The Decadal Survey for Korean Astronomy : 2026~2035



Myungshin Im (Seoul National University)
on behalf of
The Long-term Strategic Planning Committee of The Korean Astronomical Society
(長期發展研究委員會)

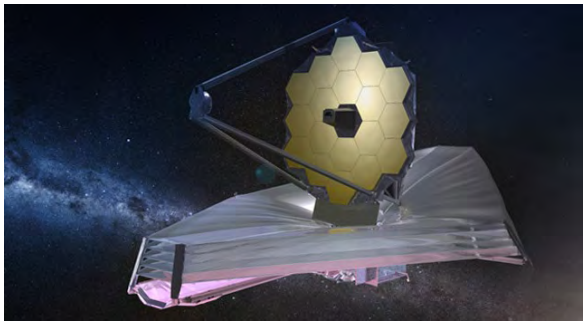
(2025/12/9, EAMA11@Niigata, Japan)

Need for Long-Term Plan

- Astronomy Nobel Prizes
  - 2015
    - Solar Neutrio
  - 2017
    - First Detection of Cosmic GW from Binary Black Hole Merger
  - 2019
    - Cosmology Theory
    - Descovery of Sun-like Exoplanet
  - 2020년
    - Supermassive Black Holes at the Center of Our Galaxy



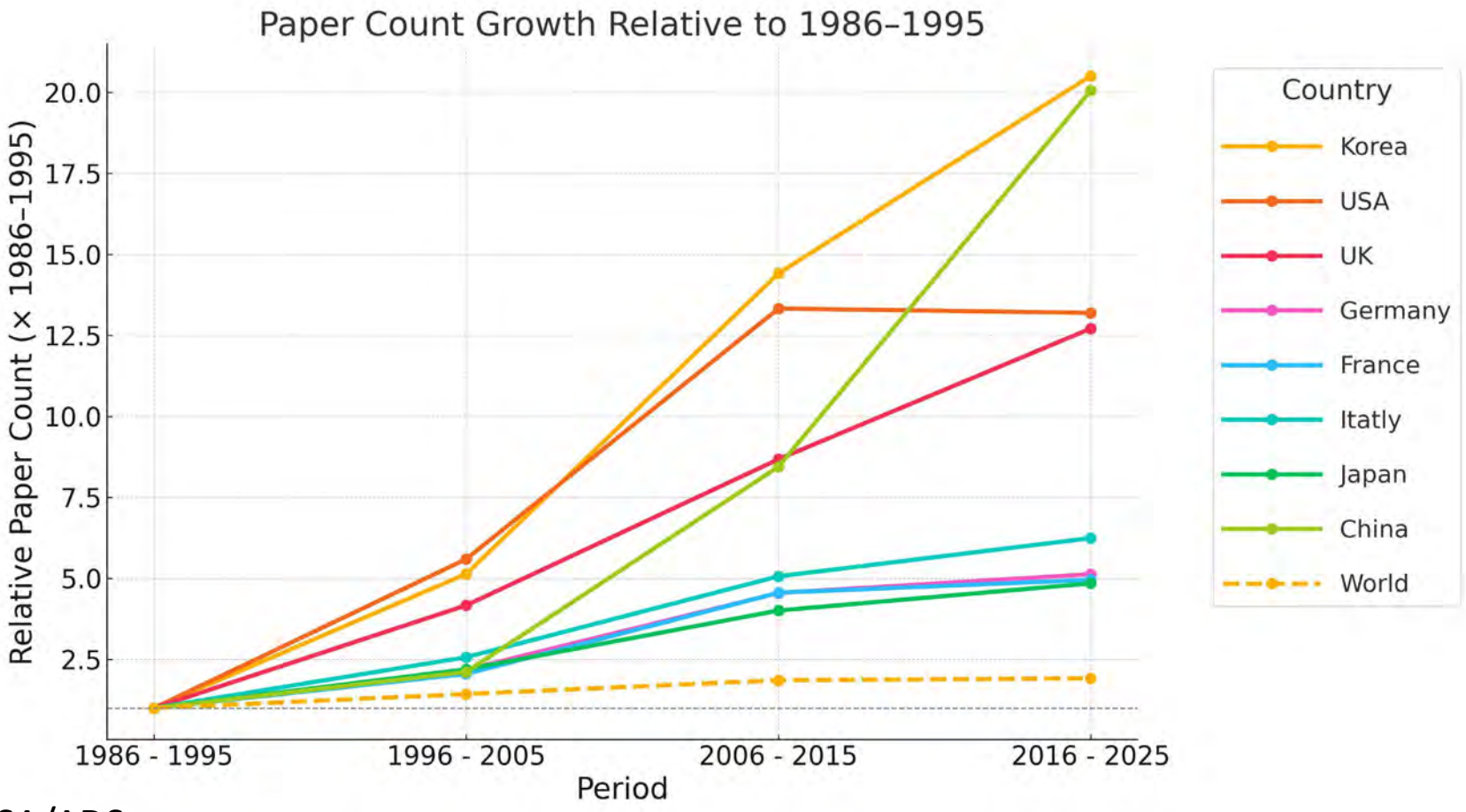
- Large-scale faciltities and Creative Projects are key for these successes
  - 8-10m Ground-based Telescopes
    - Gemini, Subaru, Keck, VLT, etc
  - Multiple Radio Telescope Array
    - ALMA, EHT, etc
  - Space Telescopes
    - HST, Gaia, Kepler, TESS, JWST, etc
  - Multimessenger Facilities
    - LIGO, VIRGO, KAGRA, IceCube, etc



