Baek[1,2], Heesu Yang[1]

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[2]*Ajou University*

We design and build a portable single-slit spectrometer for the educational purpose. The observing wavelength can be optimized by rotating a manual stage outside the box. To reduce the size of the spectrometer, the beam is folded using serveral mirrors inside the instrument. In this presentation, we introduce the current design of the spectrometer.

[P-132] High-Time-Resolution Solar Spectroscopy Targeting the Na D and Hα Lines

Hyunsoo Lee, Sanghoon Lee, Jieun Choi, Shinhoe Heo

Department of Astronomy and Space Science, Chungnam National University

We are developing a custom-built solar spectrometer to investigate the fast-varying solar spectra at the Na D (~589 nm) and H alpha (656.3 nm) lines. The spectrometer is designed to cover the 5,500~6,700 Å range. The automated observation software allows us to obtain continuous solar spectra during daytime, with an exposure time of 0.04 ms. We plan to conduct observations in the upcoming fall semester. If successful, the resulting high time-resolution spectra may provide new insights into the processes of magnetic reconnection, particle acceleration in the solar corona, and their chromospheric response.

[P-133] Height-Dependent Velocity Distribution in Ellerman Bombs

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Ellerman bombs (EBs) are transient brightenings in the solar lower atmosphere, characterized by their elongated structures. This study investigates the height-dependent velocity distribution of EBs using high-resolution spectroscopic data from the Fast Imaging Solar Spectrograph (FISS). By applying the lambda-sector method to the FISS spectra, we derived line-of-sight Doppler velocities at various heights within the EBs. Our results reveal that the upper regions of the EBs exhibit significantly higher velocities than the lower regions. We interpret this velocity gradient as evidence of magnetic reconnection at the base of the EB, which drives subsequent plasma acceleration.

[P-134] Temporal Evolution of Flare Ribbon Fine Structures Using Imaging/Spectroscopic Observation

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Flare ribbons are the chromospheric footprints of solar flares driven by magnetic reconnection in the corona. The fine structures of the flare ribbon could provide indirect information about the newly reconnected magnetic field lines. This study analyzes the temporal variation of flare ribbon fine structures and their properties using observation data from August 5, 2024. The spectroscopic data in the Hα and CaII lines were obtained by the Fast Imaging Solar Spectrograph(FISS) at Big

Bear Solar Observatory, and the imaging data from the Interface Region Imaging Spectrograph (IRIS) Å Slit-Jaw Imager and the Atmospheric Imaging Assembly telescope suite on the Solar Dynamics Observatory (SDO). We identified several blob structures that are commonly known as flare kernels. We compare their spectra by selecting one pixel from each kernel. We find a difference in their intensity, but red asymmetry is common for all kernels.

[P-135] Spectroscopic Observations of Solar Filaments with a Custom-Built Spectrograph

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Solar filaments appear most prominently as long, dark features in the Hα images. These structures typically persist from several hours to a few days and occasionally lead to filament eruptions. We conducted spectroscopic observations of solar filaments using a custom-built spectrograph designed for observing solar spectrum in the Hα (6563 Å) band. To achieve a high-spectral resolution (R = 9500), we employ a 2,400 gr/mm diffraction grating with 150 mm focal-length imaging and collimating lenses. We successfully observed solar filaments on September 11, 2025, and extracted their spectra. In this presentation, we present the observational results and discuss their implications.

[P-136] Determining the Minimum Spectral Resolution to Reduce Physical Information Loss in Filter-Based Imaging Spectroscopy through Statistical Error Analysis

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Filter-based imaging spectroscopy is widely used for studying dynamic phenomena in the solar atmosphere, but higher spectral resolution inevitably increases the burden of data storage and processing. Therefore, it is necessary to optimize the spectral resolution to minimize data load while retaining meaningful physical information. In this study, we utilized Hα spectral data obtained with the Fast Imaging Solar Spectrograph (FISS) at Big Bear Solar Observatory to investigate how Doppler velocities measured in a filament region vary with different spectral samplings, and quantitatively analyzed the associated errors. We applied Gaussian-shaped synthetic filter response functions to the FISS spectra to generate artificial filter-based datasets with reduced spectral samplings (0.2, 0.25, 0.3, 0.4, 0.5, and 0.53A). Doppler velocity maps were then derived from both the original FISS spectra and the synthetic filter-based datasets using the bisector method. By comparing the velocities from the filter-based datasets with those from the original spectra, we examined how the velocity errors evolved as a function of spectral sampling. Our analysis shows that when the sampling is 0.4A or narrower, the mean error in derived velocities remains within ∼13%, whereas increasing the sampling to 0.5A or broader leads to a sharp rise in errors exceeding ∼18%. These results suggest that filter-based solar spectral observations with a sampling narrower than 0.4A can yield Doppler velocities that agree with high-resolution data to within ∼13%. We conclude that maintaining a spectral sampling not larger than 0.53A provides a practical guideline for Doppler velocity analysis in filter-based imaging spectroscopy. This finding is expected to contribute significantly to future large-scale solar observations and numerical simulations, ensuring both observational efficiency and reliability of physical information.

[P-137] Electromagnetic Compatibility and Electrostatic Discharge Evaluation for Satellite Systems: Requirements, Testing, and Design Strategies

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Electromagnetic compatibility (EMC) and electrostatic discharge (ESD) robustness are fundamental to ensuring the reliability and long-term success of satellite missions. In space, satellites are constantly exposed to harsh electromagnetic environments and charging phenomena that can lead to unexpected anomalies or mission failure if not properly managed. This poster presents the requirements, relevant international standards (MIL-STD-461, ECSS, IEC 61000-4-2), and systematic testing methodologies that are applied to satellite payloads and subsystems to mitigate these risks. The EMC evaluation encompasses both emissions and susceptibility, addressing interactions not only with the external space environment but also with the spacecraft's internal systems. The ESD evaluation highlights the unique charging and discharge phenomena experienced in orbit, and demonstrates how qualification approaches are adapted to both the component and system levels to ensure robustness.

[P-138] The Conceptual Design of the Payload Interface Unit for Navigation Satellite

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The Payload Interface Unit (PIU) in satellite systems serves as a critical intermediary between the spacecraft bus and the hosted payloads, providing an interface for the transmission of telecommands (TC) from ground control and the acquisition of telemetry (TM) data from the payload subsystems. For navigation satellites, the PIU is specifically engineered to ensure seamless communication and data handling between the bus system and the navigation payloads, thereby supporting mission-critical functions. In addition to these core communication tasks, the navigation PIU incorporates advanced functionalities such as Fault Detection, Isolation, and Recovery (FDIR) to guarantee high operational availability, as well as thermal management mechanisms to stabilize and protect temperature-sensitive units. We present the conceptual design of the Payload Interface Unit for navigation satellite.

한국우주과학회 제43차 정기총회

일 시 : 2025년 10월 30일(목) 16:40

장 소 : 제주 신화월드

1. 정족수 확인 ····· 총무이사 정종균
2. 개회선언 ····· 회장 박종욱
3. 전회의록 낭독 ····· 총무이사 정종균
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8. 다양성위원회 보고 ····· 위원장 임조령
9. 감사보고 ····· 감사 최기혁
10. 안건 1. 2025년 결산(안) 심의 ····· 재무이사 이주희
11. 안건 2. 2026년도 예산(안) 심의 ····· 재무이사 이주희
12. 안건 3. 제22대 회장선출 건 ····· 회장 박종욱
13. 안건 4. 감사선출 건 ····· 회장 박종욱
14. 안건 5. 부회장, 이사 선출 건 ····· 회장 박종욱
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