



Recent Space Science Activities in China

DONG Xiaolong

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



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Next 5 Years**



Scientific Highlights

Two Themes of China's Space Science Program

Theme 1: How did the universe and life originate, and how does it evolve?

How did the universe originate and how does it evolve?

How did life originate and how does it evolve?

What are the law of matter motion and the law of life activity in space environment?

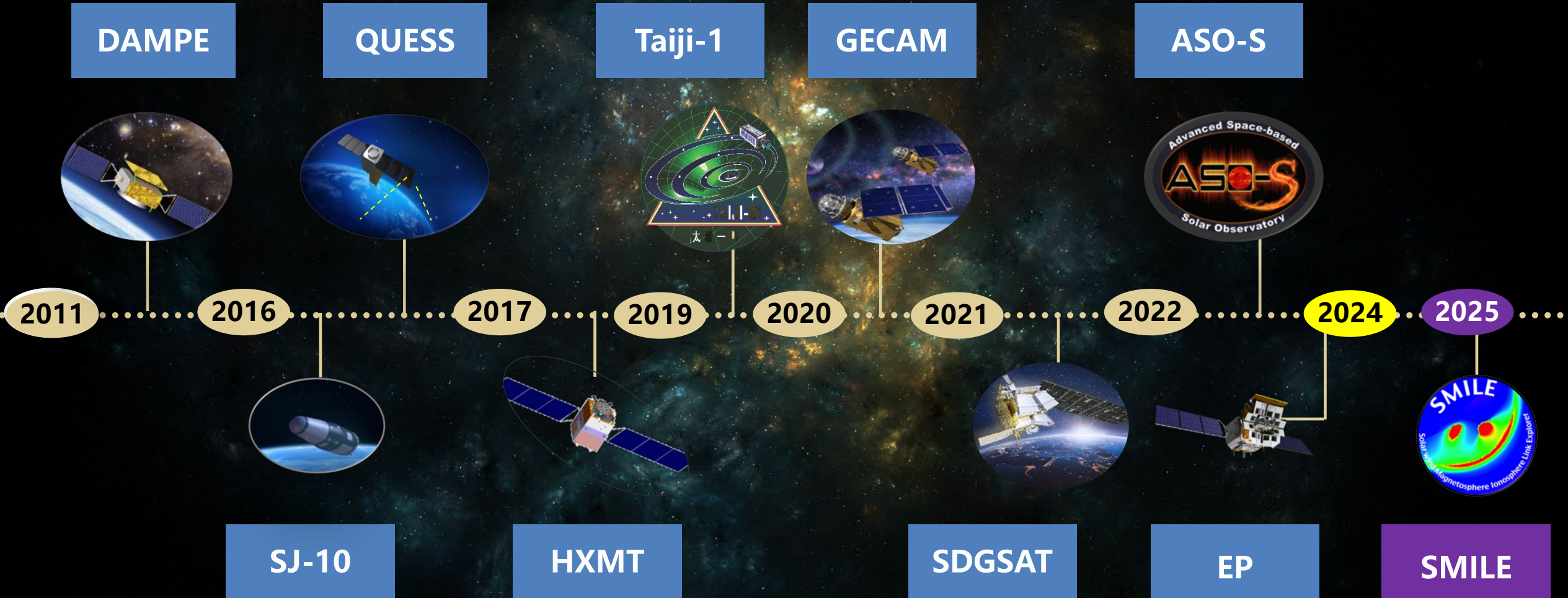
Theme 2: What is the relationship between solar system and human being?

What is the nature of solar activity?

What is the origin and evolvement of solar system, and its relationship with the sun?

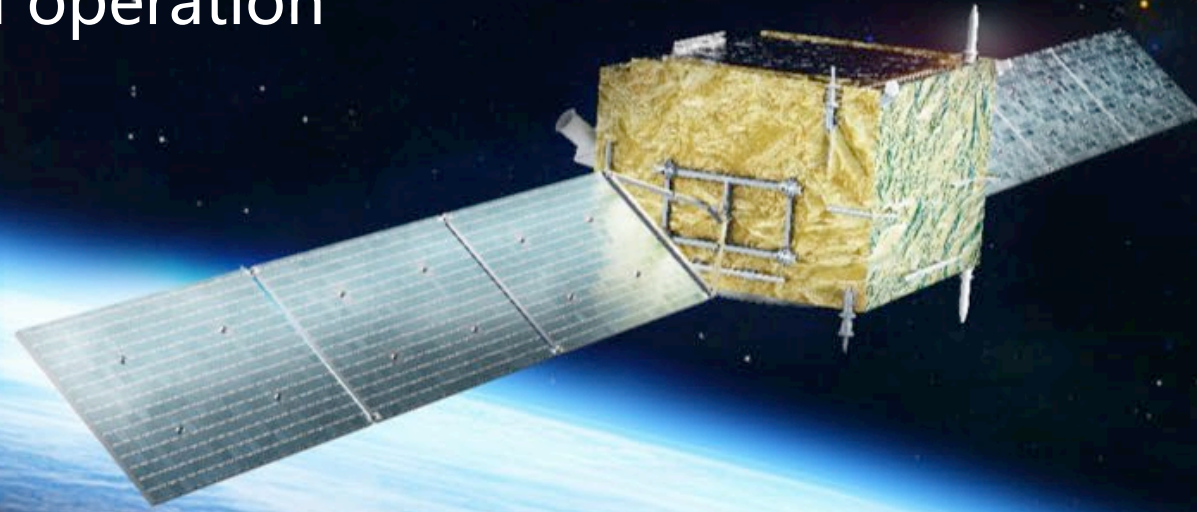
How does the earth system evolve?

Strategic Priority Program on Space Science (SPP)



Dark Matter Particle Explorer (DAMPE)

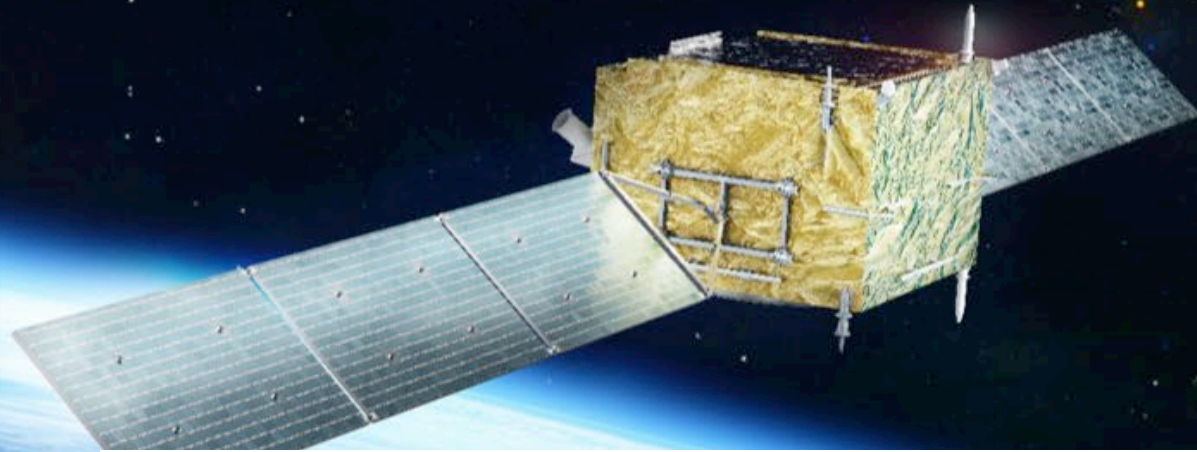
- Launch: Dec. 17, 2015
- Status: in extended operation



