China's Space Science Activities and International Cooperation

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April 1, 2025

Nssc 中国科学院国家空间科学中心
National Space Science Center, CAS

zoom


SSW 2025 - Kavli Auditorium
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01

Scientific Highlights

Major Space Programs in China

01

Space Science Satellite Mission

Led by Chinese Academy of Sciences (CAS)

02

Lunar and Deep Space Exploration

Led by China National Space Administration (CNSA)

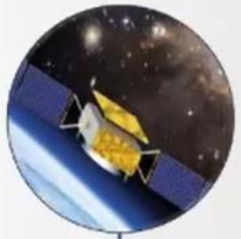
03

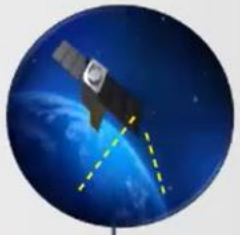
China Manned Space

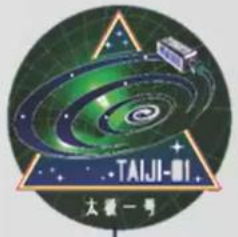
Led by China Manned Space Agency (CMSA)

Strategic Priority Program on Space Science (SPP)

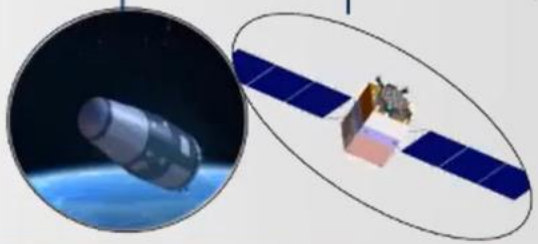
DAMPE | QUESS | Taiji-1 | GECAM | ASO-S | SMILE

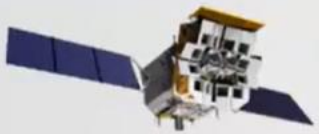






2011 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2024 | 2025



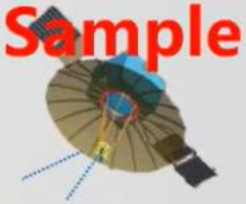


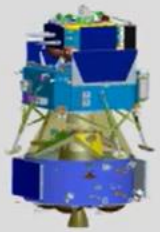
Approved | SJ-10 | HXMT | SDGSAT | EP

decommissioned | in extended operation | in operation | to be launched

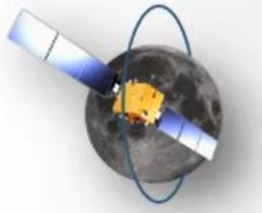
Chinese Lunar Exploration Program:

Orbiting、Landing、Sample Returning

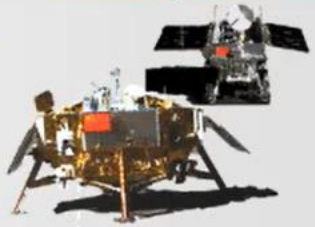




2007.10
CE-1



2010.10 CE-2

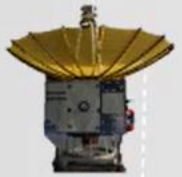


2013.12 CE-3

2018年5月
Queqiao-1

2018.12
CE-4

2020.11 CE-5

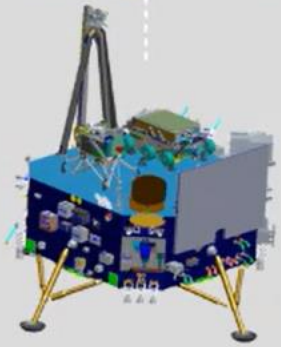


2024.3
Queqiao-2

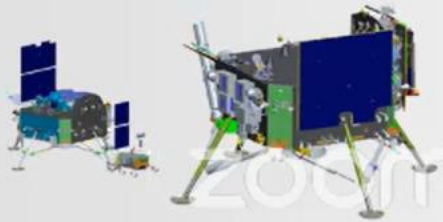
2024.5
CE-6

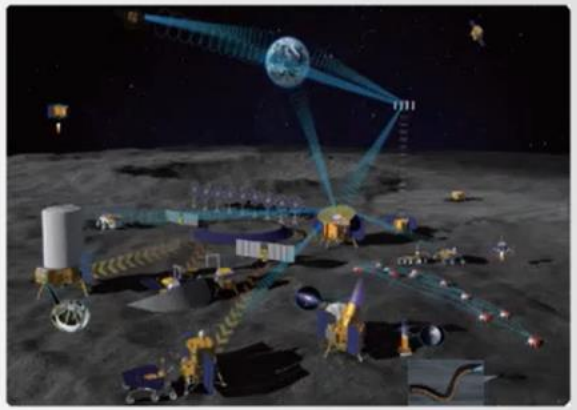
CLEP-4

2029
CE-8



2026
CE-7





Around 2035
International Lunar Research Station

Chinese Lunar Exploration Program: Chang’e - 6 missi

- Launch: May 3, 2024
- Return: June 25, 2024

- Sample collected: 1935.3 g
- Landing: Aitken Basin

The first to collect lunar samples in the South Pole - on the far side of the Moon and returned them to Earth

Isotopic Dating Reveals the Magnetic Evolution History of the Moon's Far Side

- The age of low-titanium basalt obtained in this study, combined with crater statistical analysis, fills the gap in the calibration of lunar impact history between approximately 3.2 and 2 billion years ago.
  Zhang et al., 2024, Nature

