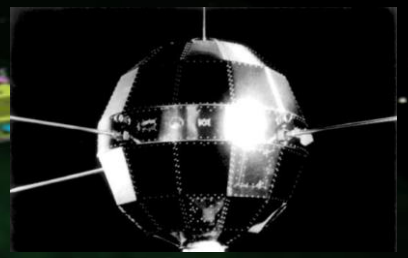


Progresses and future of China's Space Science Missions

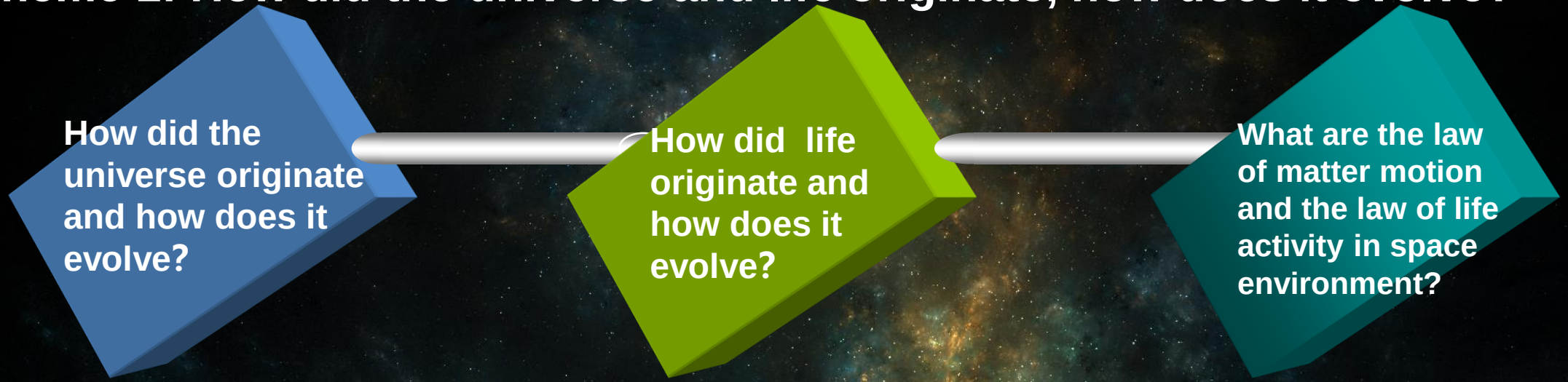
Xiaolong Dong

National Space Science Center, CAS

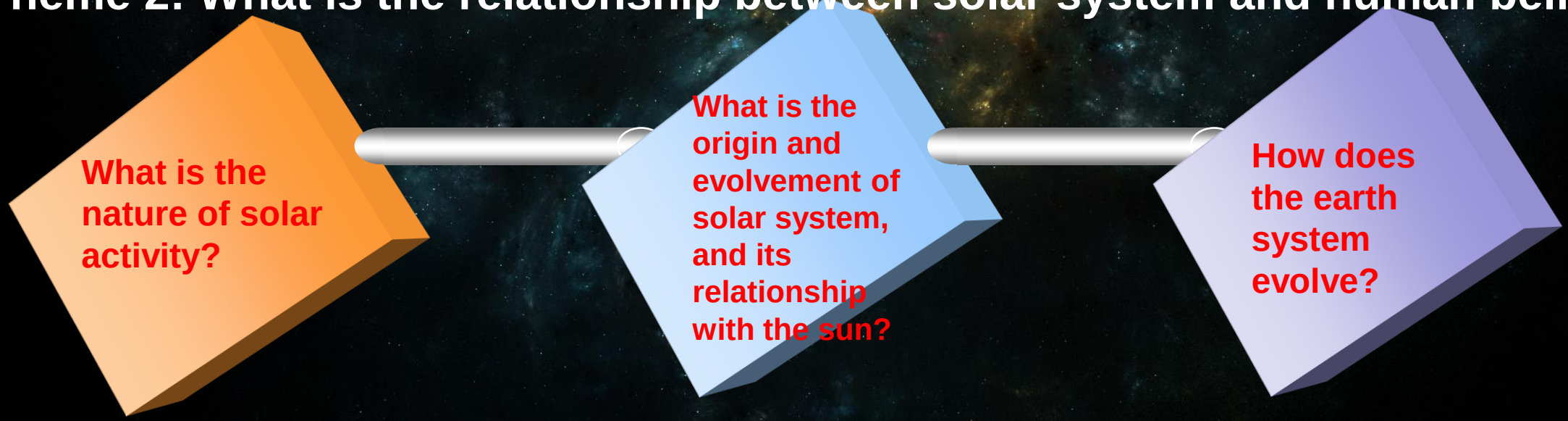
August 31, 2021

Themes of China's Space Science Missions

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



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



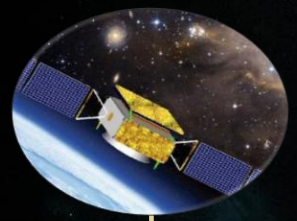
Roadmap of China's Space Science Missions

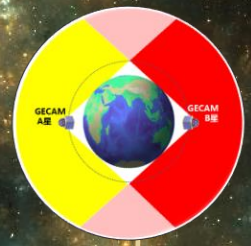
DAMPE

QUESS

GECAM

ASO-S





2015 2016 2017 2020 2021 2022 2024

SJ-10

HXMT

EP

SMILE

Strategic Priority Program on Space Science (I)

Strategic Priority Program on Space Science (II)

DArk Matter Particle Explorer (DAMPE)

Launch: Dec. 17, 2015

- Operation for 3 yrs
- Extension of 2 yrs

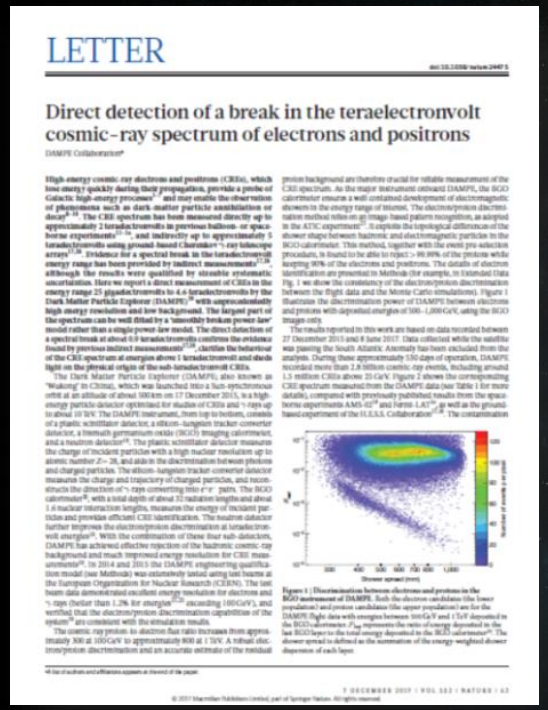
悟空 / Monkey King
悟：understanding
空：space