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

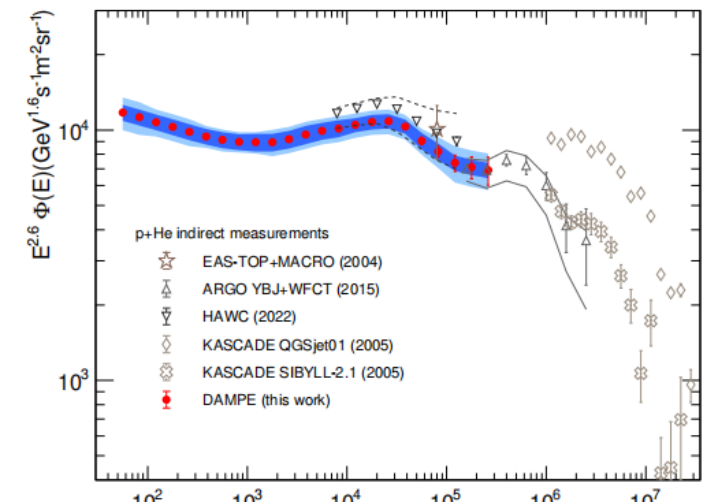
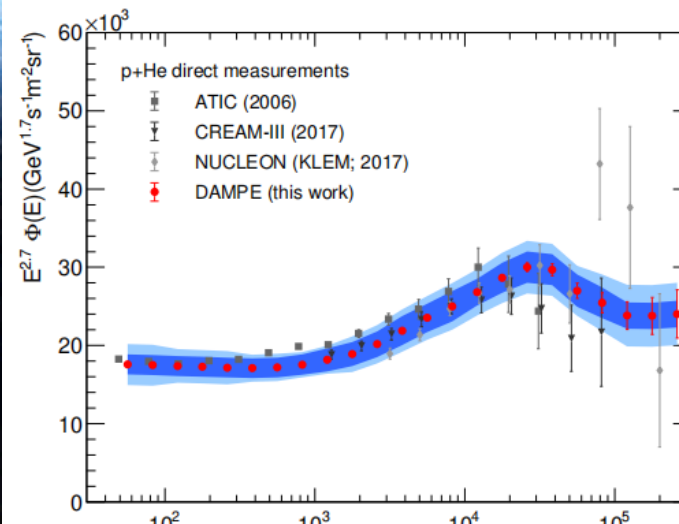
DAMPE' s latest scientific highlights

The DAMPE spectral measurement of cosmic ray proton+helium nuclei reveals a hint of hardening structure at ~ 150 TeV



proton+helium spectrum

46GeV \sim 316TeV



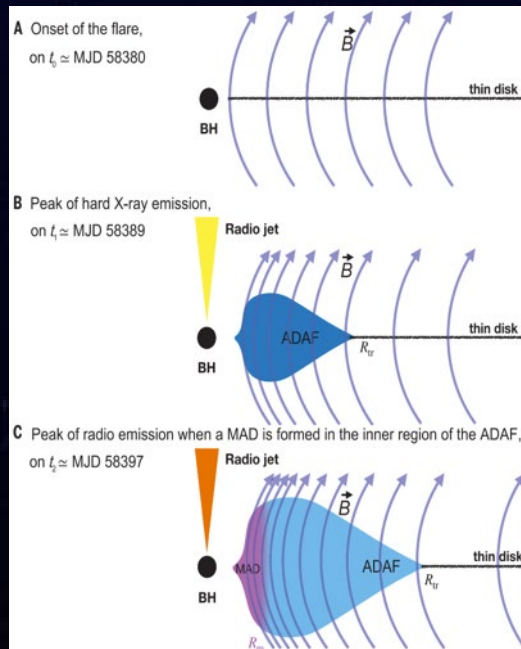
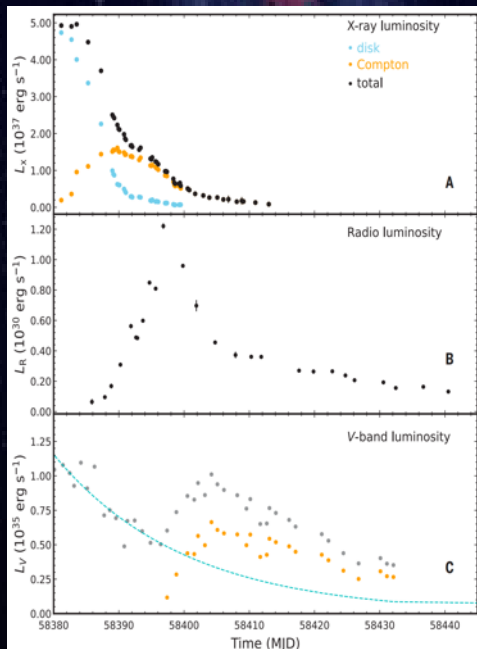
Hard X-ray Modulation Telescope (*Insight* - HXMT)

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



慧眼 - HXMT

HXMT's latest scientific highlights



Observations of a black hole x-ray binary, indicate formation of a magnetically arrested disk

Science, VOL 381, NO 6661 (2023)

Corona

Black Hole

Accretion Disk

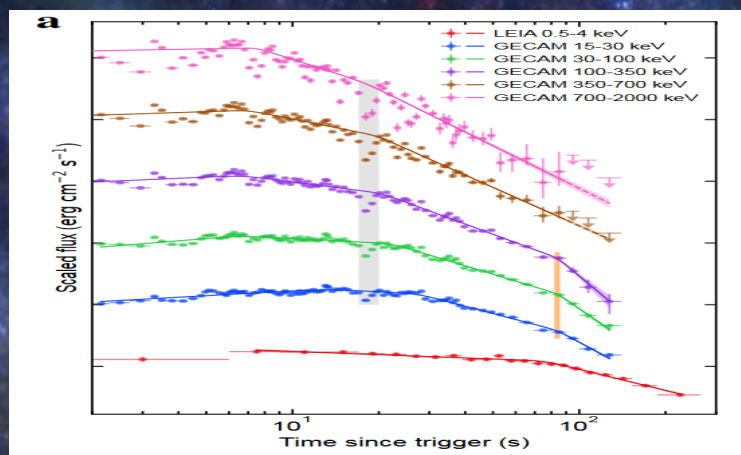
Disk + outflowing corona evolve with time

Insight-HXMT

Gravitational wave high-energy Electromagnetic Counterpart All-sky Monitor (GECAM)

Launch: Dec. 10, 2020

GECAM-B was triggered in-flight by the extremely bright long burst at 2023-03-07, which was also observed by Fermi/GBM (GCN 33405).



Xiong et al., GCN 33406(2023),
Sun et al., Nature, in review

Advanced Space-based Solar Observatory (ASO-S)

Launch: Oct. 9, 2022

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:

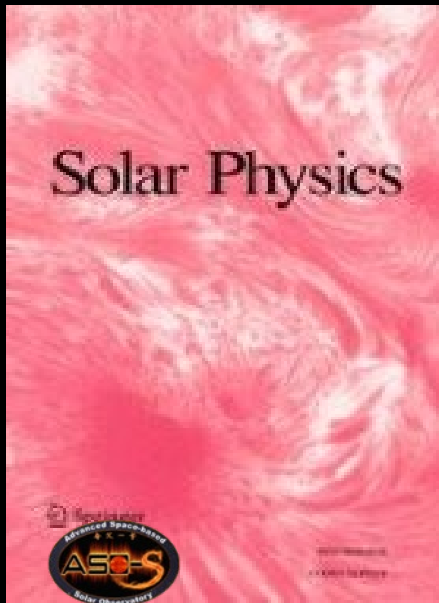
Full-Disc Vector Magnetograph (FMG)

Hard X-Ray Imager (HXI)

Lyman-Alpha Solar Telescope (LST).