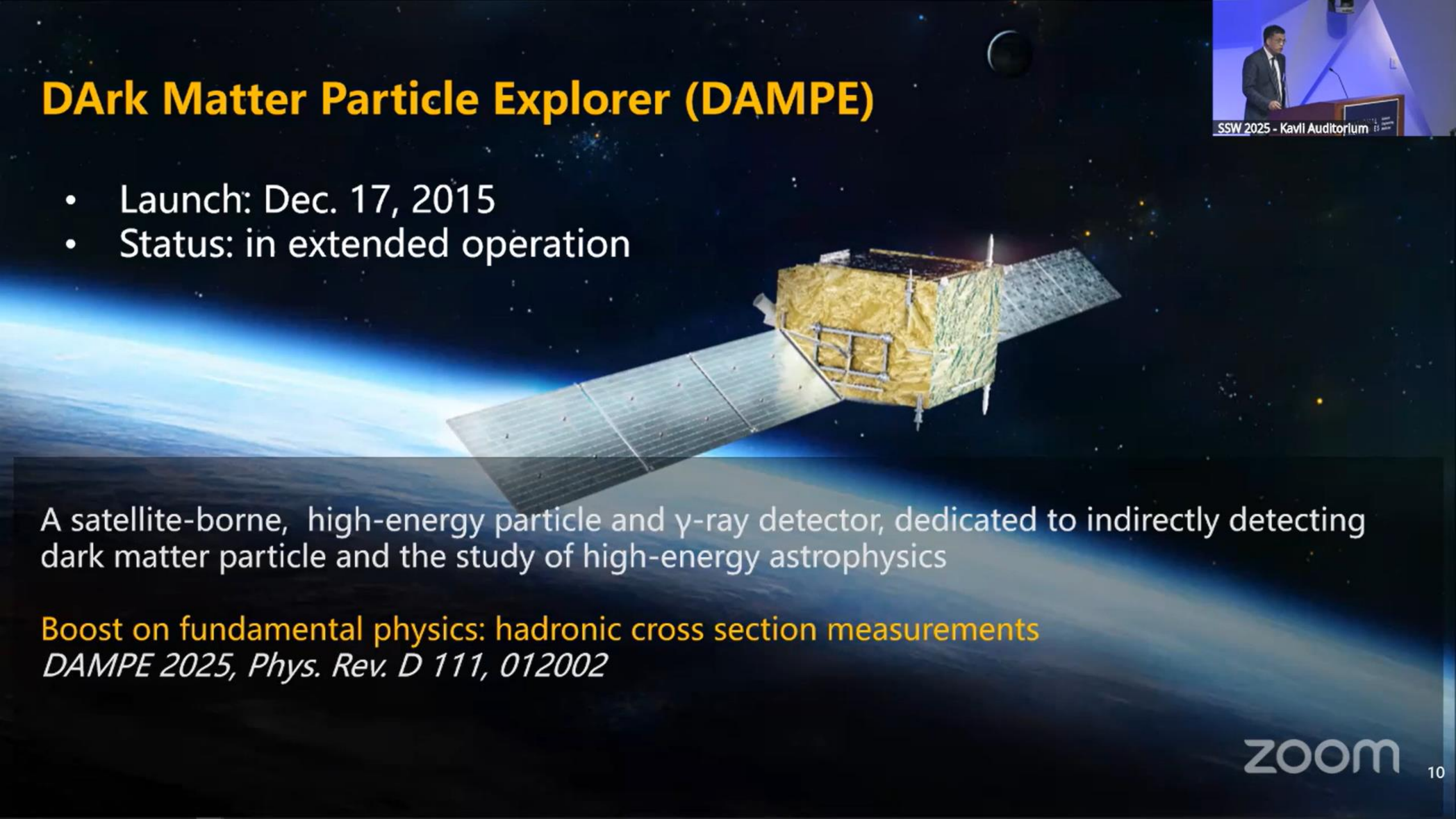
- The eruption age of basalts at Chang'e 6 sampling site has been constrained to **≈ 2.8Ga**
  Cui et al., 2024, Science

Chinese Lunar Samples Unveil the Moon's Magnetic Midlife

Chang'e-6 basalts suggest that the lunar dynamo may have reactivated after an initial sharp decline in its early stages

Cai et al., 2025, Nature

DArk Matter Particle Explorer (DAMPE)

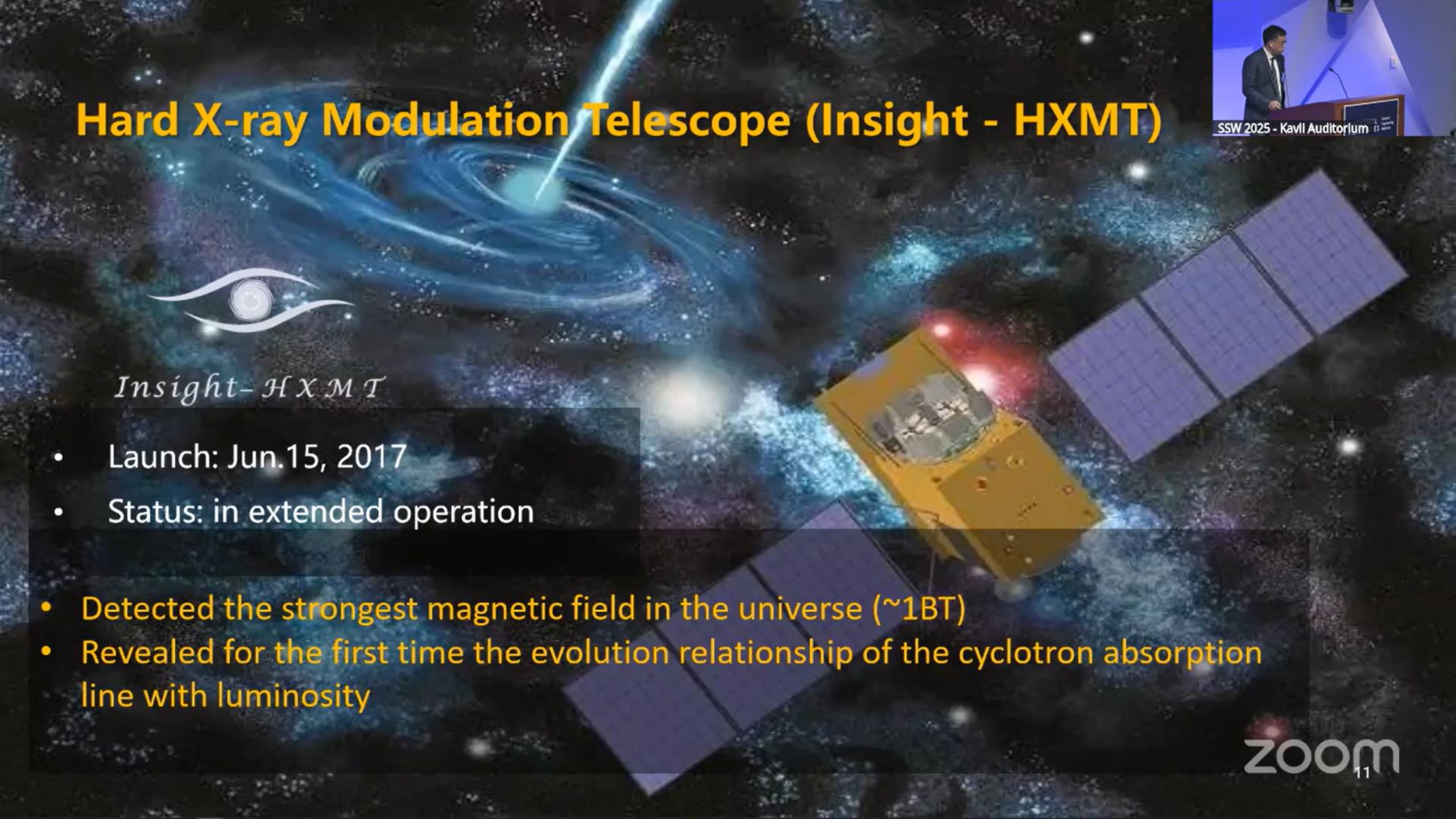


- Launch: Dec. 17, 2015
- Status: in extended operation

A satellite-borne, high-energy particle and γ-ray detector, dedicated to indirectly detecting dark matter particle and the study of high-energy astrophysics

Boost on fundamental physics: hadronic cross section measurements
DAMPE 2025, Phys. Rev. D 111, 012002

Hard X-ray Modulation Telescope (Insight - HXMT)



Insight-HXMT

- Launch: Jun.15, 2017
- Status: in extended operation

- Detected the strongest magnetic field in the universe (~1BT)
- Revealed for the first time the evolution relationship of the cyclotron absorption line with luminosity

Advanced Space-based Solar Observatory (ASO-S)

Launch: October 9, 2022

Status: in operation

The ASO-S is uniquely designed to reveal connections among the solar magnetic field, solar flares, and CMEs. Its major scientific objectives therefore can be summarized as '1M2B', standing for the Magnetic field and the two kinds of Bursts (flares and CMEs).