JWST
(NASA)

Korean Astronomy Growth vs World

Steady increase in publication



NASA/ADS

Korean Astronomy Development ~ Major Facilities

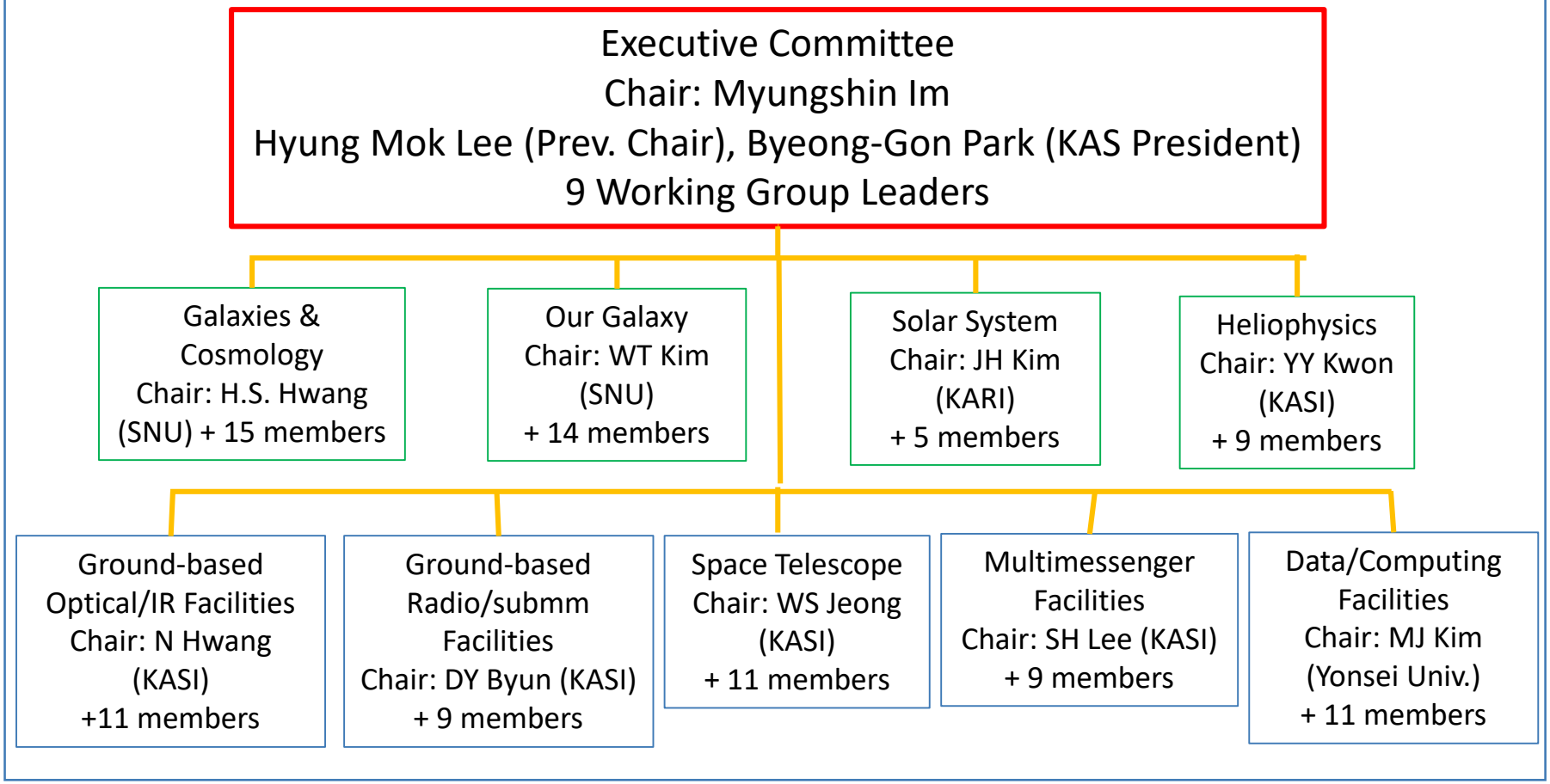
We need to prepare for next leap



Long-term Strategic Planning Committee of KAS (長期發展研究委員會)

About 80 members from various organizations