ASO-S's latest scientific highlights



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Collection

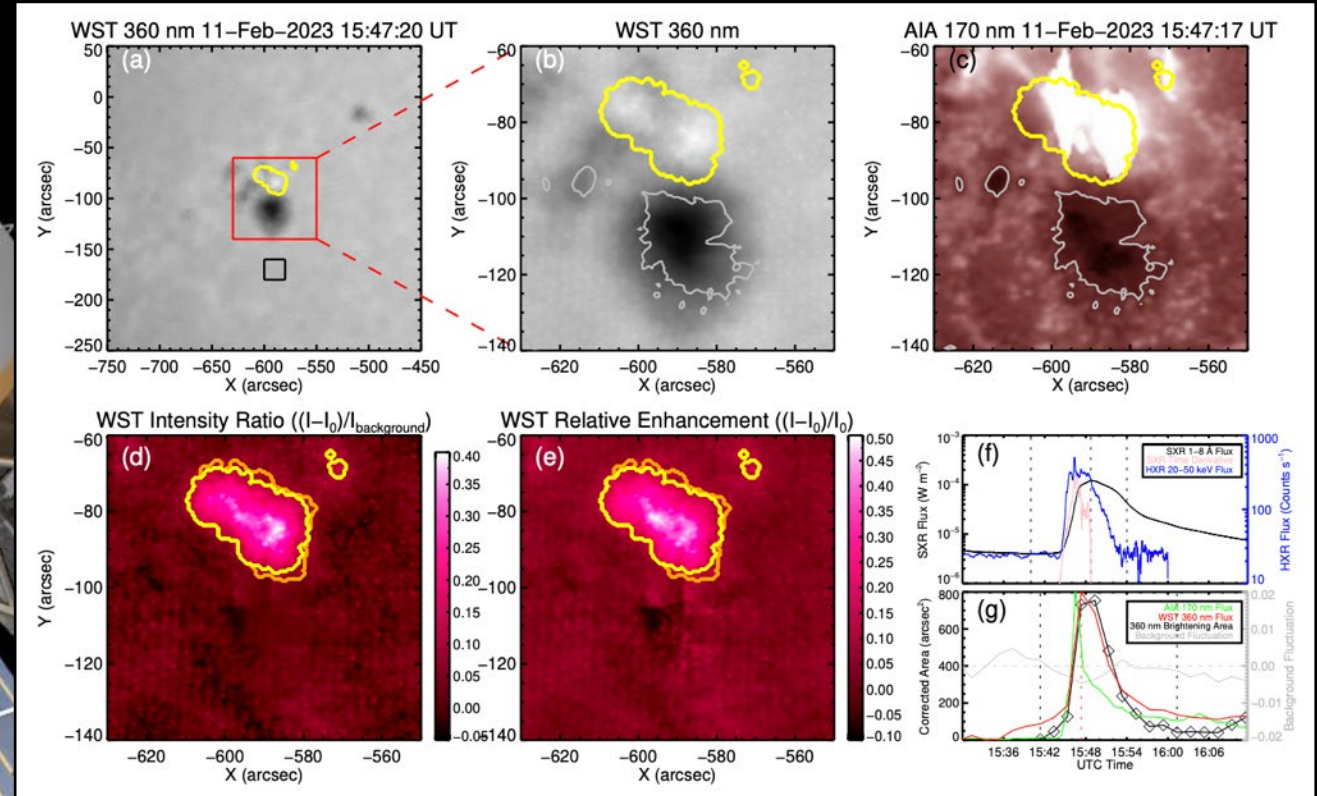
ASO-S Mission: Inflight Performance and First Results

Submission status	Open for submission from	Submission deadline
Open	20 January 2023	15 March 2024

The *Advanced Space-based Solar Observatory (ASO-S)* was launched on October 9, 2022, opening the era of comprehensive solar space observation in China. The mission aims at exploring connections among solar magnetic field, solar flares, and CMEs.

Editors

 Weiqun Gan (甘为群) &  John Leibacher



Observations with WST at 360nm waveband show that about 25% flares have enhanced emission in the Balmer continuum, indicating white-light flares are not rare, which improves the understanding about energy depositing and transferring processes of solar and stellar flares.

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 (EP)

Launch: Jan. 9, 2024



Orbit: altitude > 650 km, inclination $< 30^\circ$

Payloads:

Wide-field X-ray Telescope (WXT, for X-ray all-sky monitoring)

Follow-up X-ray Telescope (FXT, for transient sources and variable sources observations)

Einstein Probe (EP)

Status: in orbit commissioning phase

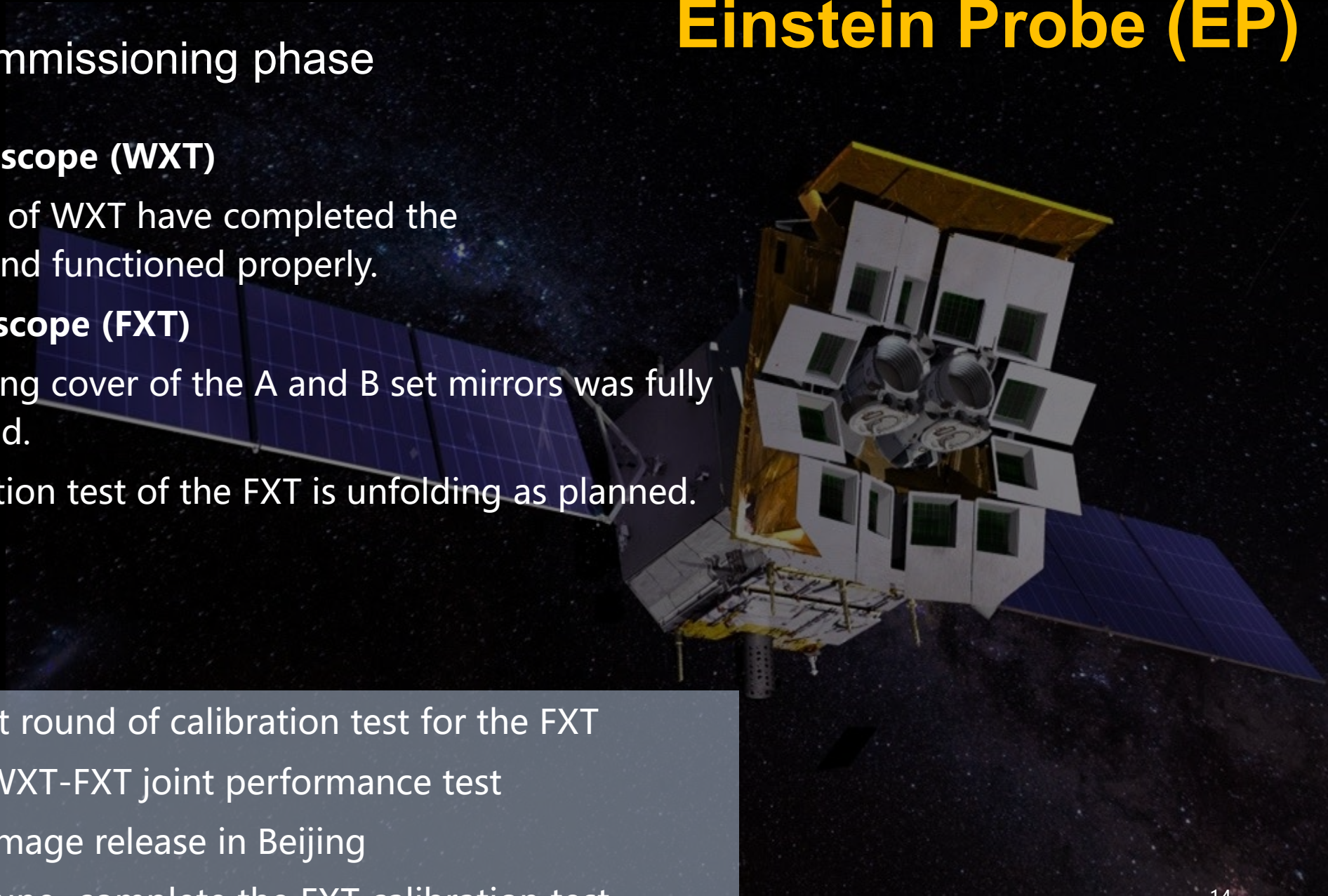
Wide-field X-ray Telescope (WXT)

- All 12 sub-modules of WXT have completed the bakeout, activated and functioned properly.