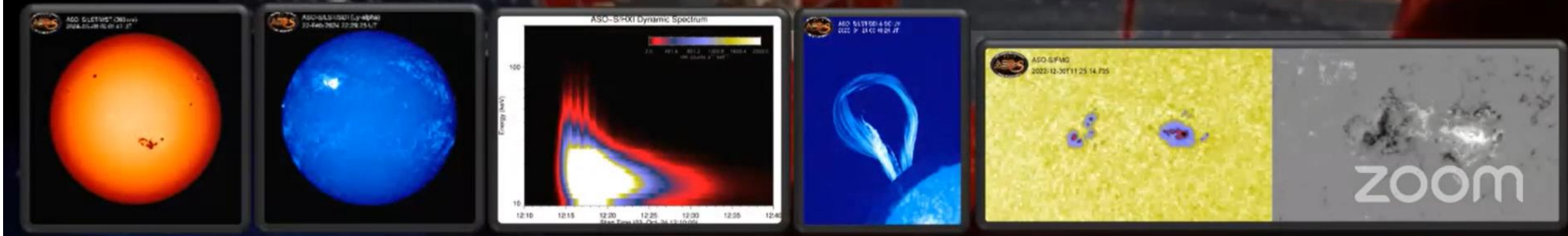
- Orbit: a sun-synchronous orbit, altitude: ~720km.
- Payloads: Full-Disc Vector Magnetograph (FMG), the Hard X-Ray Imager (HXI) and the Lyman-Alpha Solar Telescope (LST).

Advanced Space-based Solar Observatory (ASO-S)

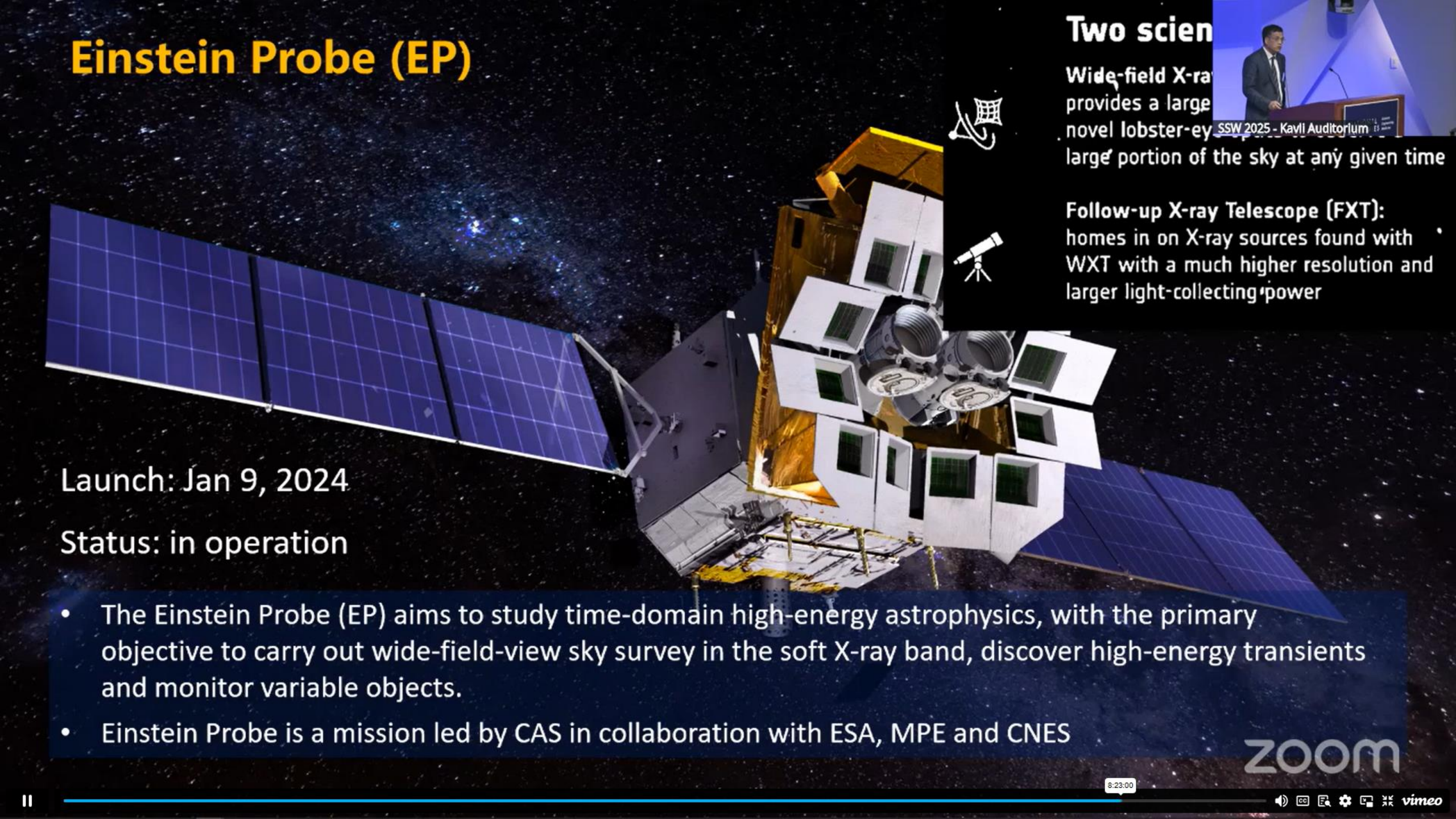
Launch: October 9, 2022

Status: in operation

- **First Carrington map in Ly-alpha, a key for computing Ly-alpha emission in corona**
- **First detection of Ly-alpha wave in the solar atmosphere**



Einstein Probe (EP)