- Executive Committee + 9 Working Groups



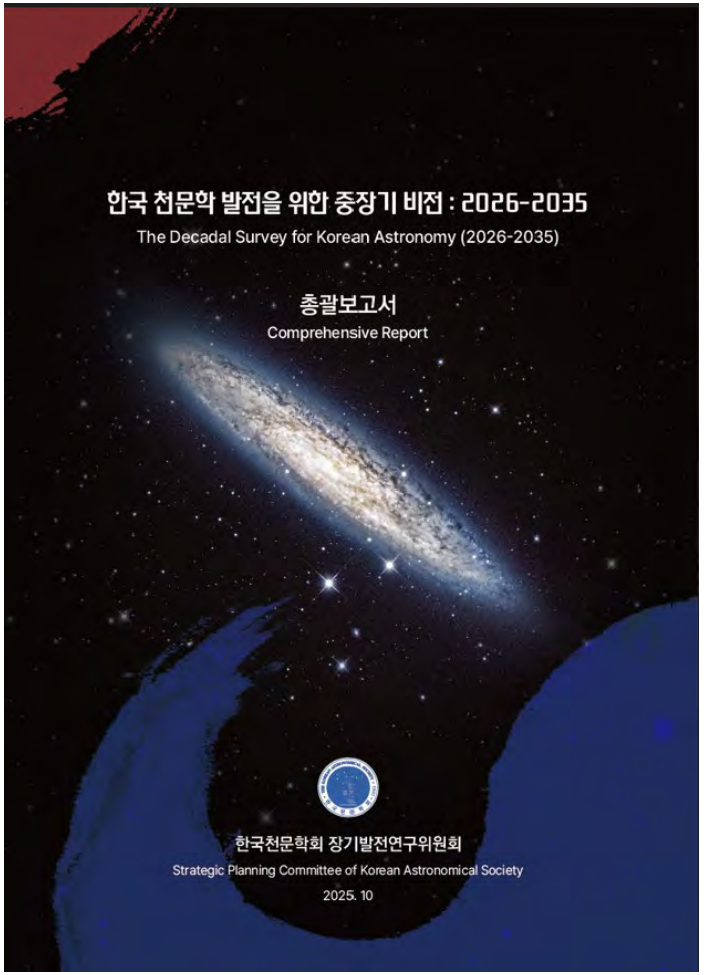
The Decadal Survey for Korean Astronomy (2026–2035)

One Comprehensive Report + 9 Working Group Reports

- KAS Decadal Surveys
  - 1993 Report
  - 2013 Report (Updated on 2017)
- – 2024: Launch of Korea Aerospace Adminstration (KASA, 宇宙航空廳)