Follow-up X-ray Telescope (FXT)

- The sunshield flipping cover of the A and B set mirrors was fully deployed and locked.
- The in-orbit calibration test of the FXT is unfolding as planned.

- March 20 The first round of calibration test for the FXT
- March 21-31 The WXT-FXT joint performance test
- April 27 The first image release in Beijing
- Early April - early June complete the FXT calibration test



Solar wind Magnetosphere Ionosphere Link Explorer (SMILE)

ESA-China Joint Mission

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

Magnetosheath/
Magnetopause

SXI FOV
15.5x26°

UVI FOV
10x10°

Cusp

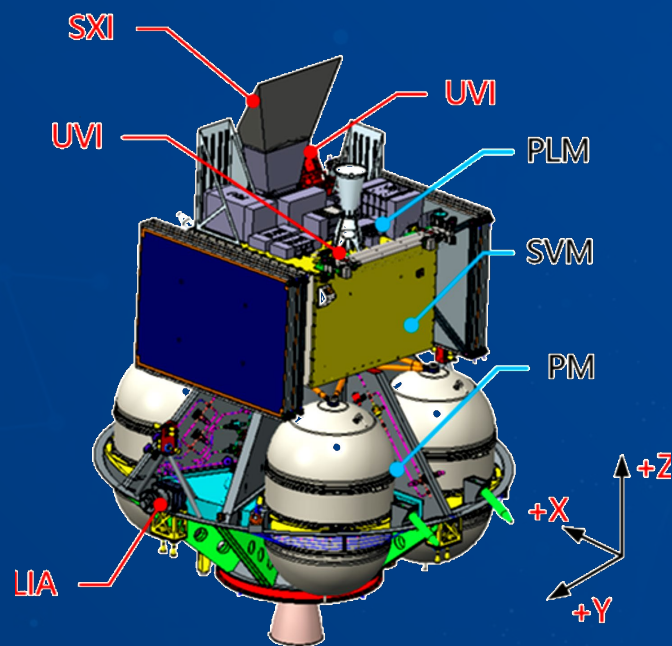
Aurora

Sun pointing

Comms

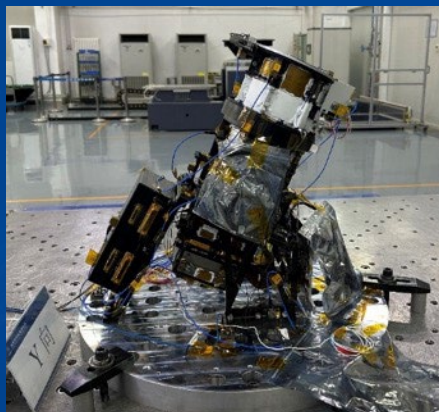
*Highly Elliptical Orbit,
inclination 98 or 70 deg
5000 km x 19 RE*

SMILE

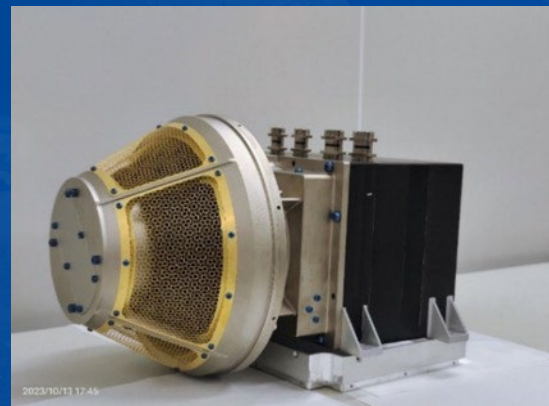


SMILE configuration

- Phase D study
- FM AIT in ESTEC: Oct. 2024-June 2025.
- Launch in Kourou: Sep.2025



UVI



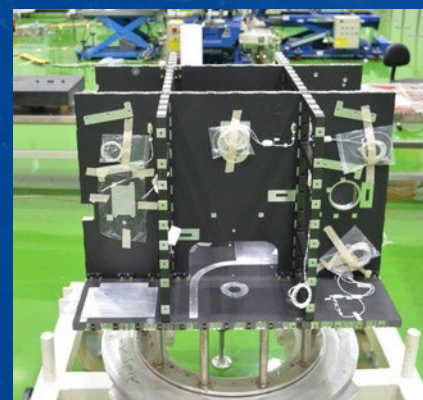
LIA



MAG



SXI

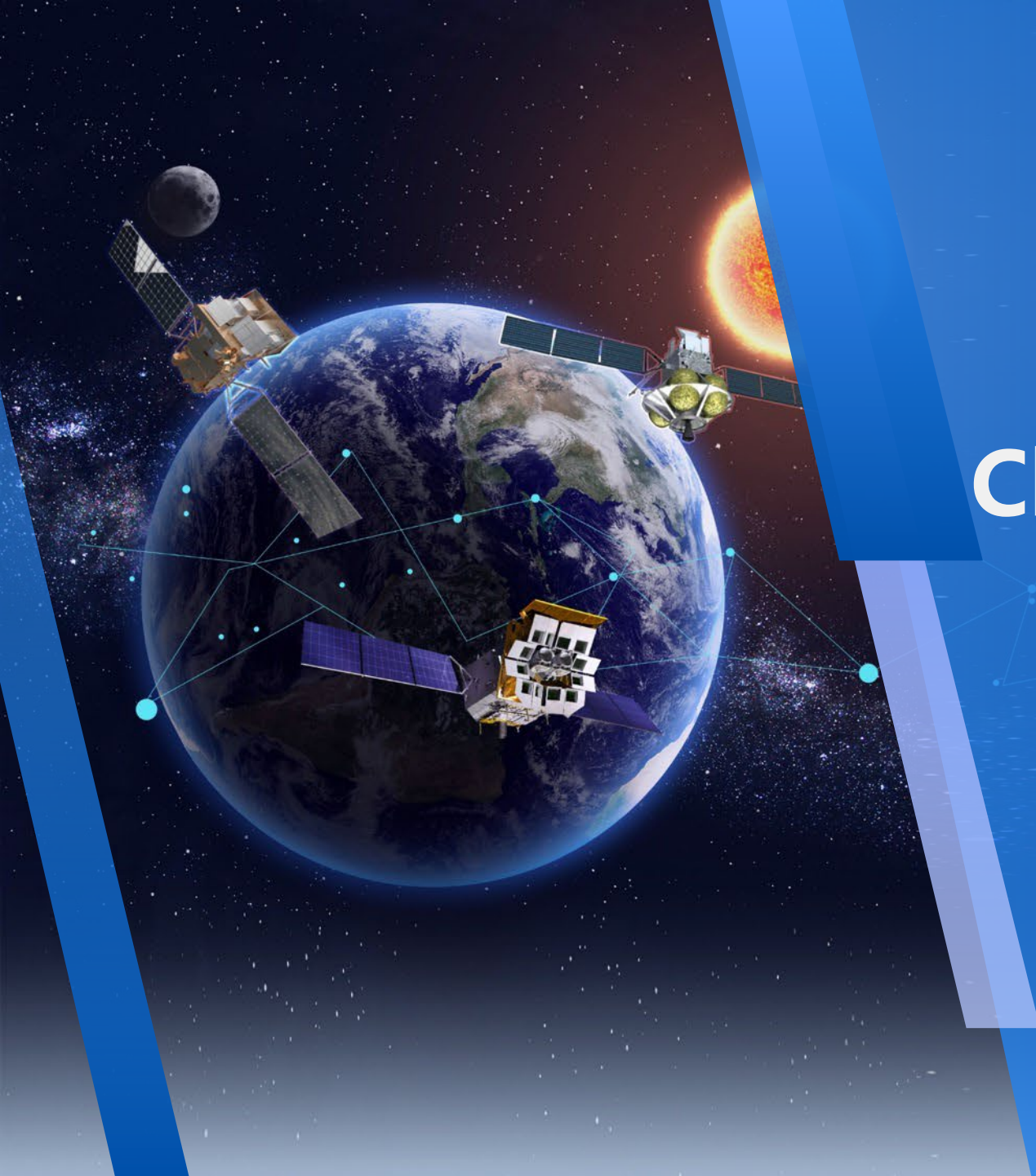


Service Module(SVM)