Launch: Jan 9, 2024

Status: in operation

Two scien

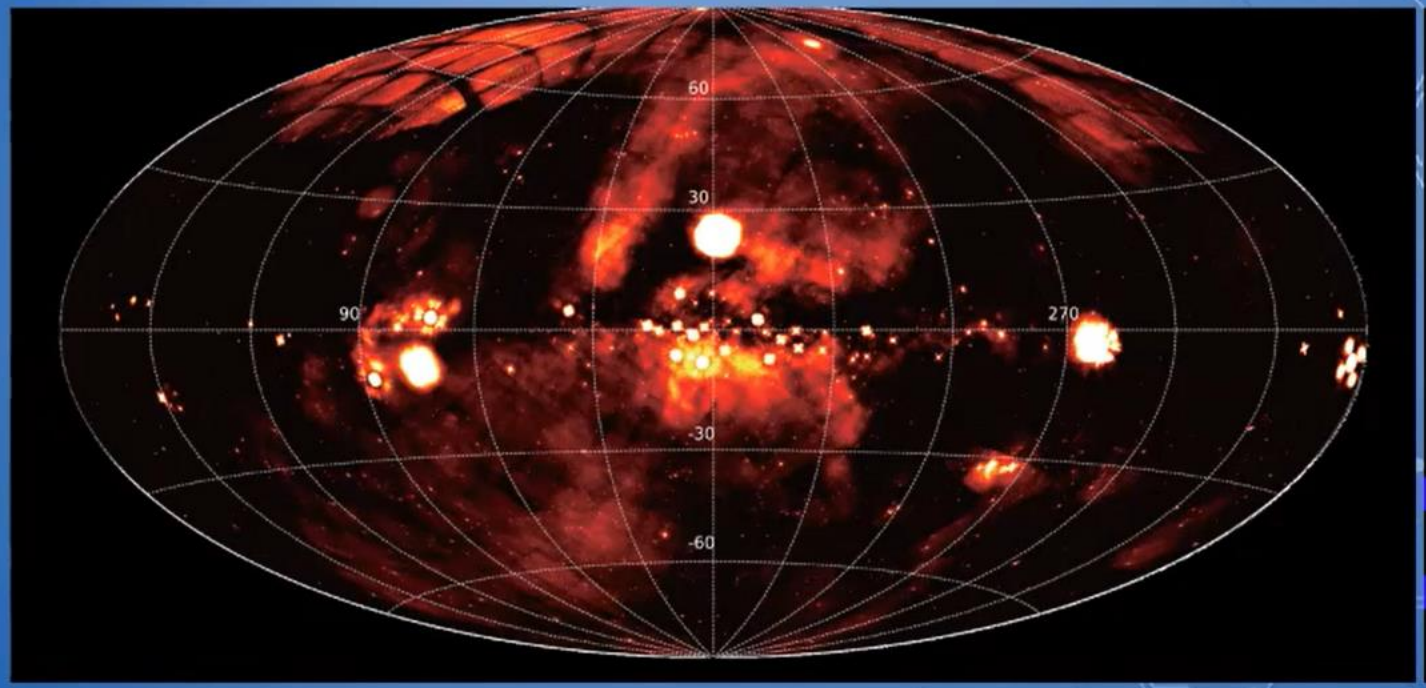
Wide-field X-ra
provides a large
novel lobster-ey
large portion of the sky at any given time

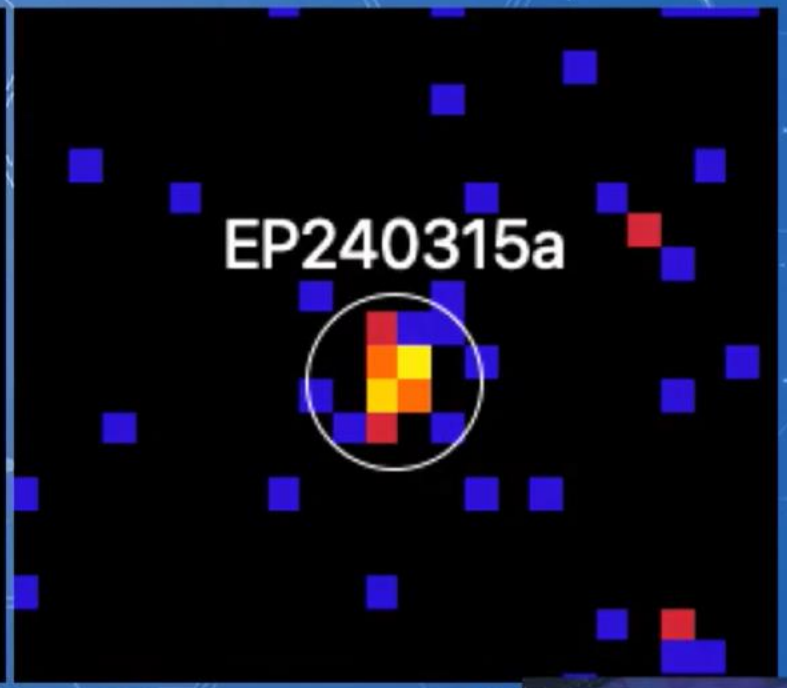
Follow-up X-ray Telescope (FXT):
homes in on X-ray sources found with WXT with a much higher resolution and larger light-collecting power

- The Einstein Probe (EP) aims to study time-domain high-energy astrophysics, with the primary objective to carry out wide-field-view sky survey in the soft X-ray band, discover high-energy transients and monitor variable objects.
- Einstein Probe is a mission led by CAS in collaboration with ESA, MPE and CNES

Einstein Probe (EP)

- Detected over 110 X-ray transients, which lasted for a wide range of timescales from seconds to months
- Detected nearly 1000 X-ray flaring stars, mostly detected for the first time.