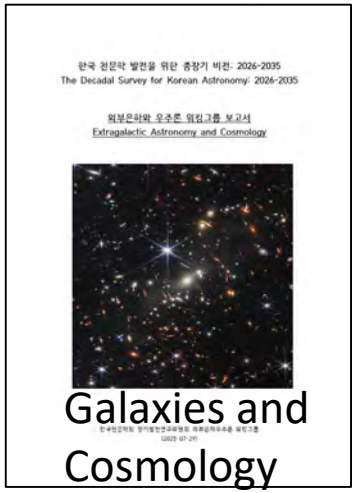
- Third Decadal Survey has been initiated by KAS
- 2024.10 – 2025.09

- Supported by KASA
- Identify important future facilities and activities for recommendation to government agencies [KASA, KASI, National Research Foundation (NRF)]



9 Working Group Reports

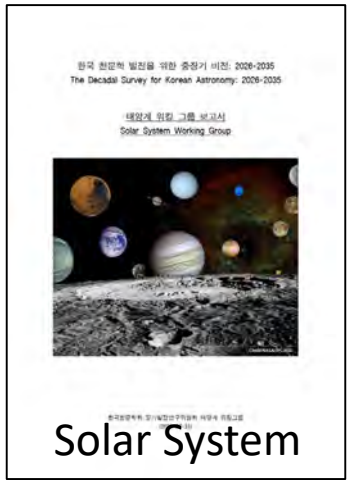
4 Science + 5 Facility Reports



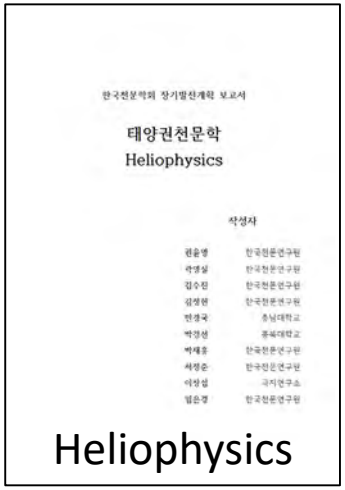
Galaxies and Cosmology



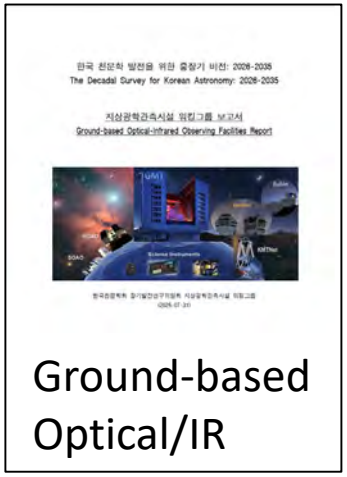
Our Galaxy



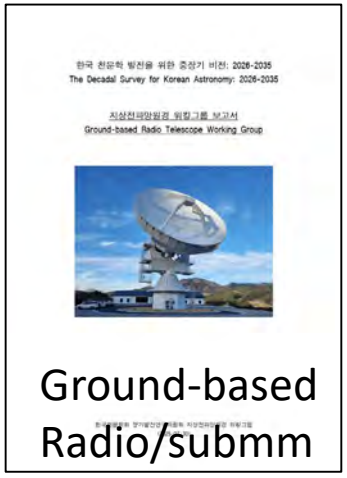
Solar System



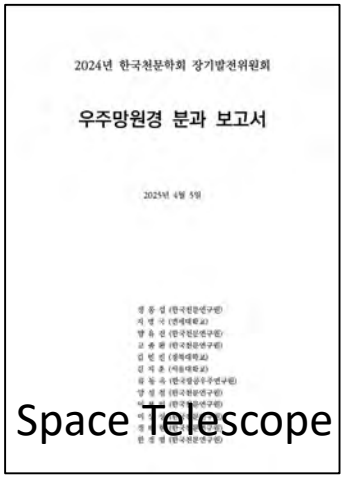
Heliophysics



Ground-based Optical/IR



Ground-based Radio/submm



Space Telescope



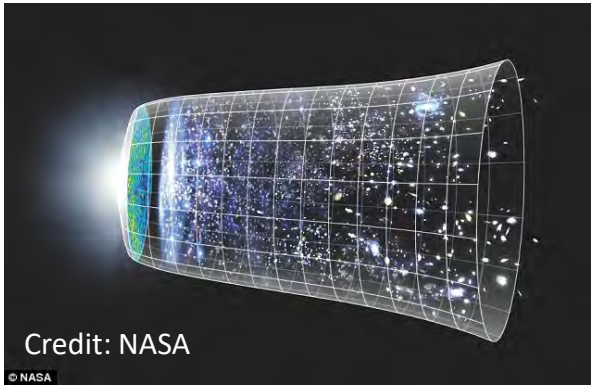
Multimessenger Facilities



Data/HPC

Key Scientific Topics for Korean Astronomy

- Two key projects

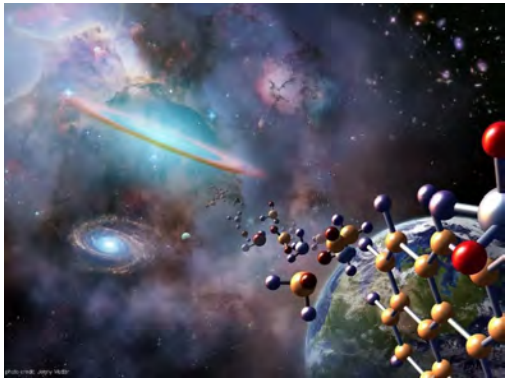


▶ First Topic : Understanding History of Universe

- What the universe is made of
- What the past of the universe like
- What kind of objects are in the universe
- Can Physics explain all of the above

▶ Second Topic : Origin of Human Beings from Cosmic Perspective

- How stars and planets formed
- How the elements of life produced
- What makes the solar system sustain the life on Earth
- Are there places like Earth in the Universe?



Facilities & Activities

23 facilities & activities are identified

Time Scale	Category	Name	'26	'27	'28	'29	'30	'31	'32	'33	'34	'35	'36~	'40~
Sustain	International Collaboration	8m-class optical telescope	Operation										TBD	
		Rubin/LSST	Operation										Archive Usage	
		ALMA	Operation & Upgrade										TBD	
		1.6m GST	Operation & Upgrade										TBD	
		SPHEREx	Operation		Extended mission & Archive Usage					Archive Usage				
	Korea-led	KMTNet	Operation & Upgrade										TBD	
		KVN	Operation & Upgrade										TBD	
Near Future	International Collaboration	GMT	Construction										Operation	
		SKA	Construction		Extended Construction and Operation									
		Next gen. GW Observatory	Construction										Operation	