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

Recorded 6.15 billion cosmic rays events with broad and fine energy spectrum

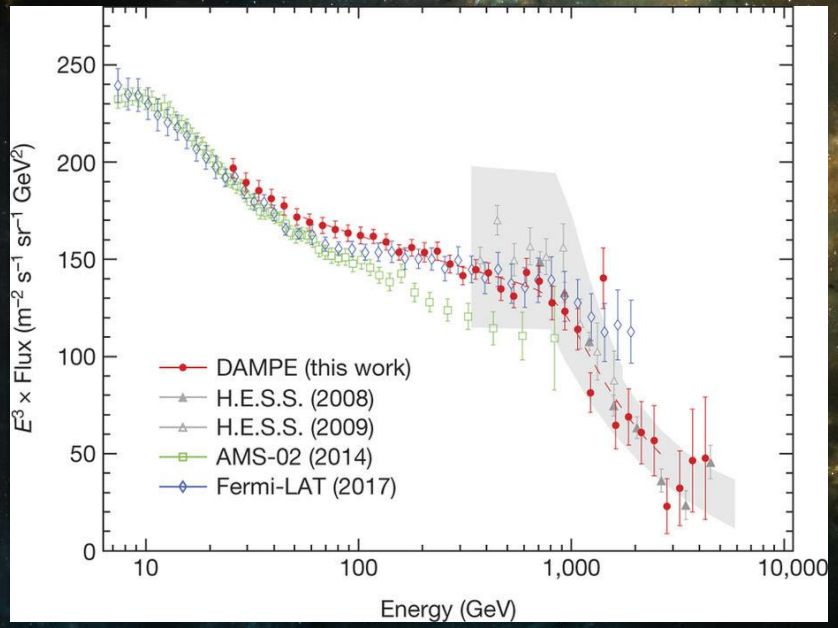
Direct detection of a break in the Tev cosmic-ray spectrum of electrons and positrons

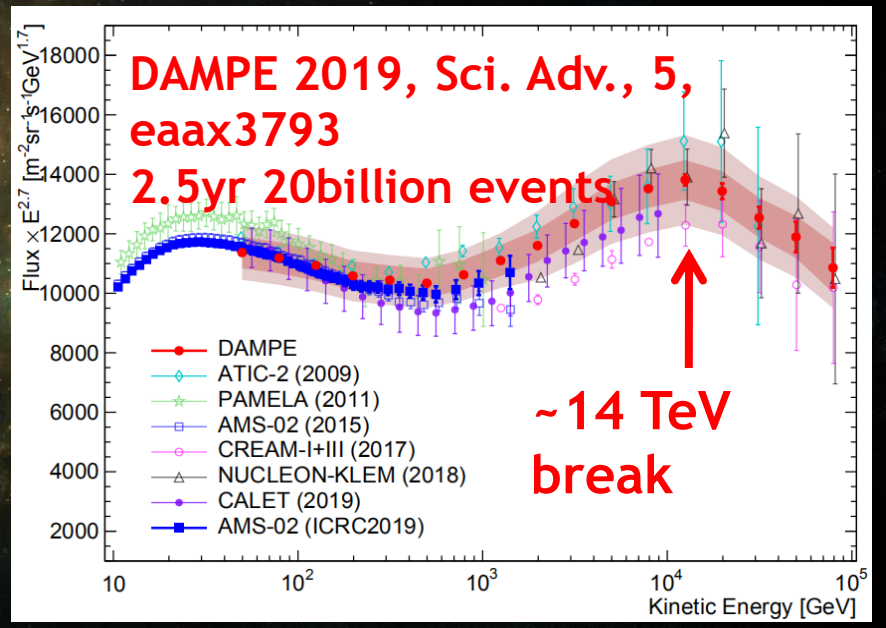
Detection of a spectral break at ~10 TeV in the proton spectrum (2019)



LETTER

Direct detection of a break in the teraelectronvolt cosmic-ray spectrum of electrons and positrons





DAMPE Collaboration, *NATURE*, P63-66, VOL 552, Dec. 7, 2017

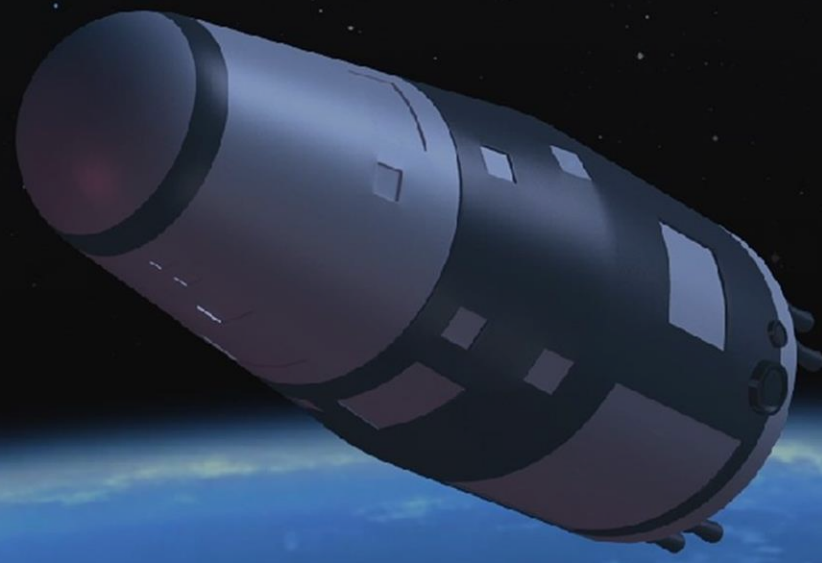
Sci Adv 5(9) ,2019

Recoverable Satellite for Microgravity and Space Life Sciences (SJ-10)

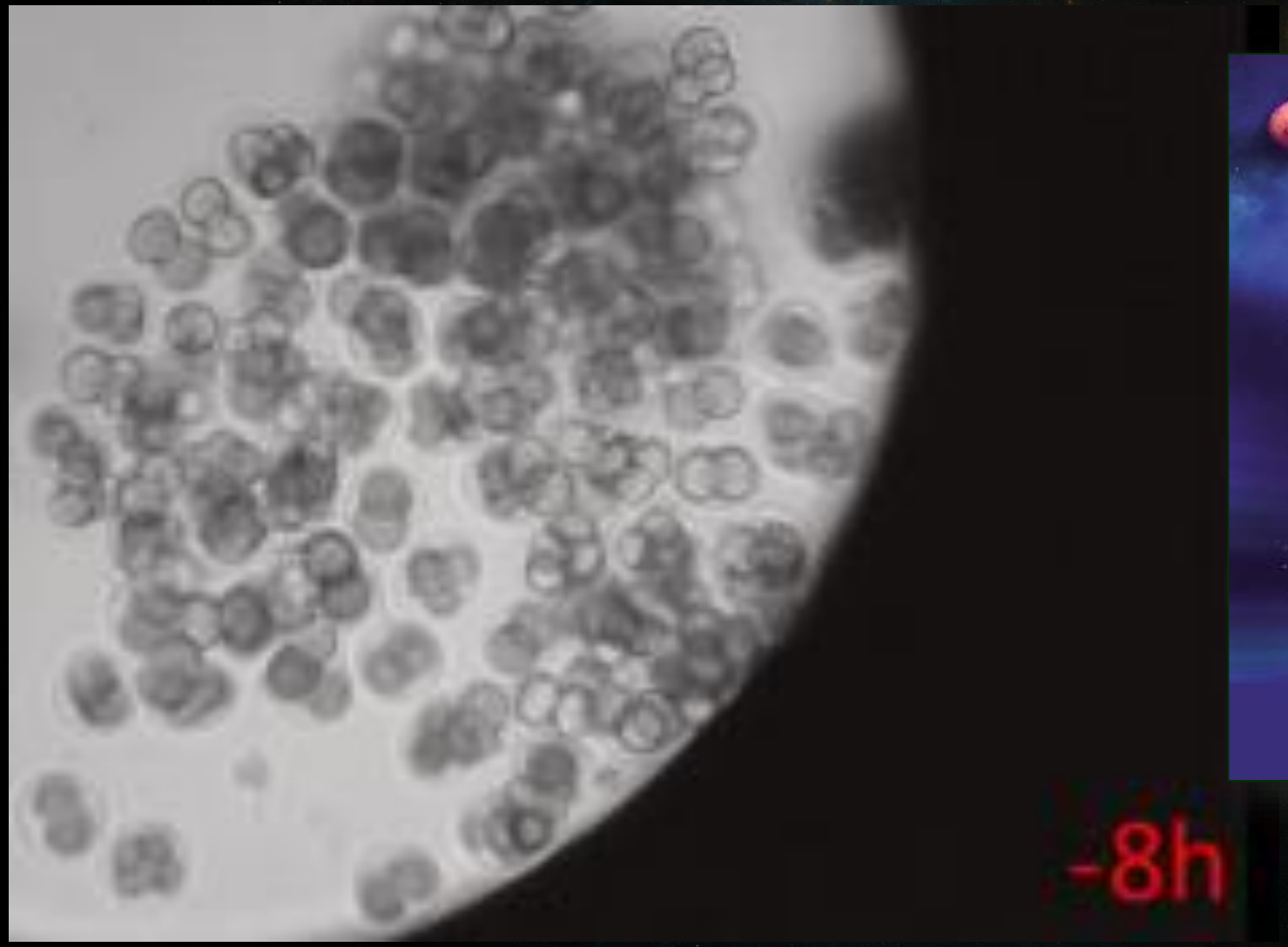
Mission in operation April 6-18, 2016

The 24th recoverable satellite of China, provides 19 space microgravity experiments