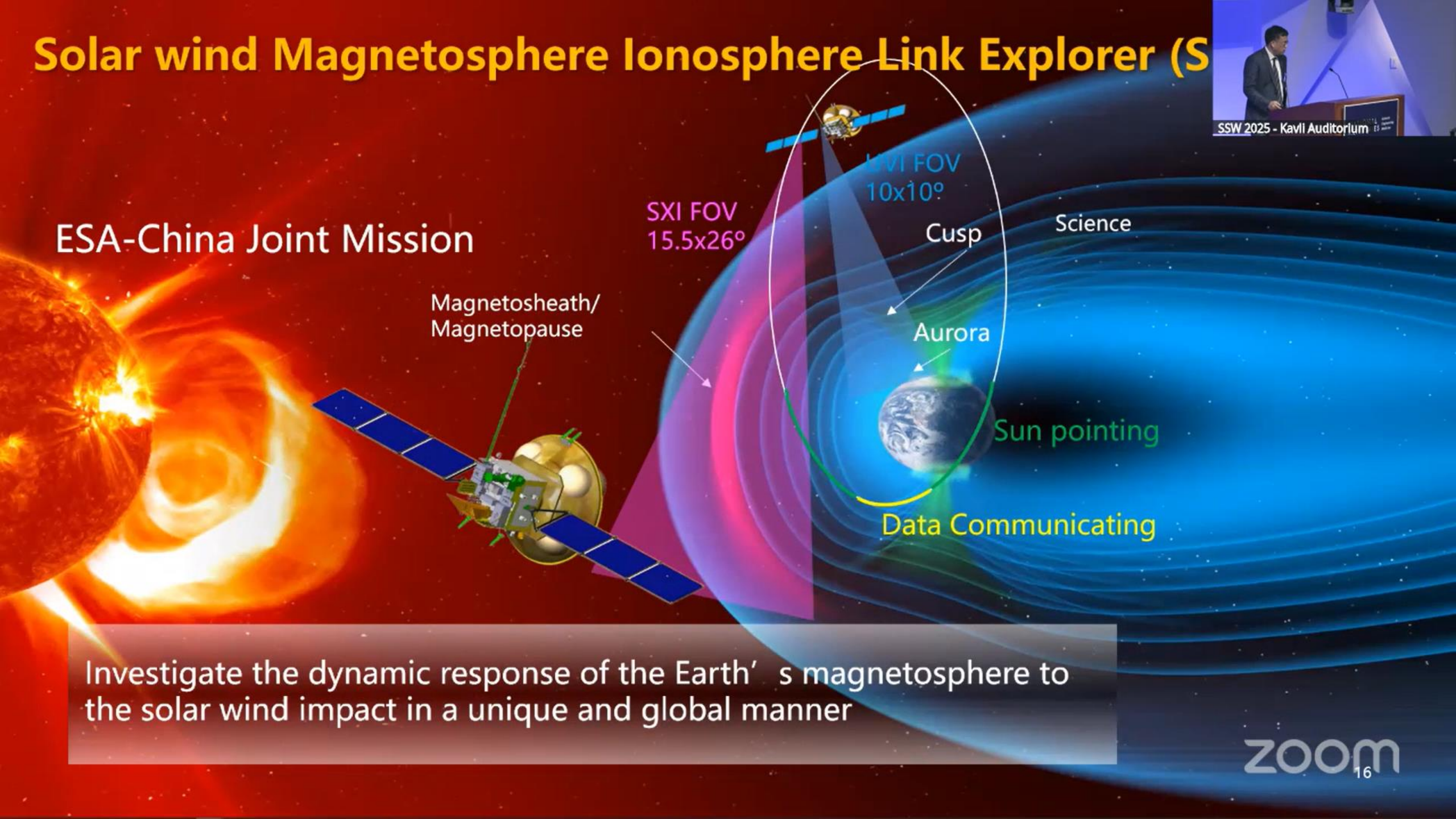




EP240315a: the most distant gamma-ray bursts first detected in X-ray
Liu Y. et al. 2025 Nature Astronomy

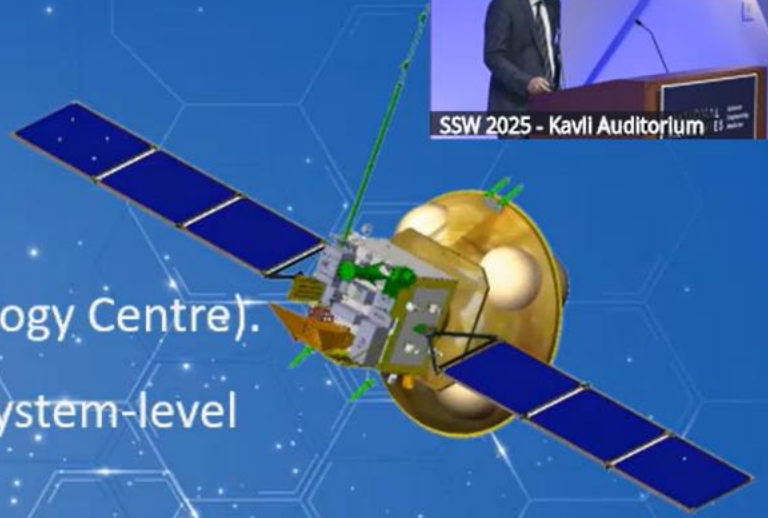
EP240408a: A new type of transient phenomena previously unknown
Zhang W . et al. 2025 Science China PMA

Solar wind Magnetosphere Ionosphere Link Explorer (S



Investigate the dynamic response of the Earth’ s magnetosphere to the solar wind impact in a unique and global manner

SMILE's Last Sprint to the Launch Pad



- December 2024: Platform arrives at ESTEC (European Space Technology Centre).
- January 2025: Platform and payload modules integrated, initiating system-level testing.
- October 2025: Completion of AIT & Flight Acceptance Review
- December 2025: Arrives at Kourou Spaceport (French Guiana) ready for launch

02

National Space Science Plan (2024 – 2050)

National Mid- and Long-term Plan for Space Science in China (2024-2050)

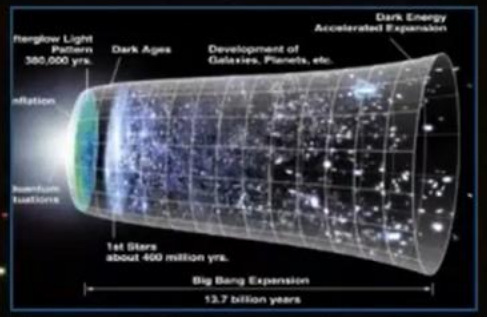
October 15, 2024

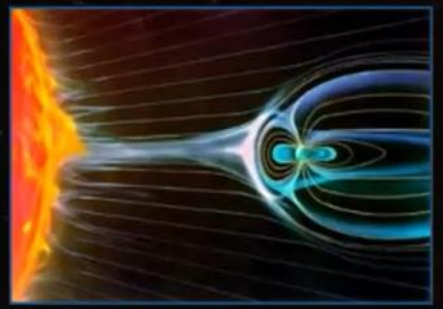
Jointly released by the Chinese Academy of Sciences, China National Space Administration and China Manned Space Agency

Five Key Scientific Themes

5 Scientific Themes

- **Extreme Universe**
- **Space-Time Ripples**
- **Panoramic View of Sun-Earth**
- **Habitable Planets**
- **Biological & Physical Sciences in Space**