Future	International Collaboration	ngVLA	Expected Commissioning Time : 2030 – 2040											
		ATEHNA												
	Korea-led	All-sky Tel. Network												
		Space Telescope												
		Large Spectroscopic Survey Tel.												
		Superconducting Tensor GW detector												
		Korea Neutrino Obs.												
		MMA Network												
		L4 Solar Mission												
		Solar and Solar system missions												
Continuing Investment	Korea-led	Data Storage / HPC Facility	Construction & Utilization / Continued Expansion											
		Instrumentation	Continued Development and Utilization											
		Creative observation projects	Continued Supports and Investment											

Prioritzation (Importance Rank, 重要度)

Facilities & activities are grouped into 4 categories

Priority or importance	Criteria
P1 (Top Priority)	World-leading science and technology development. Commmunity wide-support and transformative outcome
P2 (Very High Priority)	As important as P1 in terms of science and technology development, but impact on community is limited compared to P1, requiring long-term activities
P3 (High Priority)	Important scientifically and techinically, and it could become P1 facility in the long run. Or Scientifically very important, but limited impact on technology developement with respect to P1 and P2
O (Others)	Facilities and activitities not easy to group into P1, P2, P3, or main purpose is not astronomy. Howeve, they can be as important as P1, P2, P3 (P1, P2, P3 ranks are given)

P1 (Top Priority) Facilities

Ongoing Projects

- Giant Magellan Telescope: Necessary project to provide light-collecting power and resolution to probe exoplanets and stellar/insterstellar chemistriy as well as galaxies far away. Stable funding to finish construction and operation

- SKA: High Sensitivity & High Speed Radio Interferometer at Low Frequency. Many transformative scientific results are expected from study of early re-ionization of the Universe, multi-messenger astronomy, to name a few, Korea has started participating in the project from 2025