- Microgravity fluid physics
- Microgravity combustion
- Space material
- space radiation effects and space biotechnology

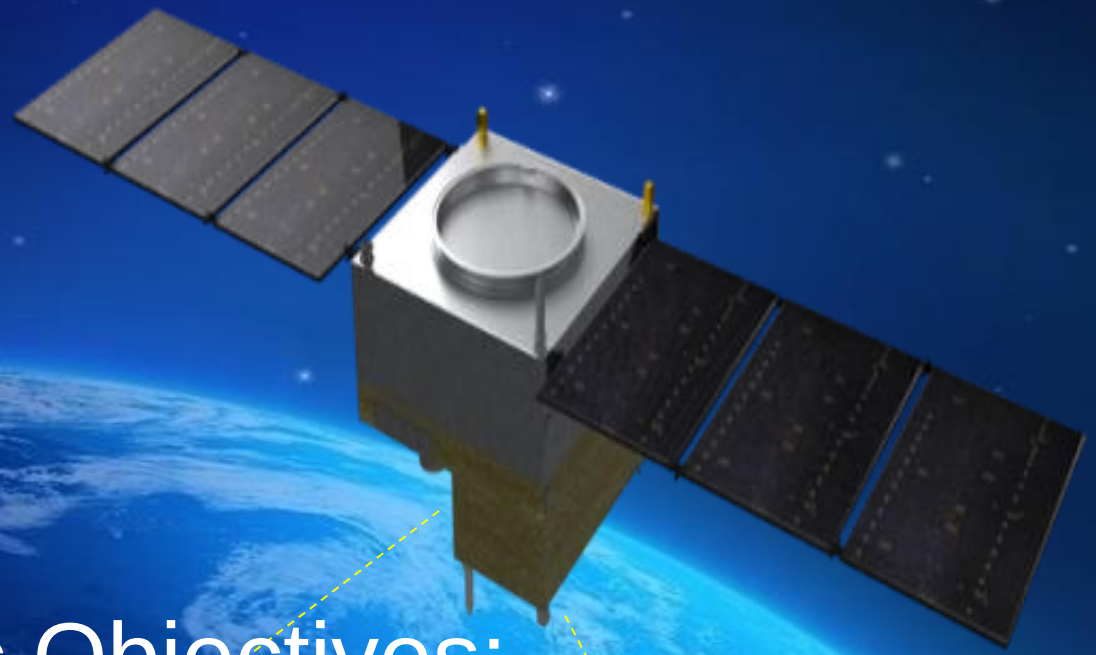


Development of mouse embryos in space



National Science Review, 2020, 7, 1437-1446

QUESS (QUantum Experiments at Space Scale)



- Scientific Objectives:
  - –Implementation of long-distance quantum communication network
  - –Quantum entanglement distribution and quantum teleportation
  - –fundamental tests of the laws of quantum mechanics

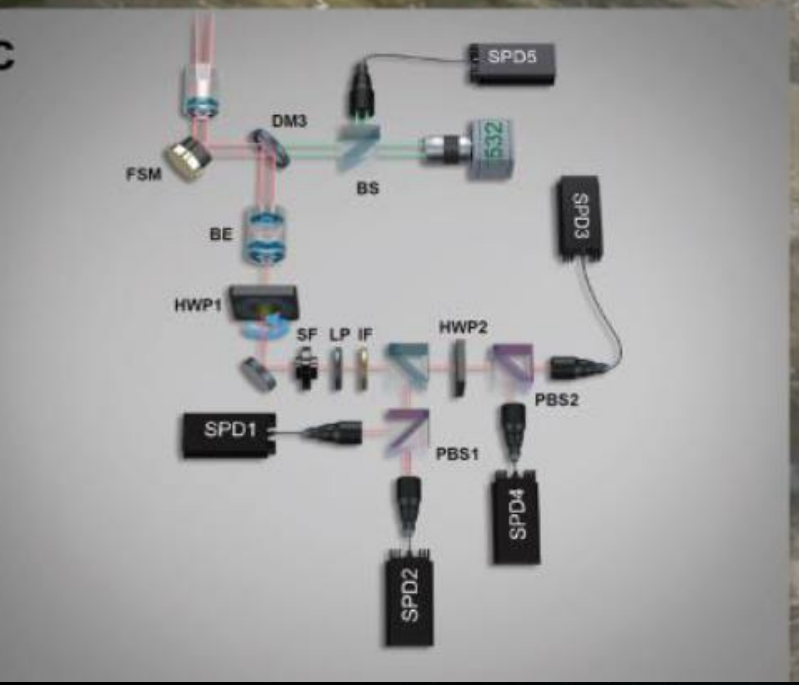
- Launch: Aug. 16, 2016
- Orbit：500km, sun-synchronous
- Status：in extended operation

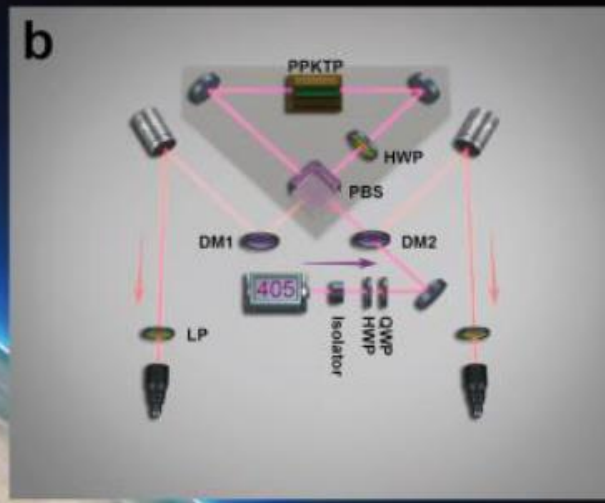
Entanglement-based secure quantum cryptography between two ground stations separated by 1120 km was demonstrated