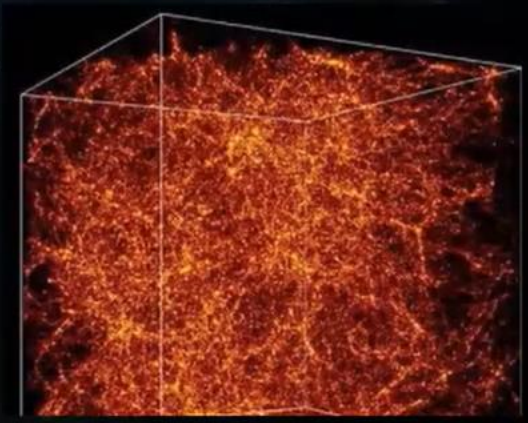




17 Pr...ities

Extreme Universe

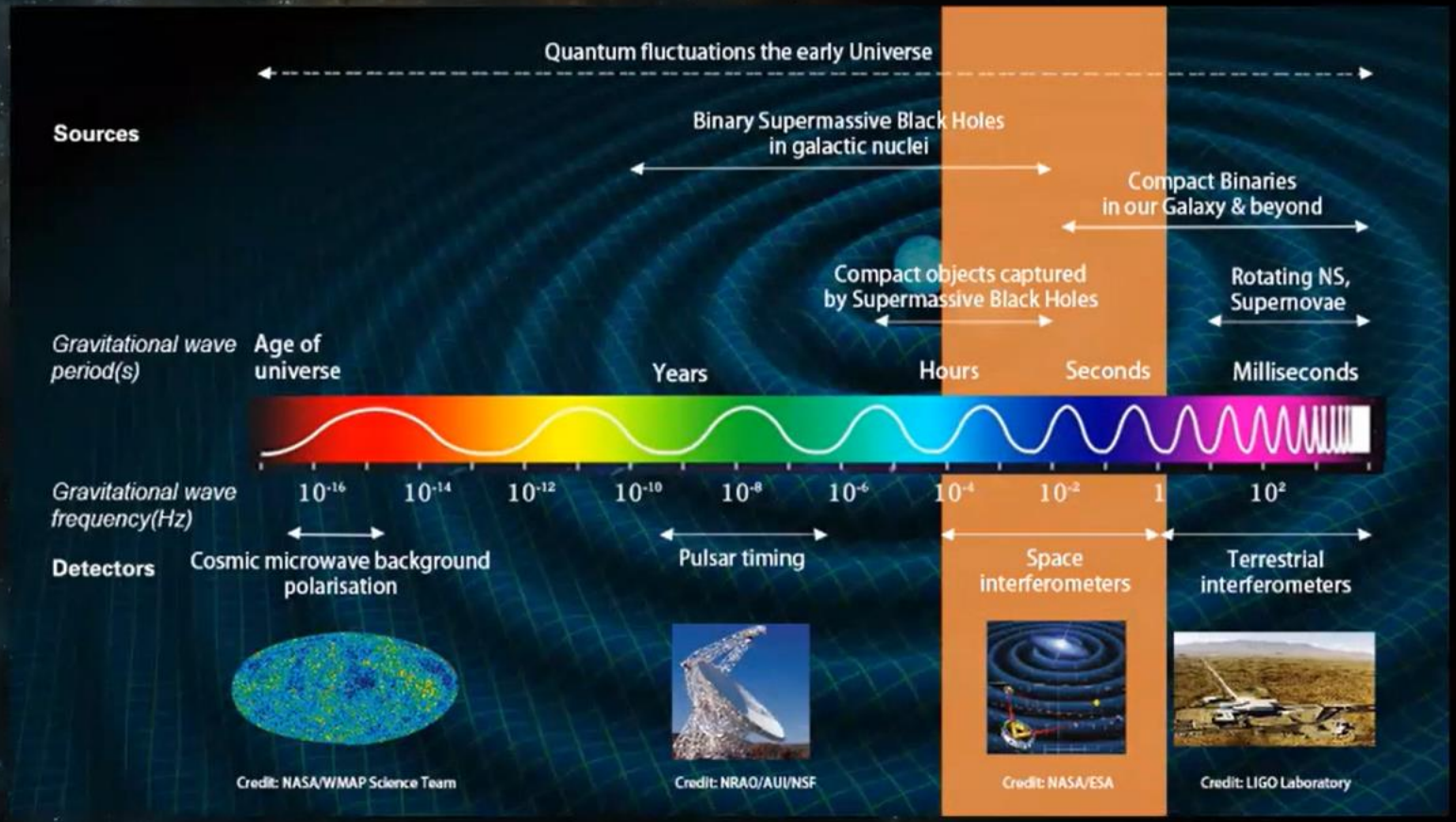
- The dark matter & extreme universe (extreme gravity, density, magnetism near black holes & neutron stars etc.)
- Origin & evolution of the universe
- Detection of cosmic baryonic matter



17 P

Space-Time Ripples

Space-based probes of medium- and low-frequency gravitational waves



17 Priorities

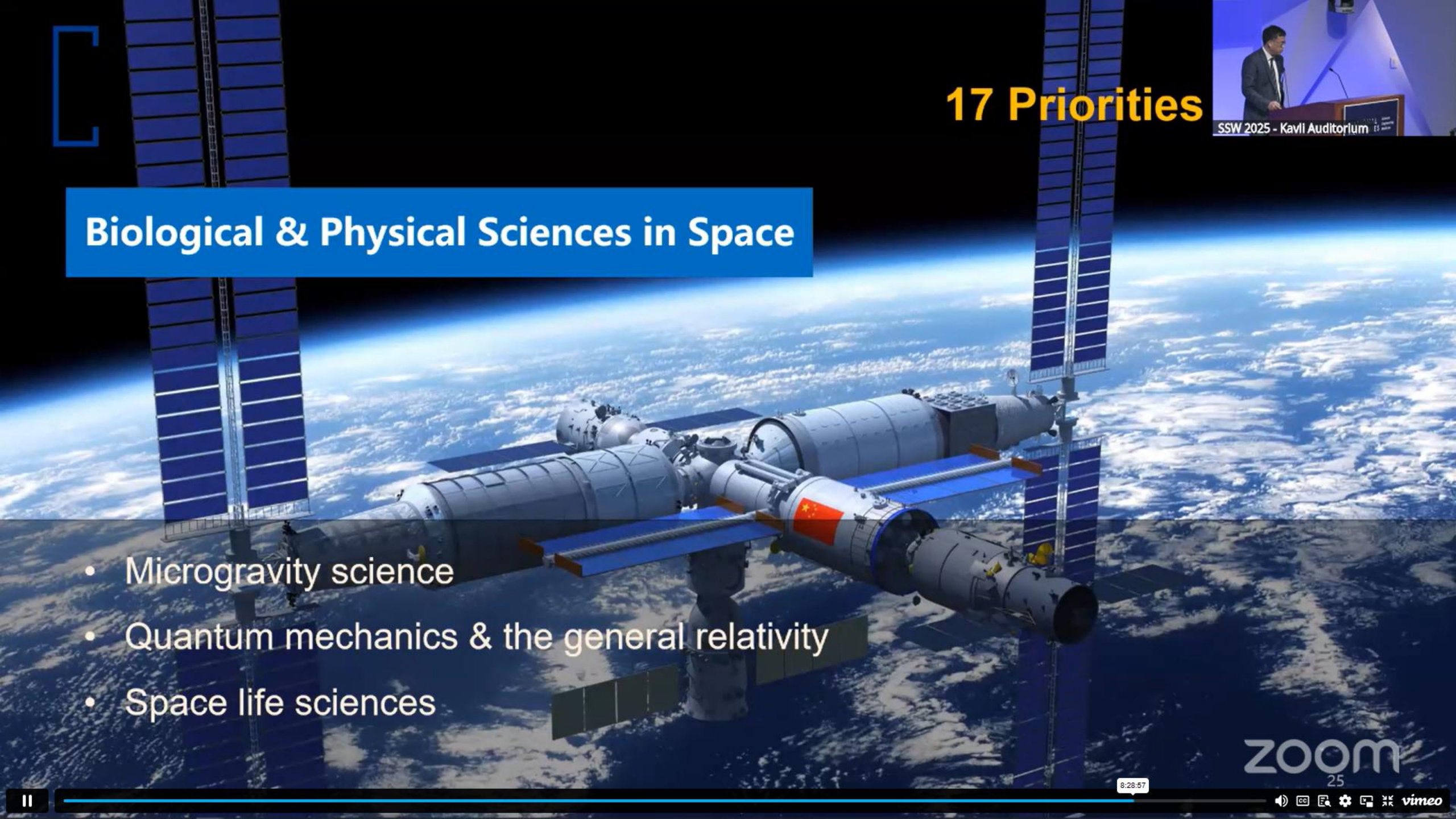
Panoramic View of Sun-Earth

- Comprehensive exploration of cislunar space
- Space weather observation
- Stereoscopic solar exploration
- Heliospheric boundary exploration
- The Earth's cycle systems