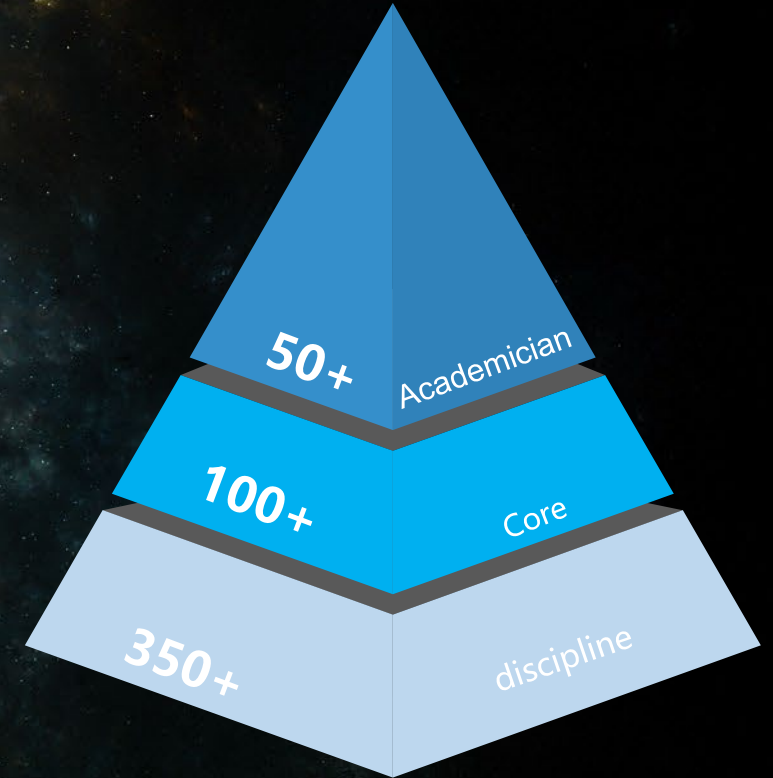
Propulsion Module(PM)

Strategy Studies for China's Space Sciences in 2024-2050



Chinese Space Science Community

- More than 500 scientists from over 60 institutions participated
- Received over 100+ mission concept proposals

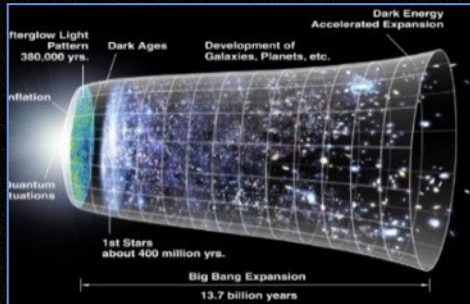


Timeframe: 2024-2050

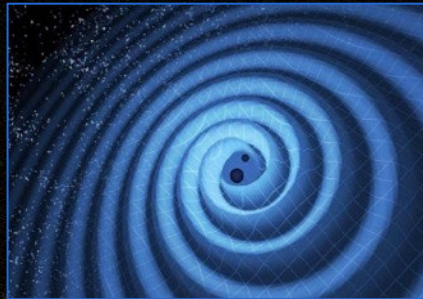


Five Scientific Themes

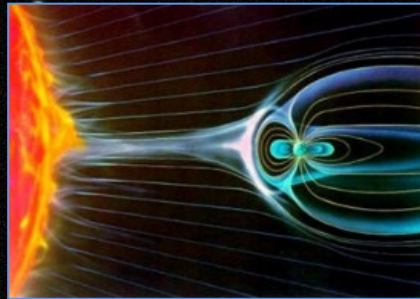
Extreme Universe



Space-Time Ripple



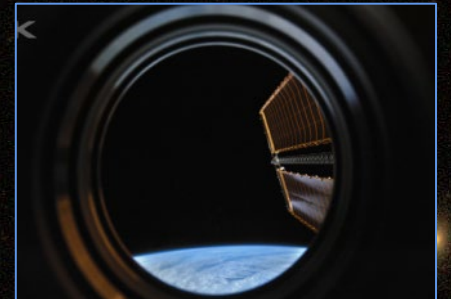
Sun-Earth Panorama



Habitable Planets



Biology & Physics in Space



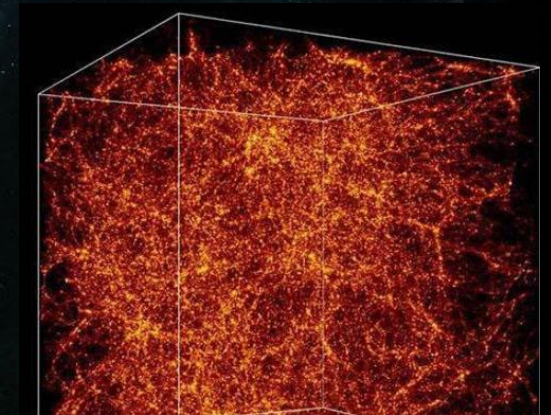
17 Priorities: Extreme Universe

1. The dark matter & extreme universe physics

(extreme gravity, density, magnetism near Black hole & neutral star etc.)