. Nature, 2020, 582: 501-505

Nanshan

1120 km





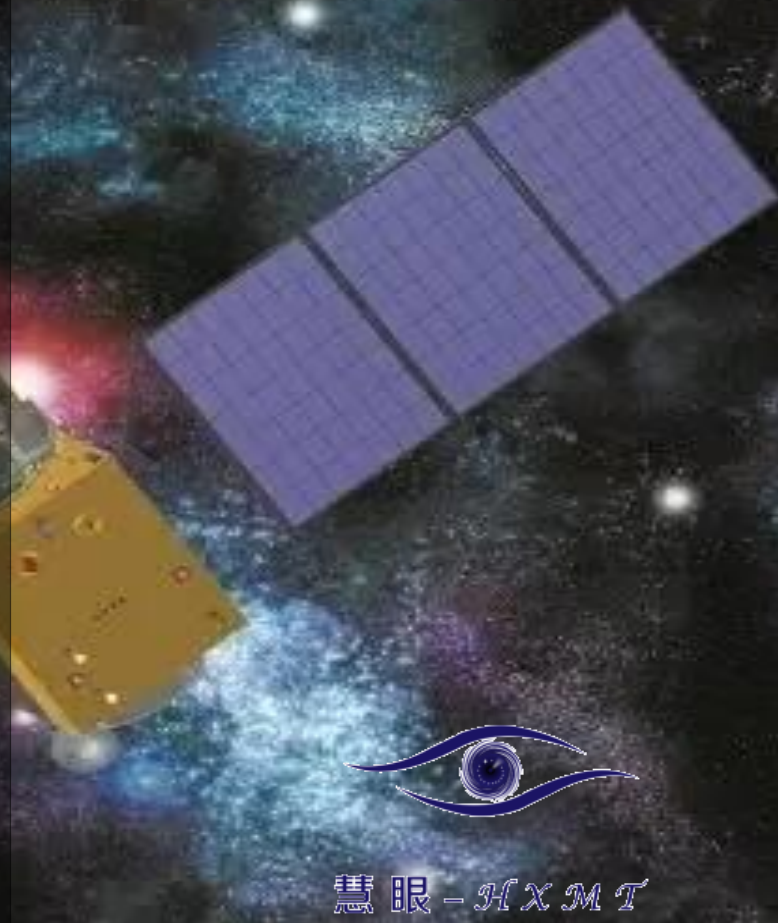
An integrated space to ground quantum communication network over 4600 km was demonstrated

Nature, 2021, 589: 214-219

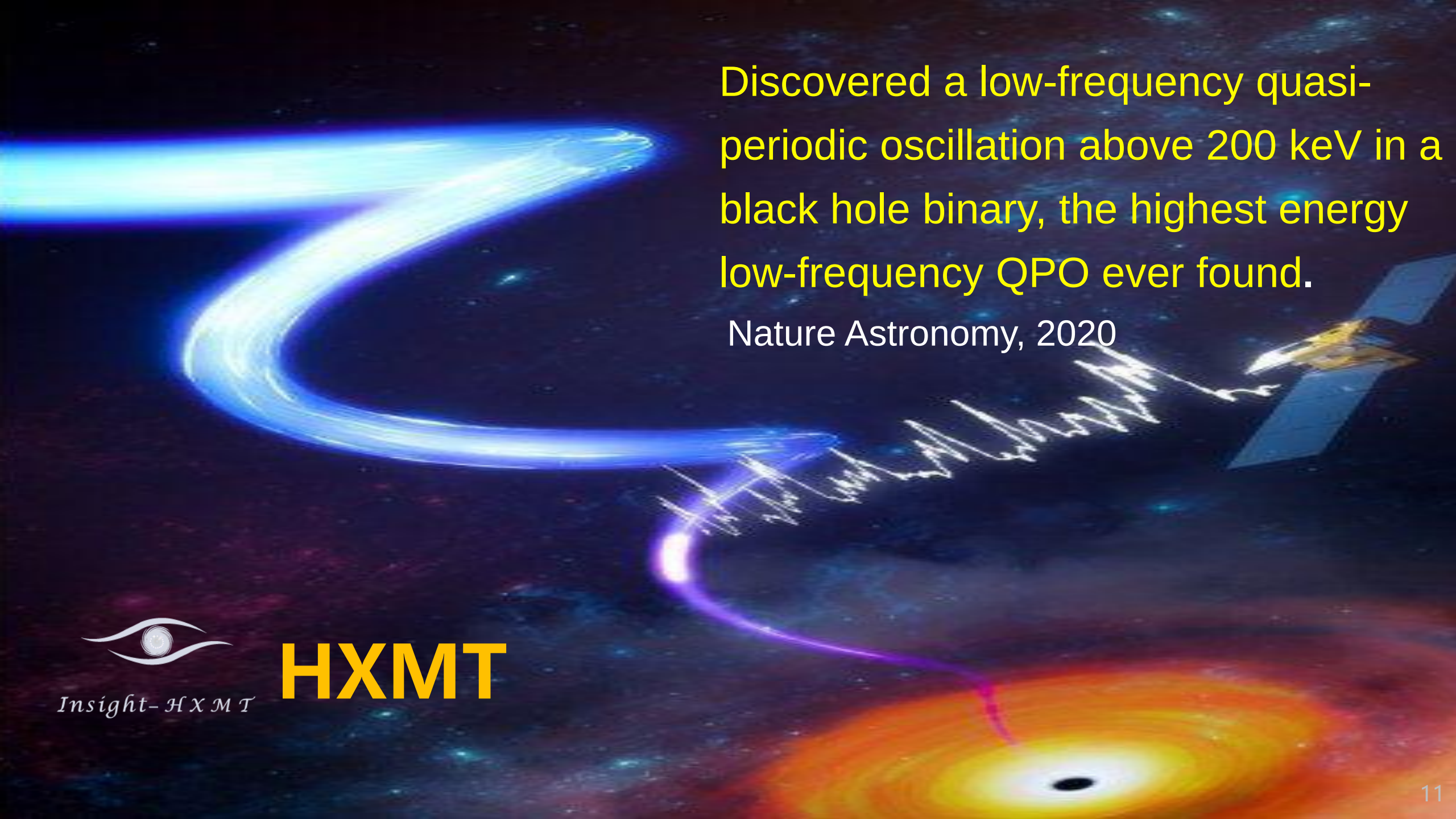
Hard X-ray Modulation Telescope (HXMT)

Science Objectives

- **Galactic plane scan and monitor survey for** more weak & short transient sources in very wide energy band (1-250 keV)
- **Pointed observations**: High statistics study of bright sources and Long-term high cadence monitoring of XRB outbursts
- **Multi-wavelength Observations** with other telescopes
- GRBs and GW EM, FRB, etc.