17 Priorities

Habitable Planets

- Origin and evolution of the solar system
- Characterization of planetary spheres
- Search for extraterrestrial life
- Exoplanets detection
- Sustainable development of the habitable Earth system


17 Priorities
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Biological & Physical Sciences in Space
• Microgravity science
• Quantum mechanics & the general relativity
• Space life sciences
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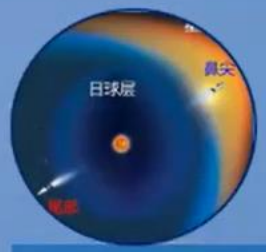
Development Roadmap



- Space station operation
- CLEP(Phase IV)/ TW
- 5-8 Science satellite missions

- Manned lunar exploration
- ILRS (lunar research station)
- ~15 Science satellite missions

- ~30 space science missions

2024 ..... 2027 2028 ..... 2035 2036 2050

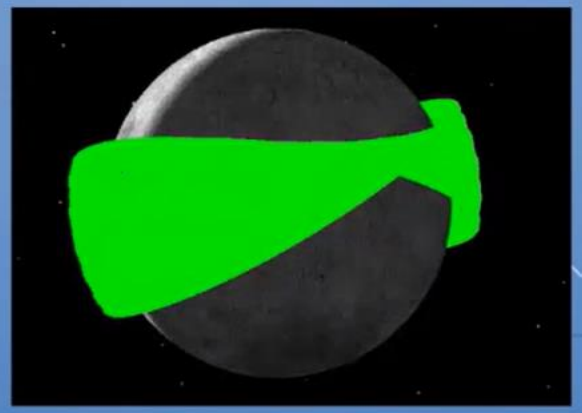
26

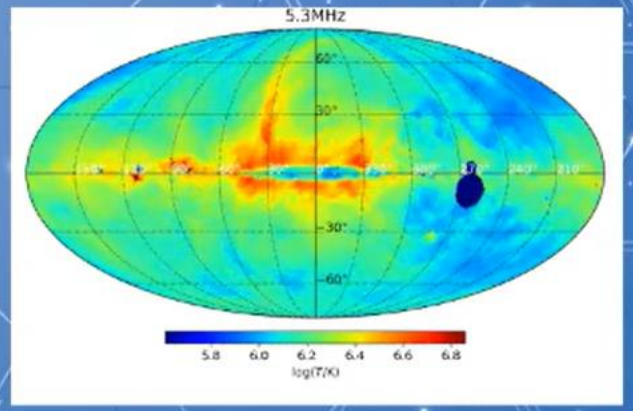
03

Space Science Satellite Missions of 2025-2030

鸿蒙计划
Discovering the Sky at the Longest wavelength (DSL)

Open a new window to image the dark age of the universe with MHz radio waves





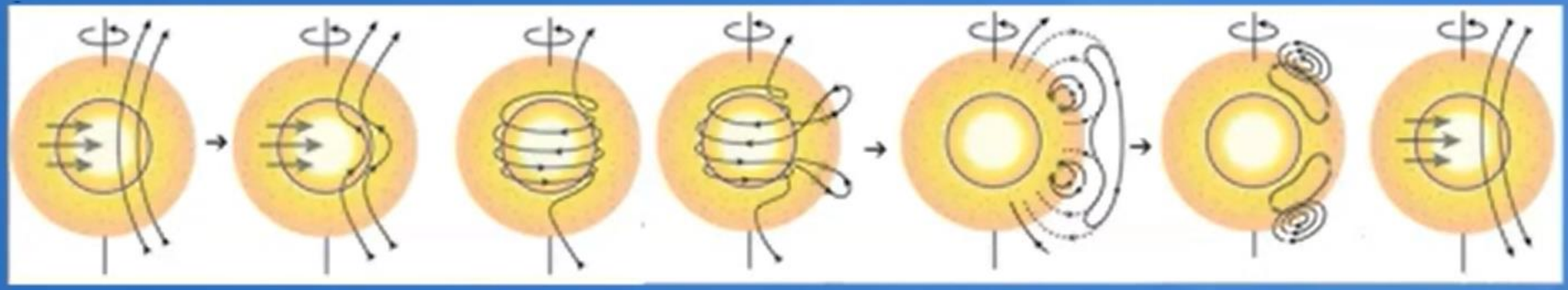
1 mother satellite + 9 daughter satellites operating in a 300 km circular lunar orbit

Payloads:

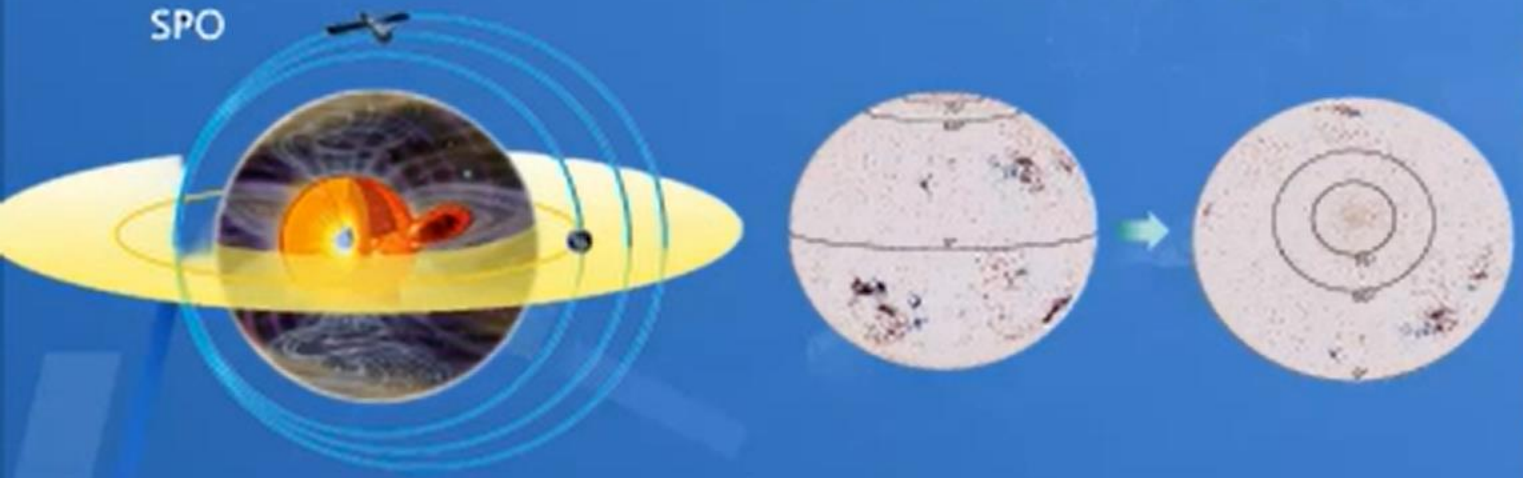
- high frequency spectrometer (HFS) antenna
- low frequency interferometer and spectrometer (LFIS)