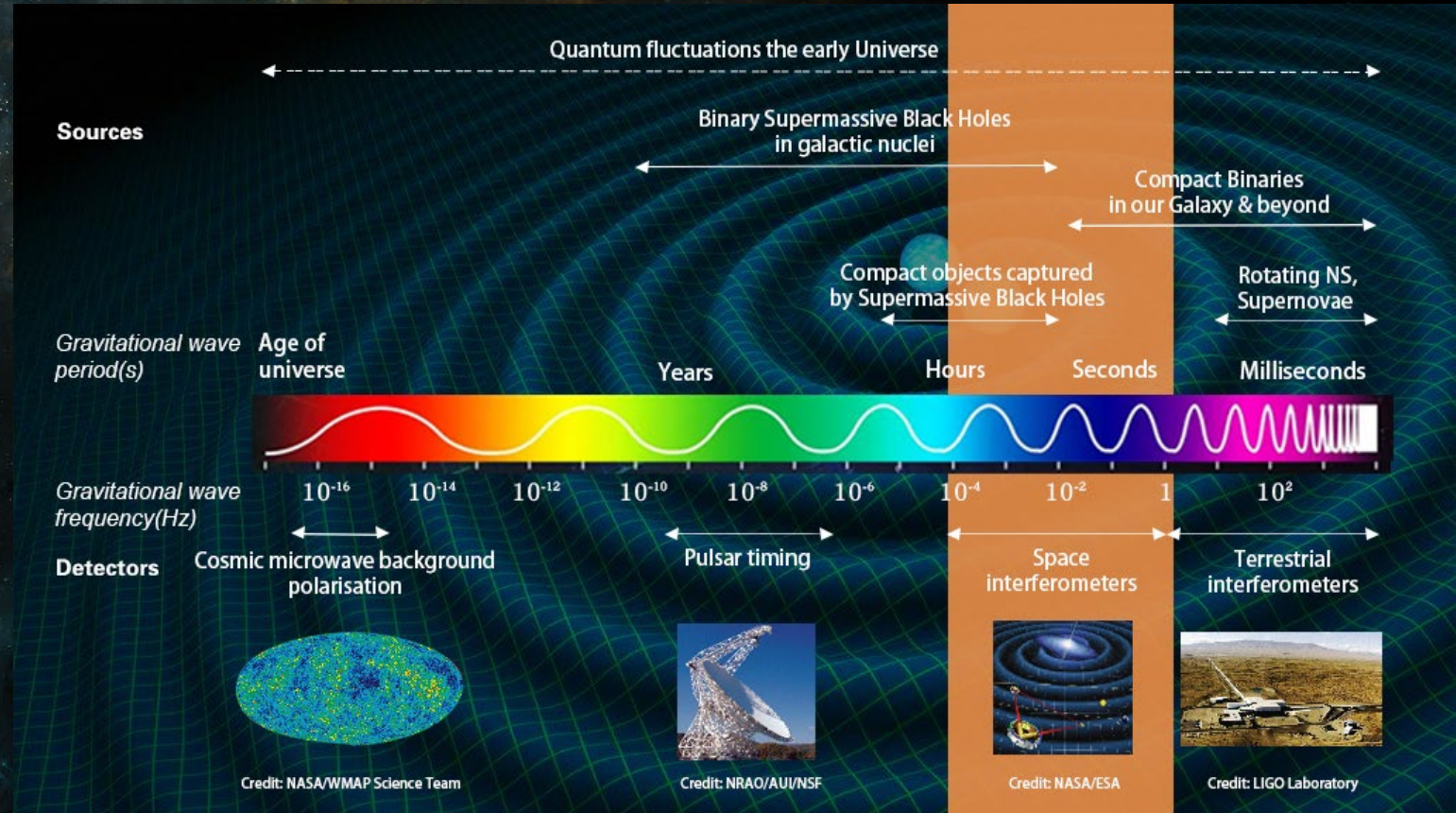
2. Origin & evolution of the Universe

3. The hot universe baryon survey by X-ray explorers



17 Priorities: Space-Time Ripple

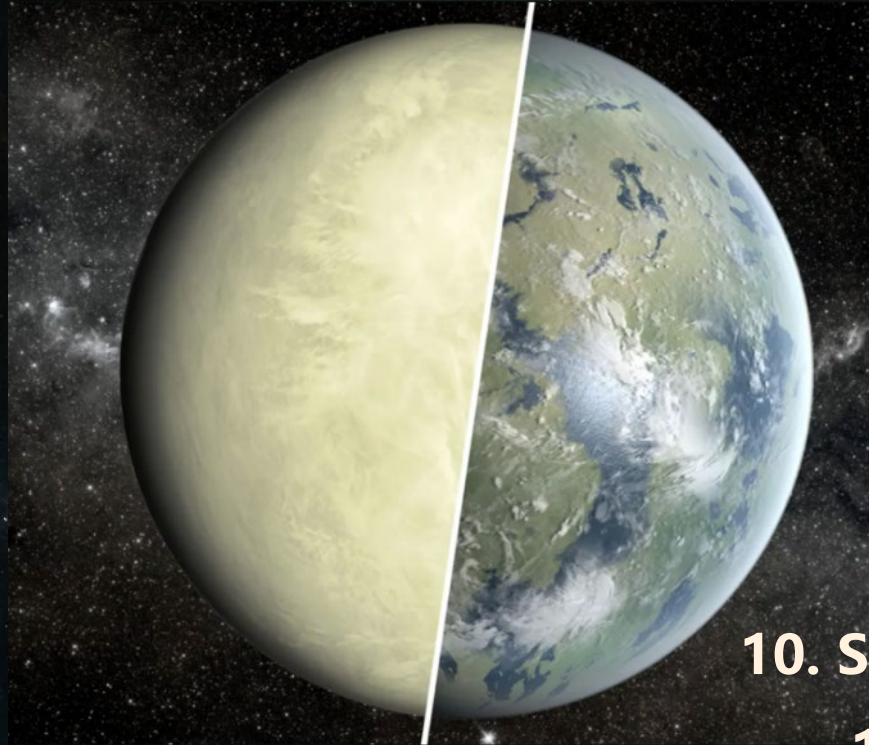
4. To explore the wrinkle of space-time through spaceborne gravitational wave observatory.



17 Priorities: Sun-Earth Panorama

- 9. Outer solar system exploration**
- 8. Solar polar & ring and flyby probes**
- 7. Space weather service in the solar system space**
- 6. Comprehensive exploration of Cislunar space**
- 5. The Earth system observatory**

17 Priorities: Habitable Planets



10. Science for sustainable development

11. Archaeology of the Solar System

12. Characterization of the spheres of the planets

13. The search for alien life beyond Earth

14. Detection, characterization and imaging of exoplanets

17 Priorities: Biology and Physics in Space



15. Microgravity science

16. Quantum & the General Theory of Relativity experiment in space

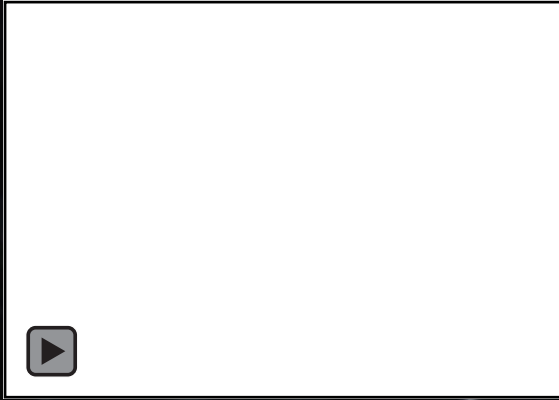
17. Origin & adaptation of life in space



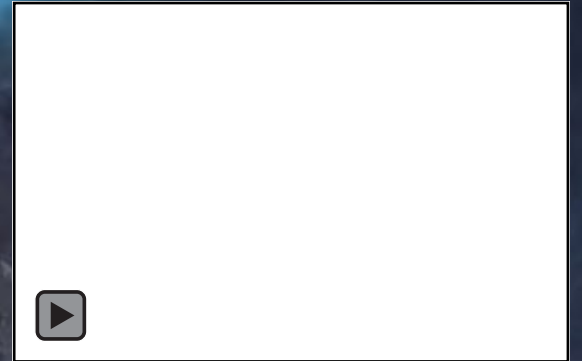
III

Preparation for the Next 5 Years

Discovering the Sky at the Longest wavelength (DSL)



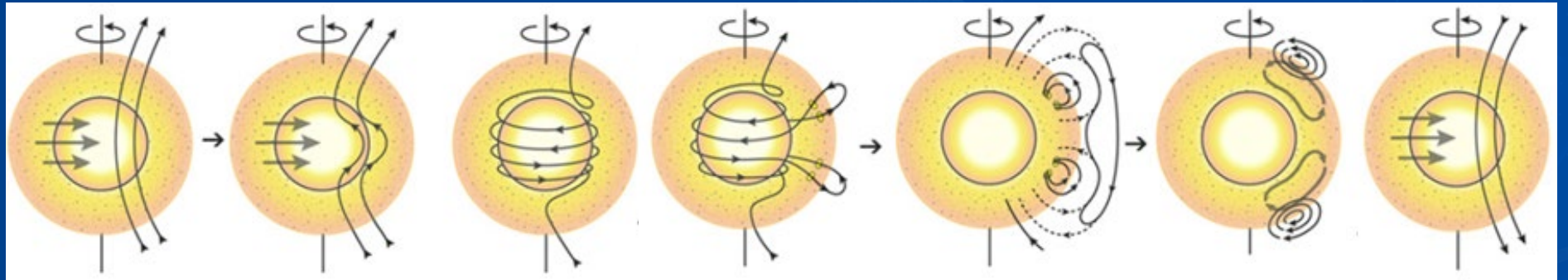
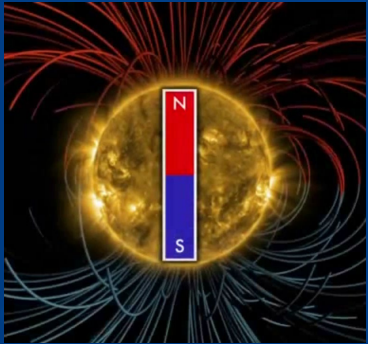
To open new frequency window, CMB imaging with MHz radio waves for early universe