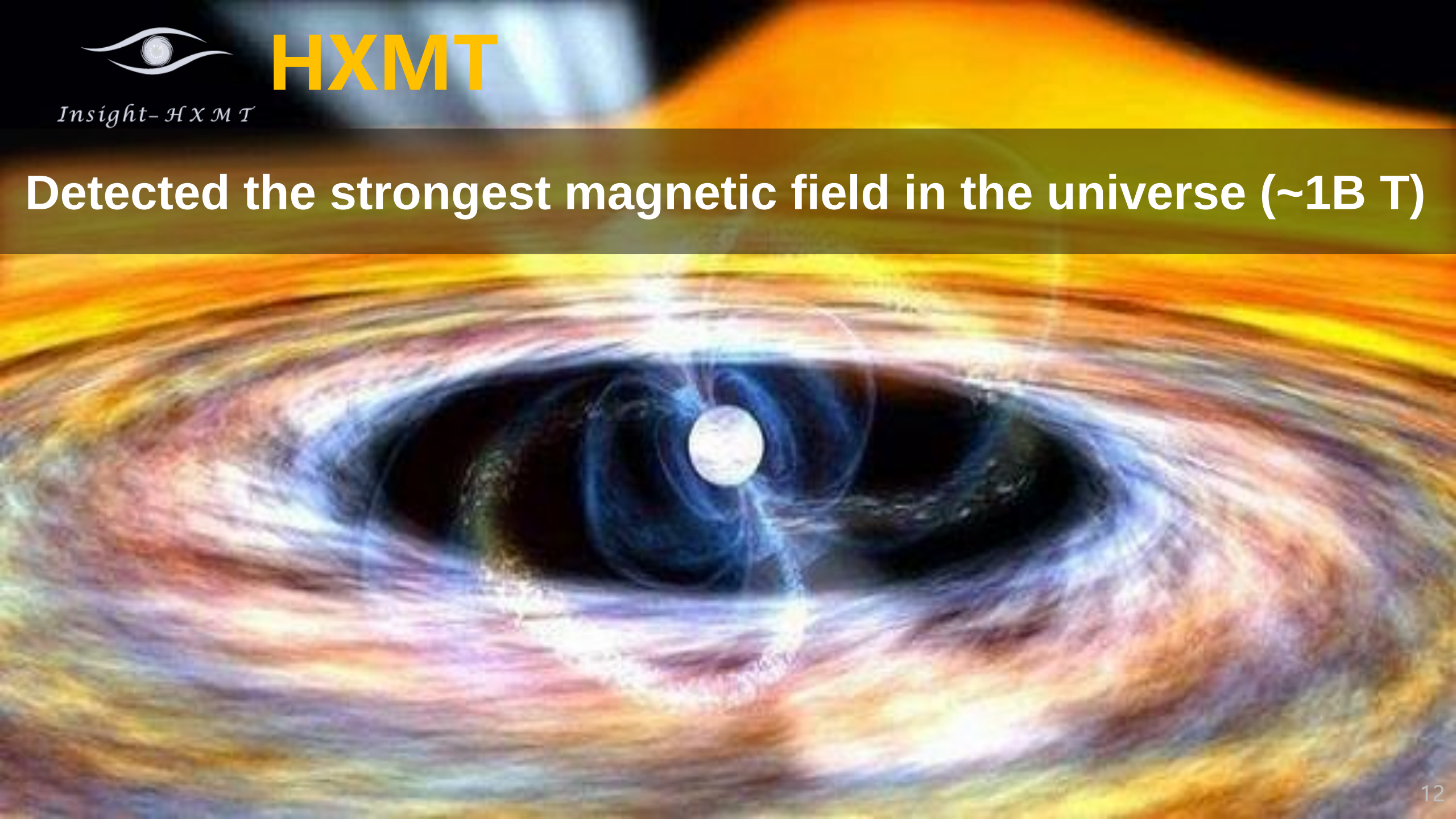
Launch： Jun. 15, 2017


Discovered a low-frequency quasi-periodic oscillation above 200 keV in a black hole binary, the highest energy low-frequency QPO ever found.
Nature Astronomy, 2020
Insight-HXMT
HXMT

Insight-HXMT

HXMT

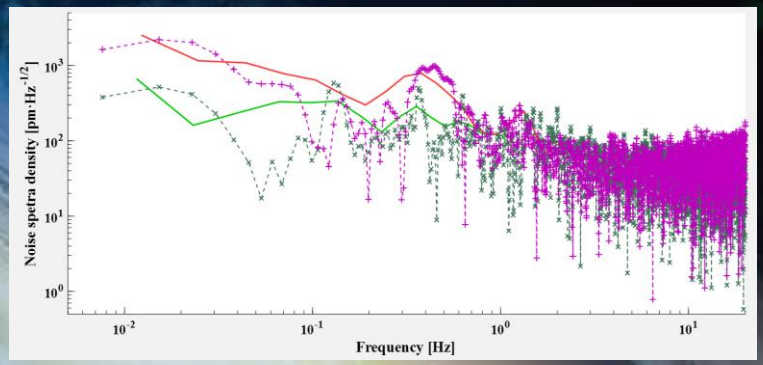
Detected the strongest magnetic field in the universe (~1B T)



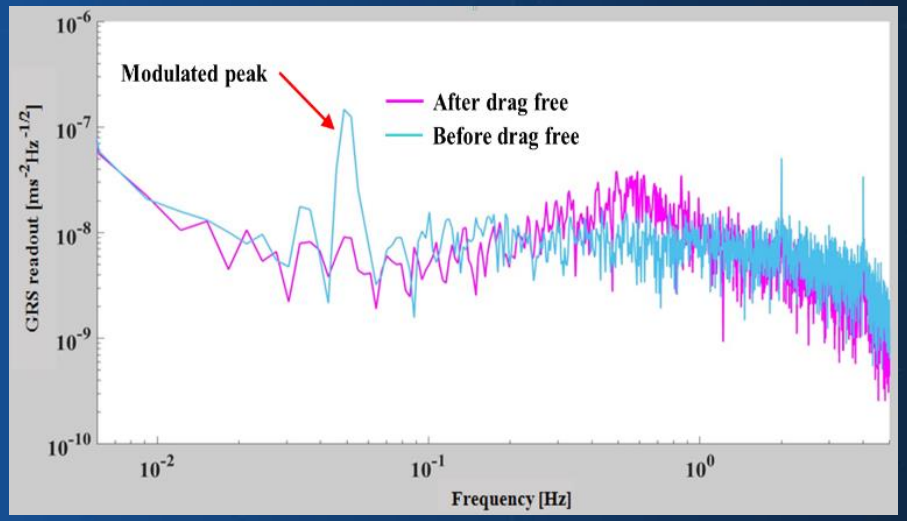
Taiji

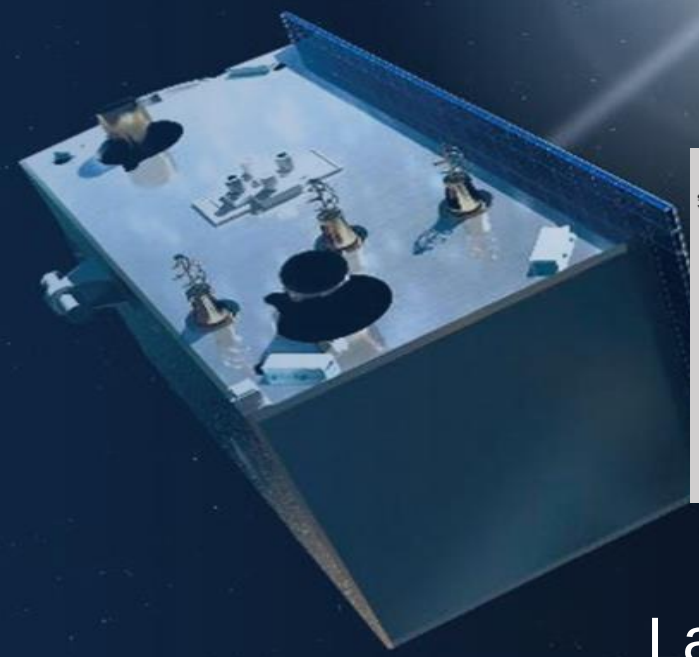
China's first technology demonstration mission for GW detection from space