夸父二号
Solar Polar Orbit Observatory (SPO)

- Obtain the frontal imaging of the solar polar region
- Unveil of origin of solar magnetic cycle, fast solar wind and heliospheric space weather processes



Credit: Sanchez et al. (2014)



Solar polar-orbit: high orbital inclination (>80°) and short period (<1.5 years)

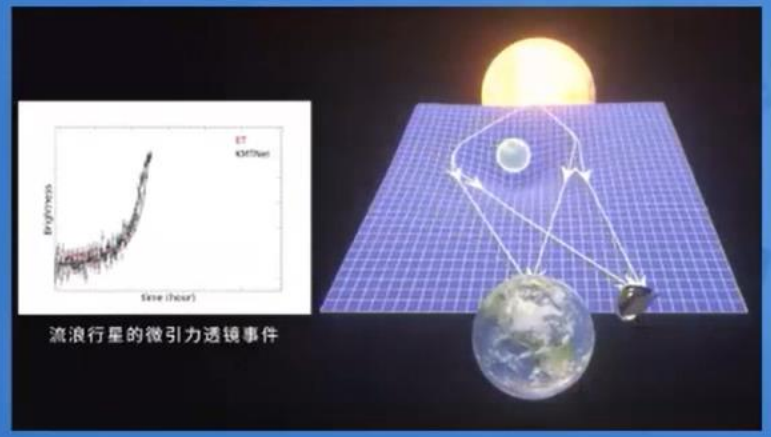
Payloads: Magnetic and Velocity Field Imager, Ultraviolet Telescope, White Light Coronagraph, Heliospheric Imager, etc.

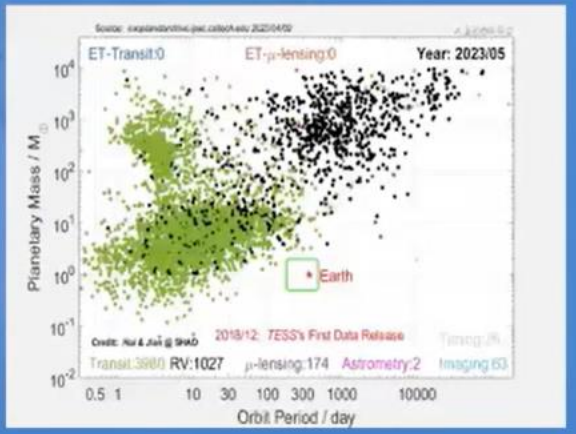
系外地球巡天
The Earth 2.0 (ET)

Explore habitable Earth-like planets outside our solar system

Orbit: Earth-Sun L2

Payloads: six 28-cm wide-field transit telescopes, one 35-cm microlensing telescope





5 times Kepler's field of view and 1/20 Kepler's noise

增强型X射线时变与偏振空间天文台
Enhanced X-ray Timing and Polarimetry (eXTP)

Explore the physics law under the extreme conditions in the universe, including extreme gravity, magnetism and density

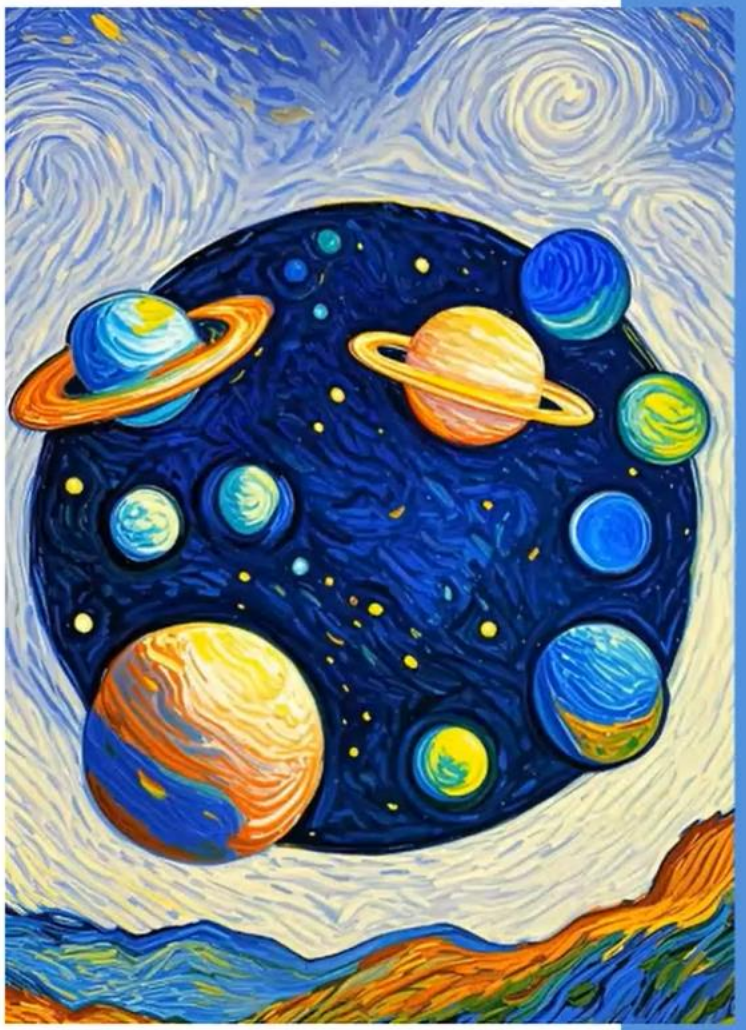
Orbit: Highly Elliptical Orbit, Apogee > 110000 km

Payloads:
- Spectroscopy Focusing Array(SFA)
- Polarimetry Focusing Array(PFA)

Space Science Satellites Development Schedule

2025	2026	2027	2028	2029	2030	2031-
Preliminary Design Phase	Launch the pathfinder-1		DSL and ET	Launch SPO	Launch eXTP	Observation and Output

Pathfinder-1: In-orbit testing and validation of key technologies



04

International Cooperation

Cooperation for Space Science Satellite Missions

- Collaboration on scientific payloads, including joint development and calibration
- Ground segment support in southern and western hemisphere for tracking, orbit determination and data reception of SPO and other missions
- Inter-mission coordination among science satellite missions/telescopes to enhance scientific outcomes
- Strategic cooperation in future space science planning, specifically planning future joint missions and exploring opportunities to participate in each other's missions.
- Collaboration of scientific research

International Meridian Circle Program (IMCP)

- To connect 120ºE and 60ºW meridian chains of ground-based monitors worldwide, in order to provide a global picture of unfolding space weather events.
- 1000+ Ground-based observations for sustained global observation of the space environment
- IMCP will be one of the candidates for Major International Science Program initiated by MOST this June

空间科学 · 探索与发现

To explore the unknown,
we are open for cooperation.

It's for science!

Nssc 中国科学院国家空间科学中心
National Space Science Center, CAS

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