GMT



SKA

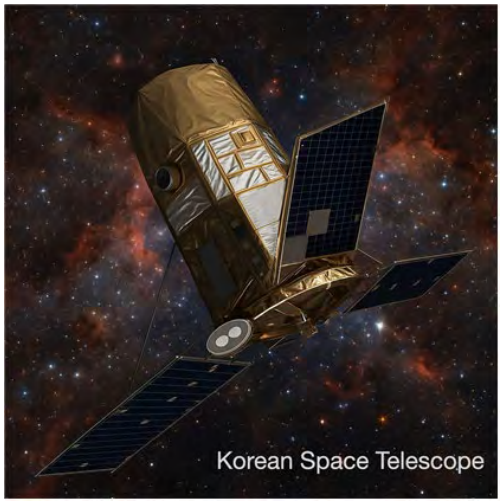
P1 (Top Priority) Facilities

New Initisatives 1

- Korea Large Spectroscopic Telescope (KLST): Twin 6.5m telescopes for spectroscopic survey to 22 mag (2.5 deg^2, 10,000 fibers). Constraints on cosmological parameters (especially, dark energy) from large scale structure of the Universe out to z ~ 1
- Korea Space Telescope (KST): Mid-sized (1 to 1.5 m diameter) wide-field space telescope (wavelength range of 0.4 to 1.6 micron, 0.25 deg^2). Spectral mapping capability similar to SPHEREx. Galaxy Evolution and Cosmology & Time-Domain Astronomy [SPHEREx & PRIMA as development projects]



KLST

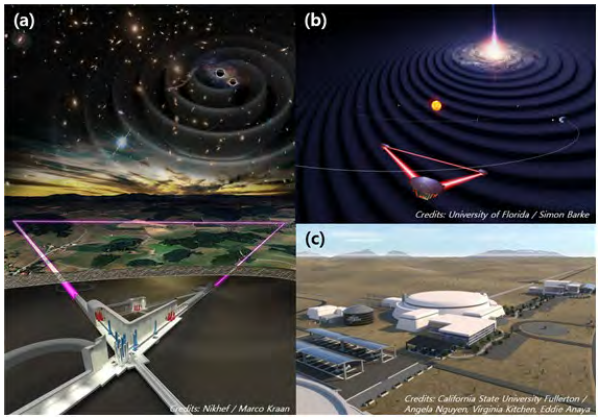


KST

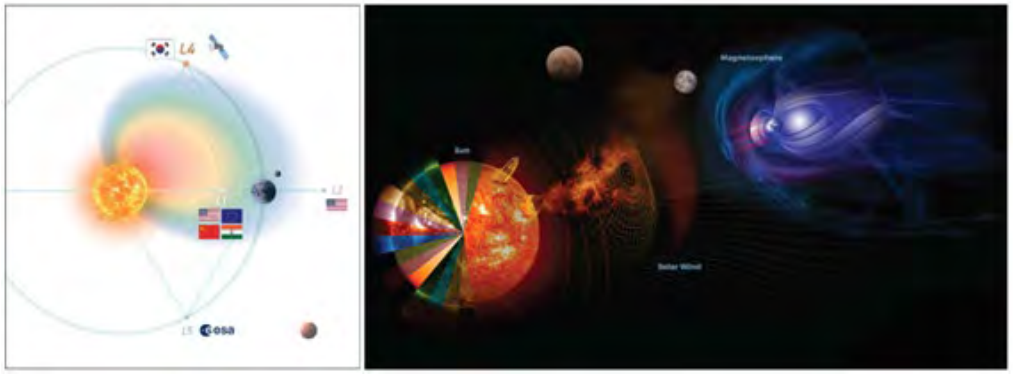
P1 (Top Priority) Facilities

New Initiatives 2

- Next Generation GW Observatories: International Collaboration Project with next generation GW detectors such as Einstein Telescope, Cosmic Explorer, and LISA. It will probe the end product of stellar evolution and test GR, as well as provide cosmological parameter measurements
- L4 Mission: Heliospheric mission to place a probe at L4 for improving the physical models of solar activities and space weather prediction.
- Data Archive and Computing Faclilities: Data archive for big data from next generation observatories and high performance computing system to interpret the astrophysical data through simulation works.