Laser interferometer

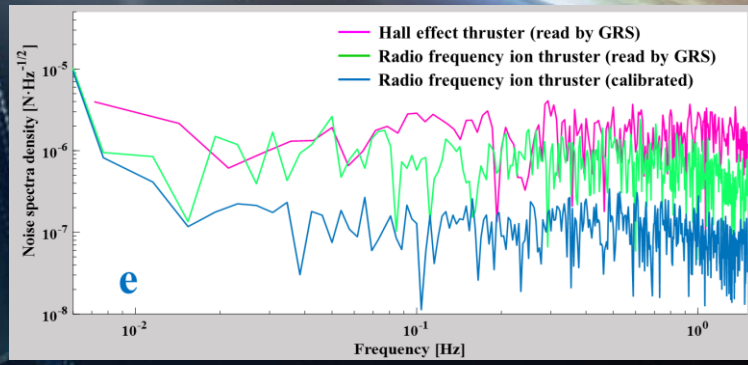


Drag-free control experiments





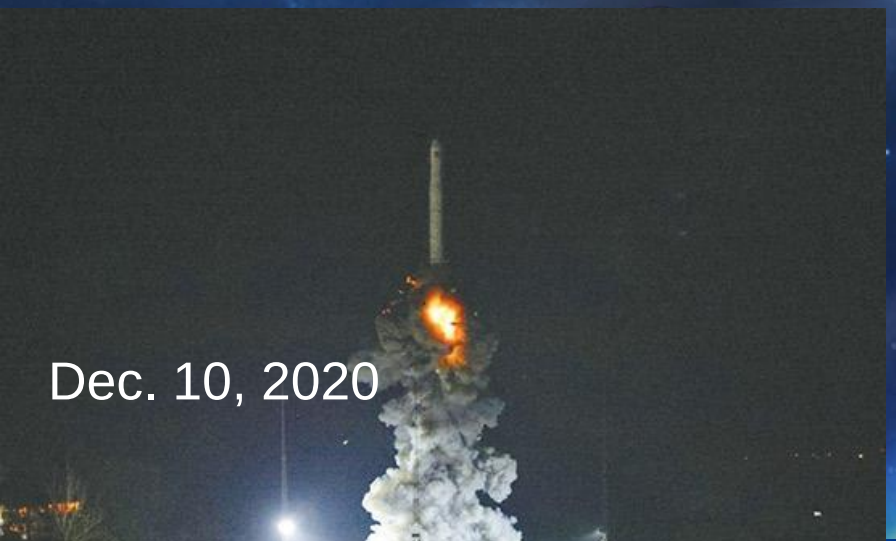
μ-Newton Thruster

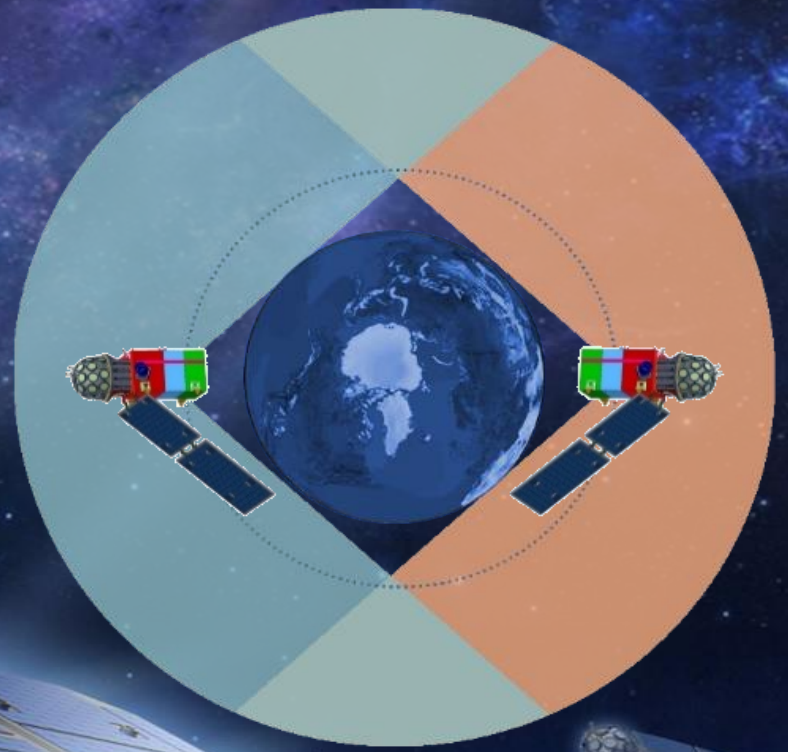


Launched 31 Aug, 2019

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

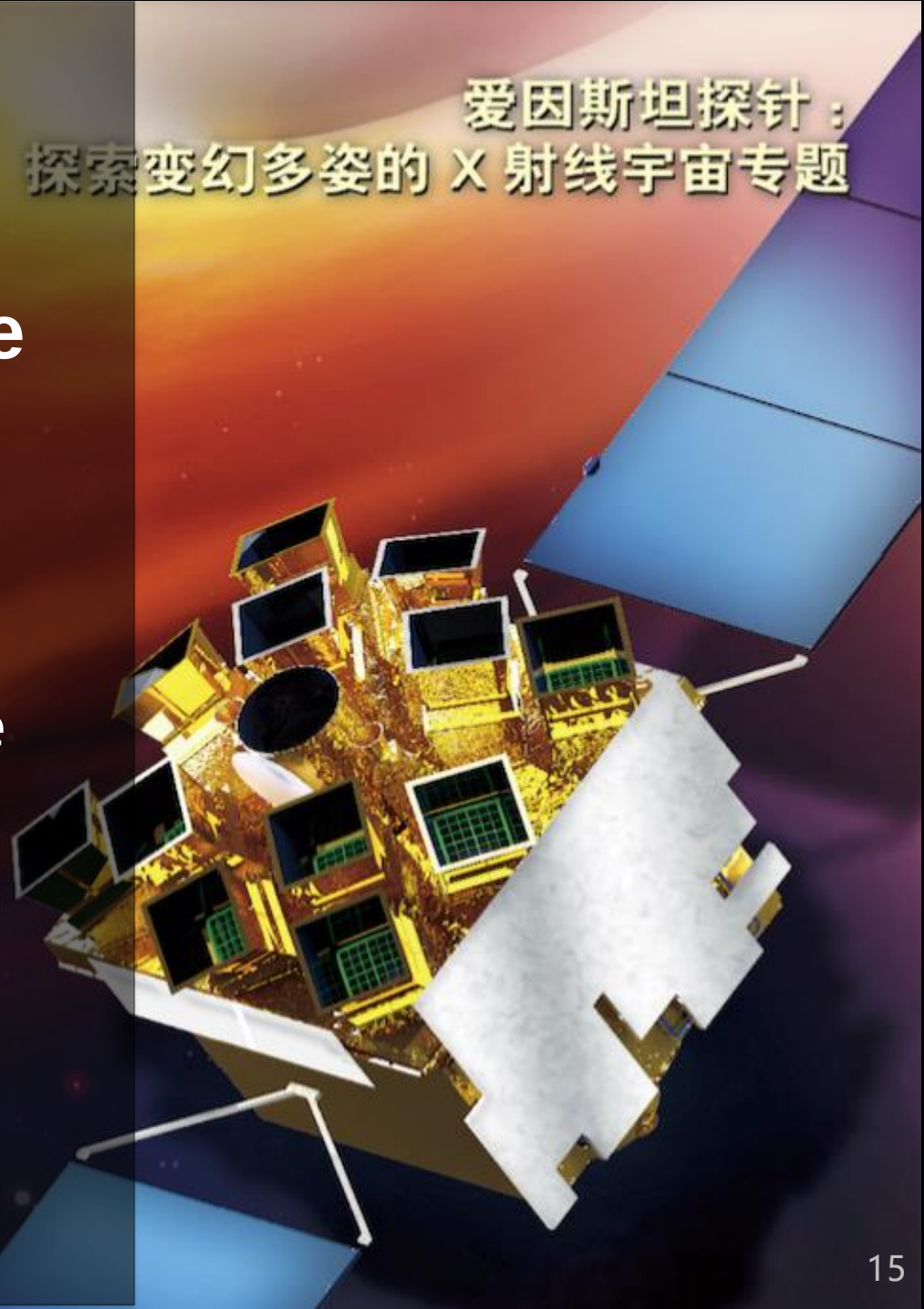
- Independent confirmation of GW event
- Accurate localization, host galaxy, redshift
- Astrophysical content of the GW source
- GW+EM, Cosmology, fundamental physics





- **Two satellites in conjugate orbit**
- **Monitor all-sky GRB**

Einstein Probe (EP)