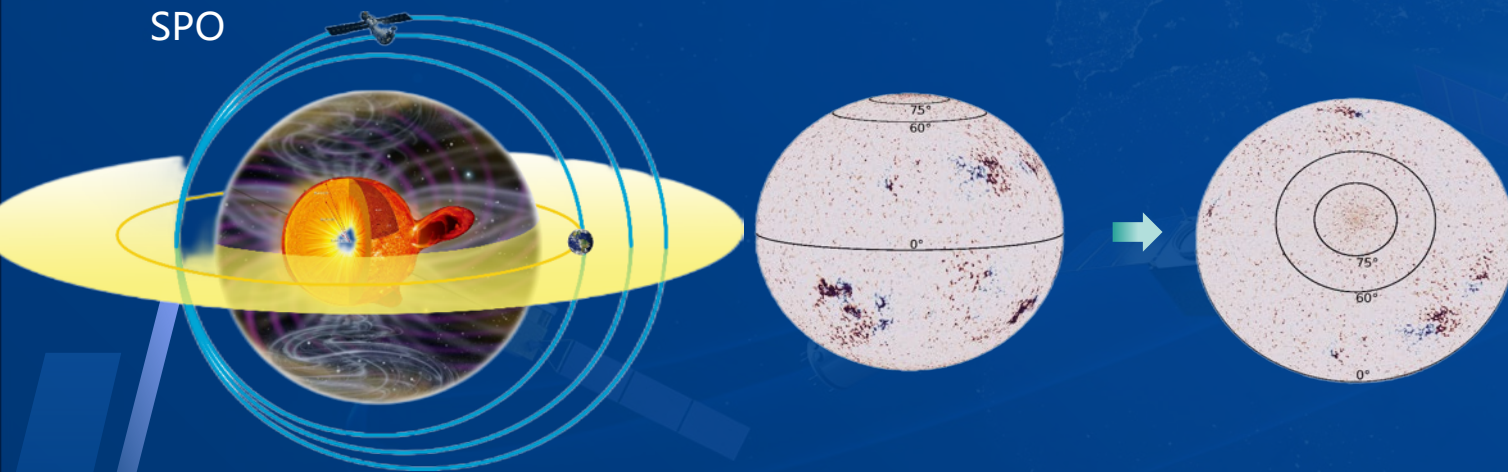
Payloads:

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

Solar Polar Orbit Observatory (SPO)

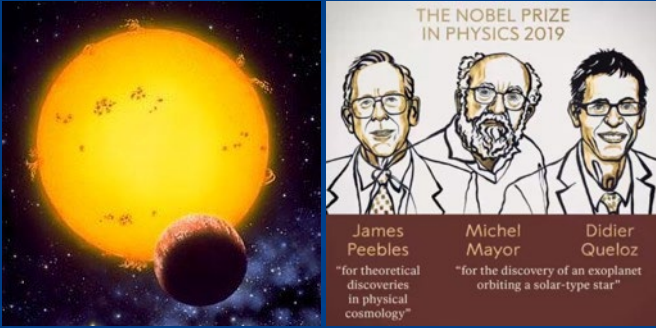


to obtain the frontal imaging of the solar polar region
exploring solar polar regions: properties, cause and consequence



- **Solar polar-orbit:** high orbital inclination ($>80^\circ$) and short period (<1.5 years)
- **Payloads:** Magnetic and Velocity Field Imager, Ultraviolet Telescope, White Light Coronagraph, Heliospheric Imager,...

The Earth 2.0 (ET)

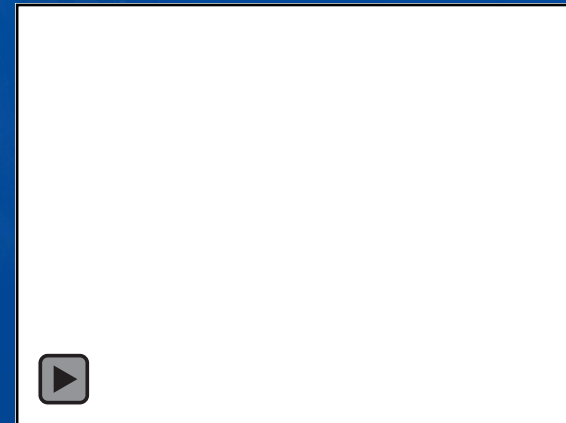
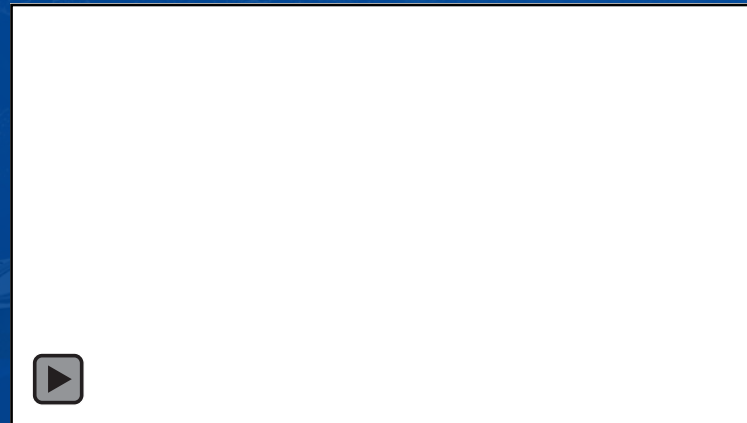
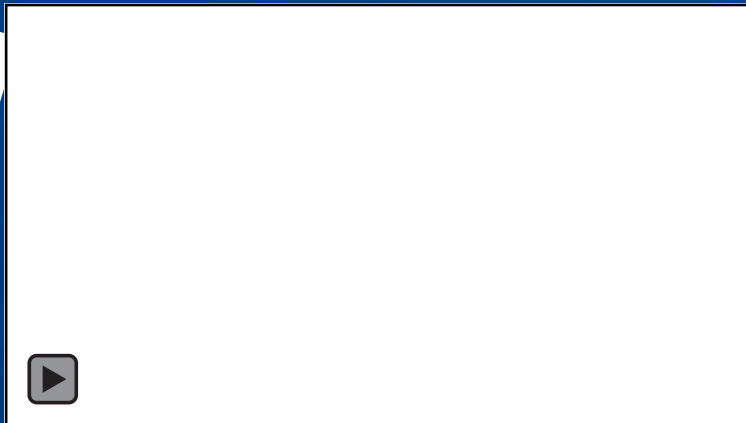


to discover habitable Earth-like planets outside our solar system

- **Orbit:** Earth-Sun L2
- **Payloads:**

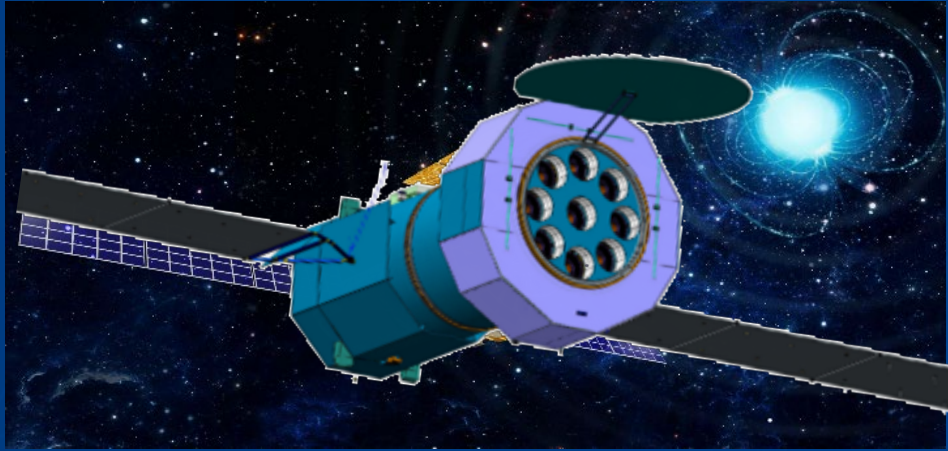
six 30-cm wide-field transit telescopes

one 35-cm microlensing telescope



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

Enhanced X-ray Timing and Polarimetry (eXTP)