Next Gen. GW Observatories



L4 Heliospheric Mission

P2 (Very High Priority) Facilities

New Initiatives

- All-Sky Survey System: Upgrade of optical telescopes through remote/robotic operation + new instruments and telescope (3.5-m). Nurture of manpower in observations and instrumentation, and impact science in time-domain astronomy
- ngVLA: Next generation radio telescope at mid-frequency between ALMA and SKA. Synery with KVN is expected. Long-term project
- Small space telescopes: Small space telescopes for unique specific mission that can be used as technology development. Many candidate mission exist such as Ices Explorer, S-KMTNet, S-Drift, Capella, and down-selection through open competition is desired
- Lunar GW Observatory: Project to develop tensor GW detector to use eventually on the moon. Impact science by opening mid-frequency range
- ATHENA: Wide-field Auroa imaging and high altitude atmosphere physics mission to improve space weather forcast.



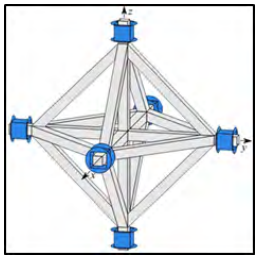
All Sky Survey System



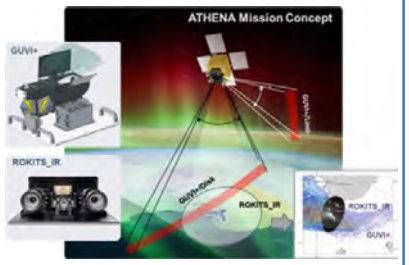
ngVLA



Small Space Telescope



SC Tensor GW detector



ATHENA

P2 (Very High Priority) Facilities

Ongoing Projects

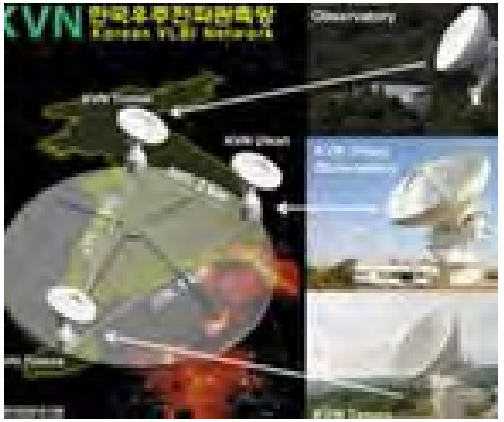
- Gemini Observatory: Will be competititve in next decade, and key play for time-domain astronomy
- KVN and ngEHT: Upgrade will place KVN as a key radio facilitiy in ngEHT
- ALMA: Continued involvement is desired to keep Korea's competitiveness in submm/mm astronomy



Gemini



ALMA



KVN

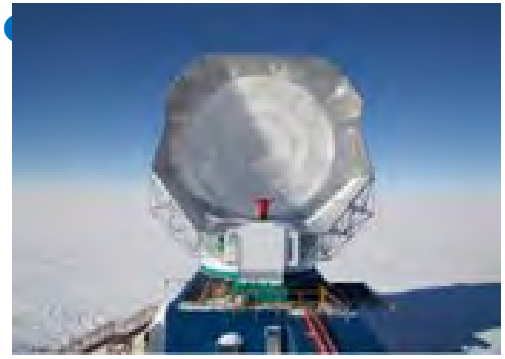
P3 (High Priority)

Future and Current Facilities

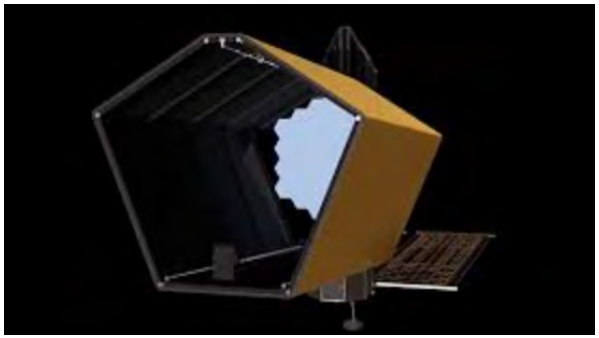
- Rubin/LSST
- Antarctica Observatory (Optical & Radio)
- 3-m or Larger Aperture Space Telescope
- Korea-led heliospheric missions