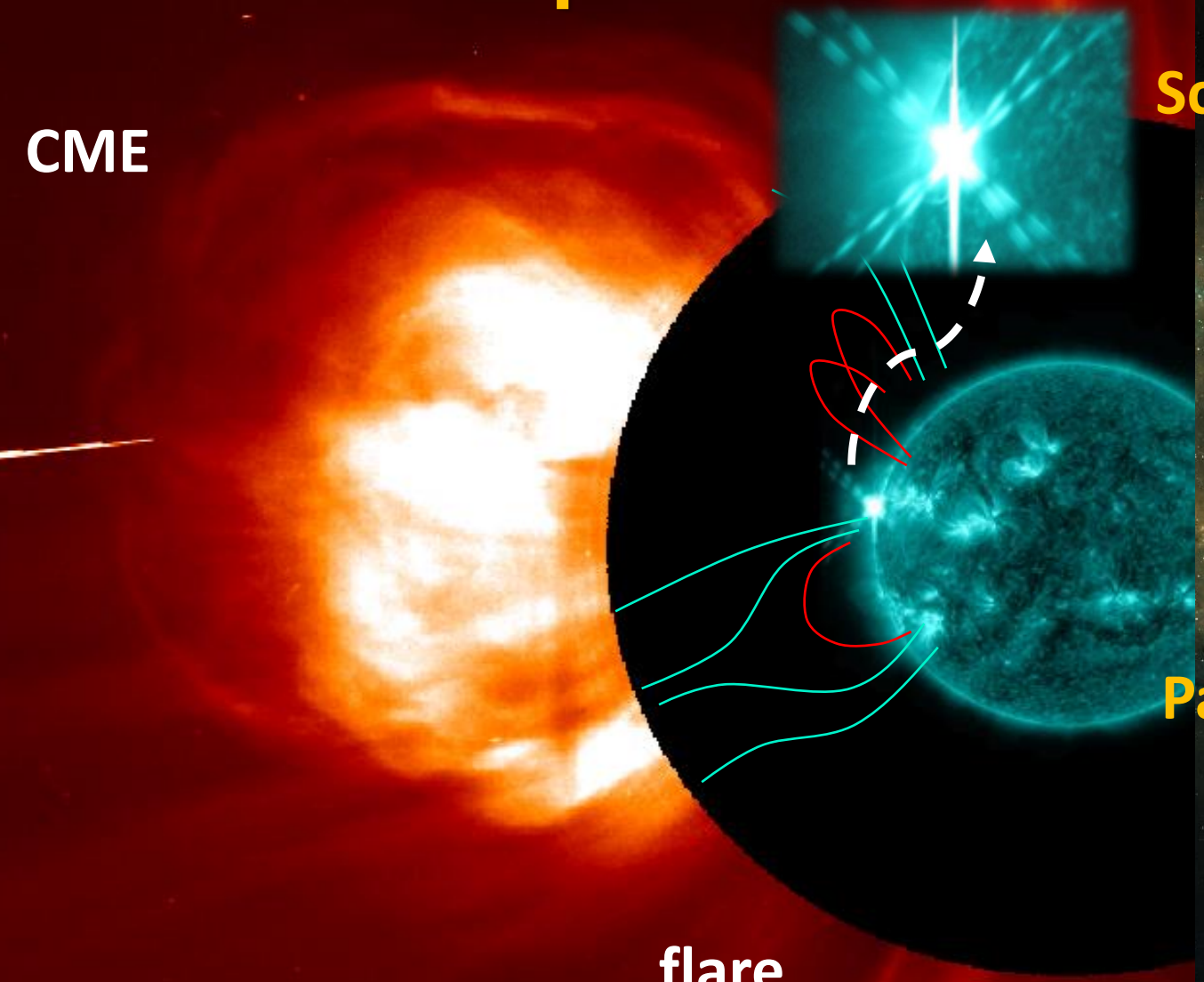


exploring the dynamic X-ray universe

- Carry out systematic survey of soft X-ray transients and variability of X-ray sources at unprecedented sensitivity and high cadence

- **Launch: 2023**

Advanced Space-borne Solar Observatory (ASO-S)



Launch: 2022

Science Objectives

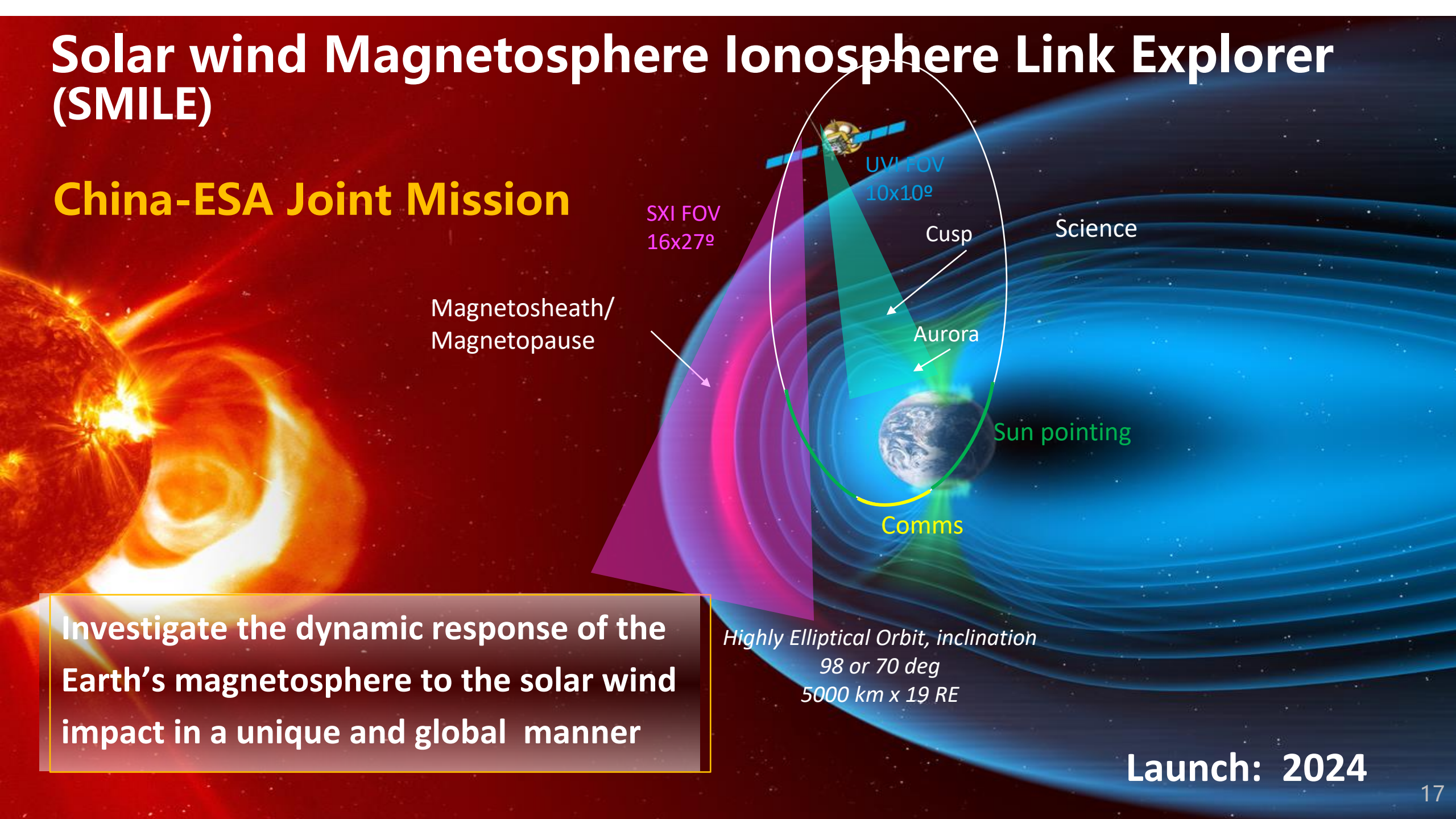
- Relationship between solar magnetic field and solar flares
- Relationship between solar magnetic field and CMEs
- Relationship between solar flares and CMEs

Payloads

- Full-Disc Vector Magnetograph (FMG): solar magnetic field
- Hard X-ray Imager (HXI): solar flare
- Lyman-alpha Solar Telescope(LST): CME

Solar wind Magnetosphere Ionosphere Link Explorer (SMILE)