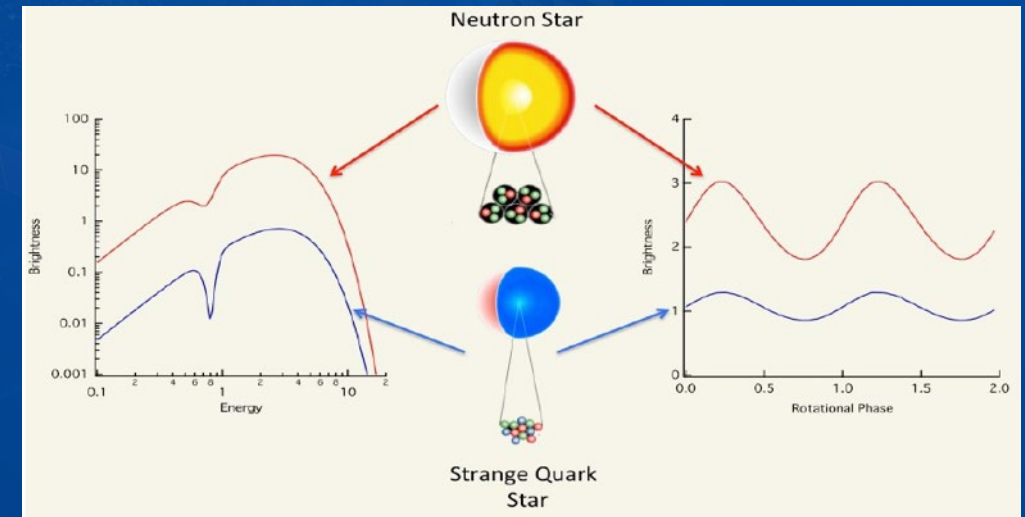
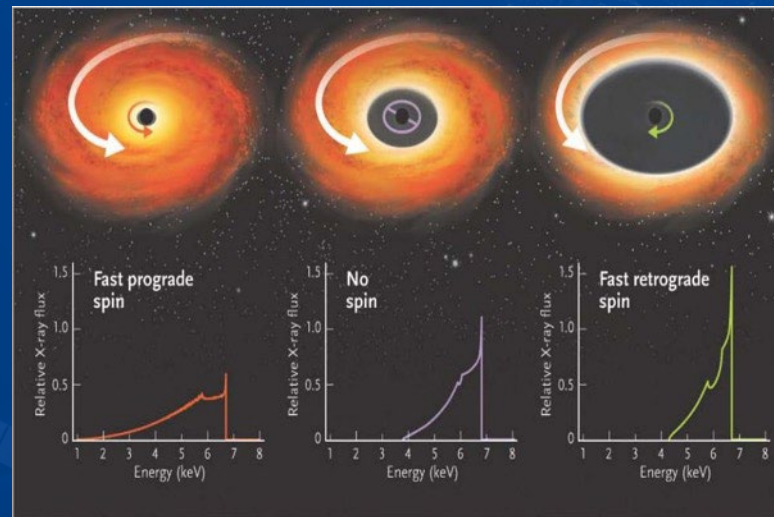
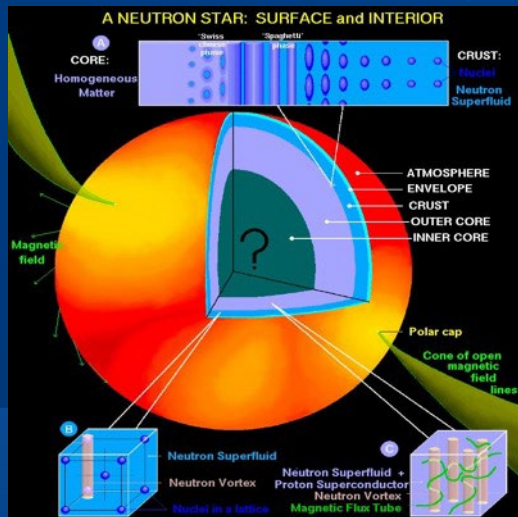


to explore the physics of the extreme universe:
extreme gravity, magnetism, density

Orbit: Highly Elliptical Orbit, Apogee > 110000 km

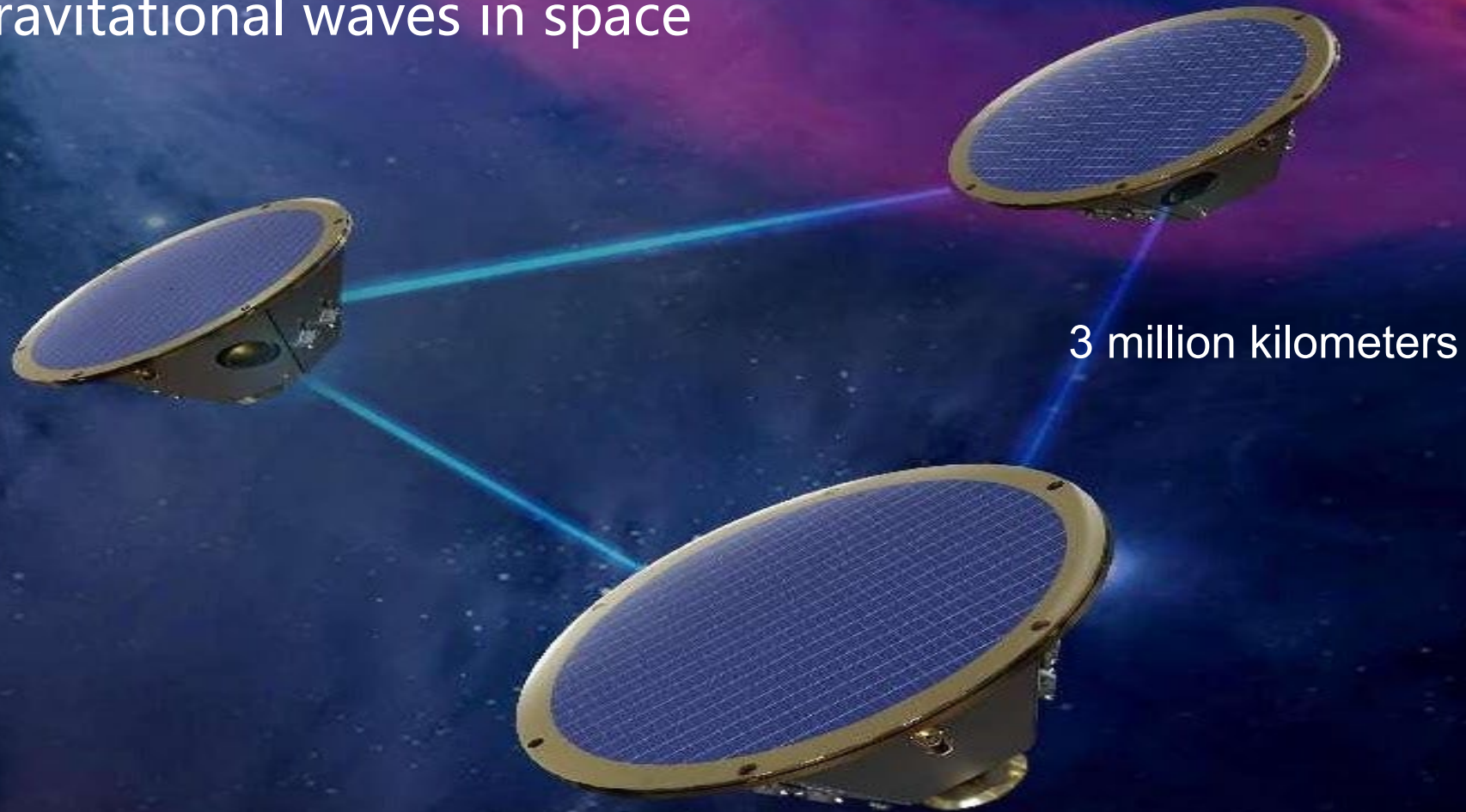
Payloads:

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



Taiji-2

aims to detect millihertz ($0.1\text{mHz} \sim 1.0\text{Hz}$)
gravitational waves in space



To explore the unknown,
we are open for cooperation.
It's for **science!**



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