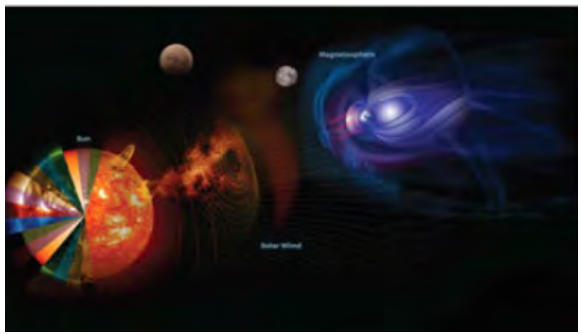
Rubin/LSST



Antarctica Obs.



Large Space Telescope



Heliospheric Missions

Other Important Activities

- Instrumenations [P2]
- Support for Moderate-Cost Createive Projects P2]
- Rollable Mirror Telescope[P3]
- Multi-Purpose Deep Space Radio Antenna {P3}
- Korea Neutrio Observatory [P3]
- Institute-University Collabotive Projects [P2]



Deep Space Radio Antenna

IGRINS (KASI)



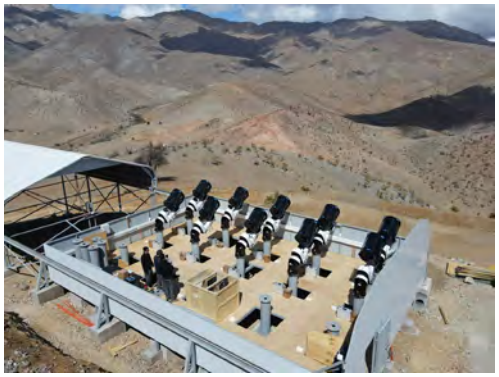
세계 정상급 대형망원경 제미니천문대, 한국산 분광기 쓴다

한국천문연구원 관측기기 개발팀

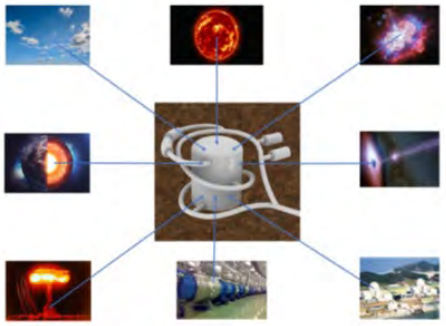
이종헌 기자

입력 2023.11.09. 10:30

미국 하와이 마우나케아에 소재한 제미니천문대의 망원경에 부착 완료한 IGRINS-2 분광기. 사진 중앙의 금색 직육면체가 분광기 본체다./한국천문연구원



7-Dimensional Telescope



Korea Neutrion Observatory

Roadmap

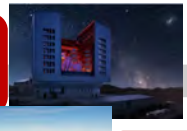
P1 + Key P2

2025 2030 2035 2040

- Ground-based Optical/Radio Telescopes
- Space Telescope
- Multimessgner Facilitiy
- Heliosphere Mission
- Other Activities

Gemini Telescopes (P2)

Giant Optical Telescope (P1)





Korean Large Spectroscopy Telescope (P1)

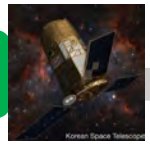
SKA (P1)

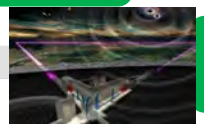


ngVLA (P2)

Small-scale Space Telescope (P2)

1m class Korean Space Telescope (P1)



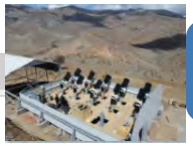


Next Generation GW Observatory (P1)

Lunar GW Observatory (P2)

ATHENA (P2)

L4 Heliosphere Mission (P1)



Data/HPC Center (P1), Instrumentation Development, Creative Projects (O, P2)



Summary

- To sustain research productivity at the forefront of astronomy, Korea needs new intitiatives of observational facilities and activities
- Decadal Survey ranked importance of facilities into P1, P2, P3, O
- GMT, SKA will be key facilities in the next decade, but new intiatives like space telescopes, large ground-based telescopes, and MMA facilities have emerged
- We hope that the report serves as important guidance for KASA, KASI, and NRF projects