China-ESA Joint Mission

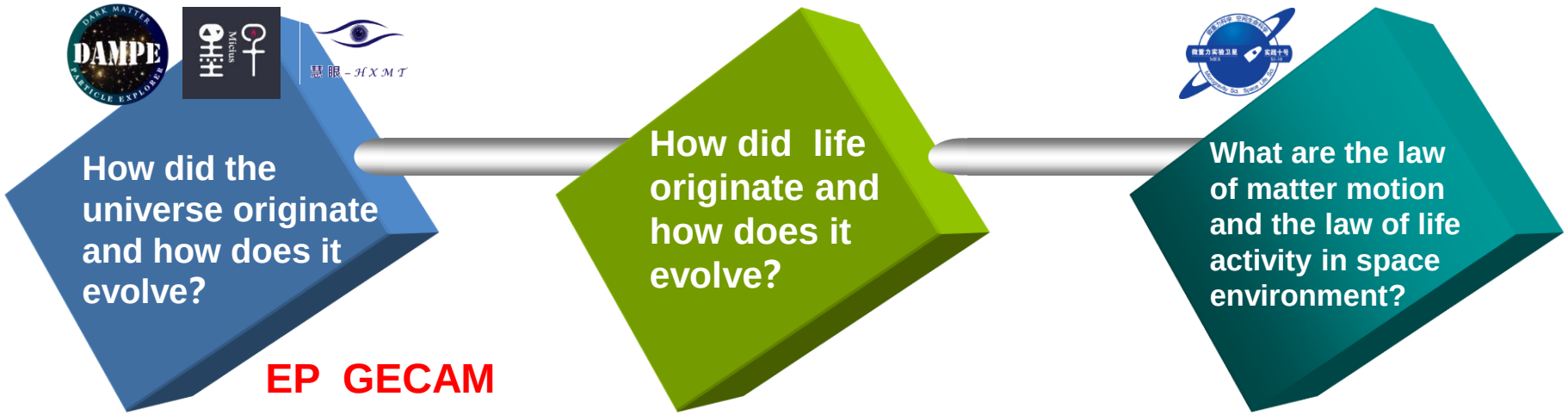


Investigate the dynamic response of the Earth's magnetosphere to the solar wind impact in a unique and global manner

Launch: 2024

Calling Taikong 2035

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



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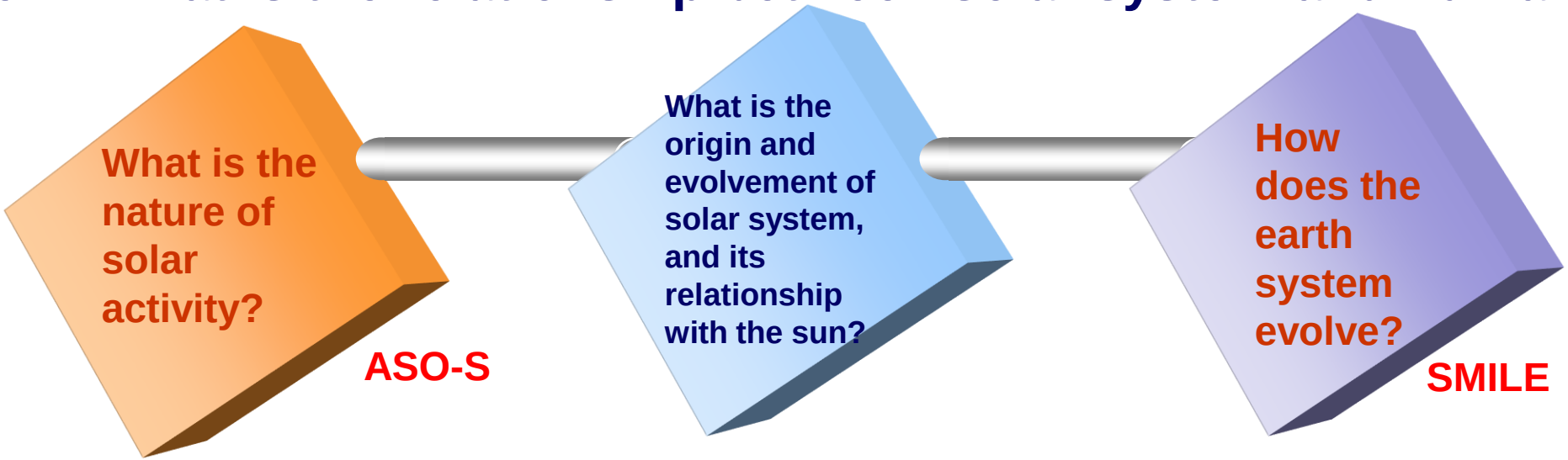
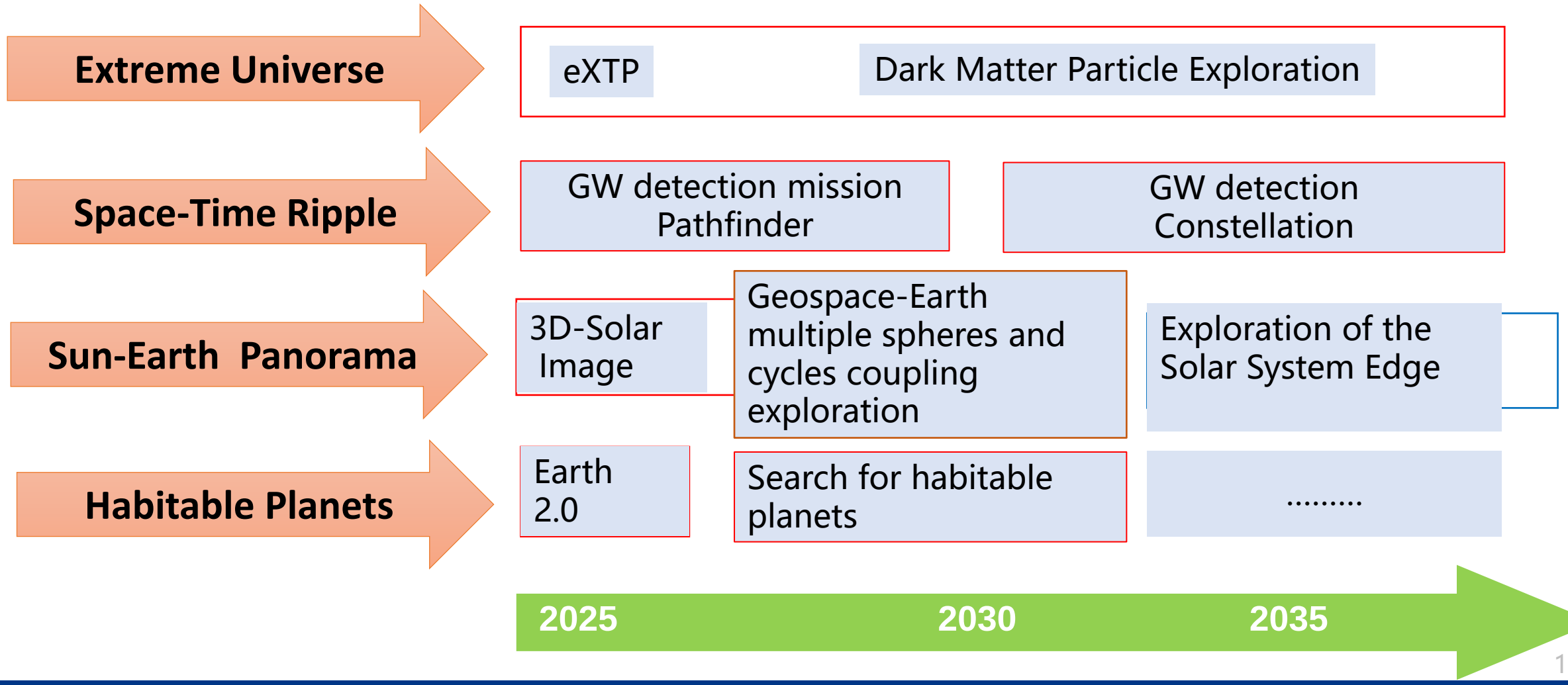


Calling Taikong 2035



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