

Space Technologies and Instrumentation

Photonics, Space, Lasers: Designing the Future Society – Vision 2040

Czech Pavilion EXPO Ósaka, Japan, 10th Sep 2025



Jiří Svoboda

Astronomical Institute of the Czech Academy of Sciences
Czech Space Programme: Science and International Collaboration

I will briefly review the space programme of Czechia with the focus on scientific missions in international collaboration with the European Space Agency and prospects for potential collaboration with Japan.



Ikkoh Funaki

ISAS/JAXA
Japanese Space Programme and Space Science Missions

After a brief overview of JAXA's space activities, ongoing/planned space science missions are introduced in the talk. Europe-Japan collaboration is mature in astrophysics and exploration, and some topics with the Czech research community are highlighted as an introduction to the session.



Yoshifumi Saito

ISAS/JAXA
In-situ plasma particle measurements in current and future planetary exploration

Technical aspects of in-situ plasma particle measurements for current and future planetary exploration are presented, together with the current status of Europe-Japan collaboration on BepiColombo arriving at Mercury next year.



Haruna Sugahara

ISAS/JAXA
Analytical Chemistry in Space: Sample Return and Onboard Mass Spectrometry

Chemical analysis of extraterrestrial materials reveals various information about the formation and evolution of the celestial bodies, and even the solar system itself. In my talk, I will introduce the analytical results of the returned sample from the asteroid Ryugu, which was brought back by the Hayabusa2 spacecraft, as well as the prospects for in situ chemical analysis on the celestial bodies in future solar system exploration missions.



Masafumi Imai

Institute of Atmospheric Physics of the Czech Academy of Sciences
Czech Contribution to the Exploration of the Solar System

We present our recent international collaboration research activities on the Solar System exploration in the Department of Space Physics, Institute of Atmospheric Physics of the Czech Academy of Science.



Yoshizumi Miyoshi

Nagoya University
Geospace Research by the Arase Satellite: Contributions to Space Weather Studies through Japan-Czech Collaboration

The Arase satellite has advanced space weather research through Japan-Czech collaboration, revealing dynamics of space radiation, aurora, and geospace. This talk highlights key findings and future Japan-Czech collaboration prospects.



Hirofumi Noda

Tohoku University
Scientific Highlights from the X-ray Imaging and Spectroscopy Mission (XRISM)

The XRISM satellite, launched on September 7, 2023, has achieved unprecedented high-precision X-ray spectroscopy in orbit. This talk will highlight key scientific results from various celestial objects observed with XRISM.



Norbert Werner

Masaryk University, Brno
Czech-Japanese collaboration in studying the Hot and Energetic Universe: From Hitomi/XRISM to future projects

I will summarise my involvement in the science teams of Hitomi and XRISM missions, in the latter of which I served as ESA Guest Scientist, and how it led to important new collaborations.



Kazuhiro Nakazawa

Nagoya University
Gamma-ray detector development in Japan-Czech collaborations: space and more

Japan and Czech Researchers have a long record of collaboration in gamma-ray detectors onboard micro-satellites. Using similar detector technologies, in Japan we are also observing on-ground Thundercloud gamma rays. This year, Czech researchers reported the first detection of a gamma-ray glow from thundercloud in Czechia, which might be indicating a new field for further possible collaborations.



Teruaki Enoto

Kyoto University
From Lunar water exploration to astrophysics from the Moon – MoMoTarO

We are developing a new project to explore water resources on the moon using neutrons generated by cosmic-ray collisions with the lunar surface, applying technologies developed for astronomical science.



Peter Oberta

Rigaku, Dolní Břežany
Development of X-ray optics

Rigaku develops advanced space optics, including Wolter-type replicated optics for high-resolution X-ray imaging and Lobster-eye optics for wide-field applications. Our expertise extends to multilayer deposition on space-qualified mirrors, enabling enhanced reflectivity and performance across a broad energy range. These technologies support cutting-edge astrophysics missions and next-generation space instrumentation.

Potential of cooperation between
Czechia and Japan
in space activities



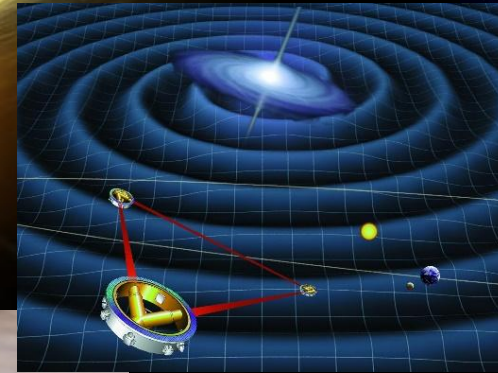
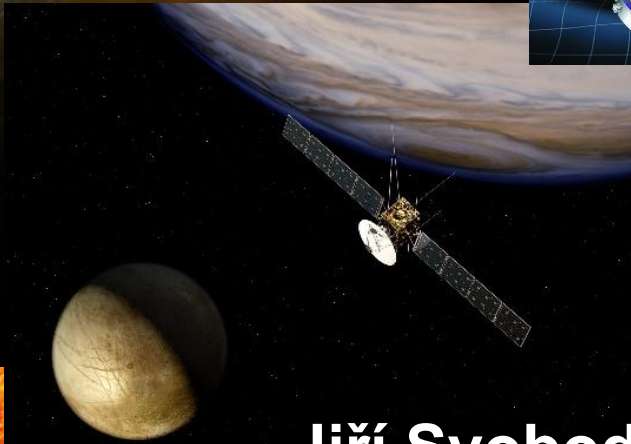
Czech Space Programme: Science and International Collaboration



czechia



EXPO 2025 OSAKA



Jiří Svoboda

Astronomical Institute of the Czech Academy of Sciences

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Space Technologies and Instrumentation

Photonics, Space, Lasers: Designing the Future Society – Vision 2040

Czech involvement in international scientific space projects

- Czechia - part of the European Space Agency (ESA)
- we are involved in all major current and planned scientific space missions by ESA
- one of the Strategy research topics of CAS: Space for Humankind

21 research topics

12 institutes of CAS

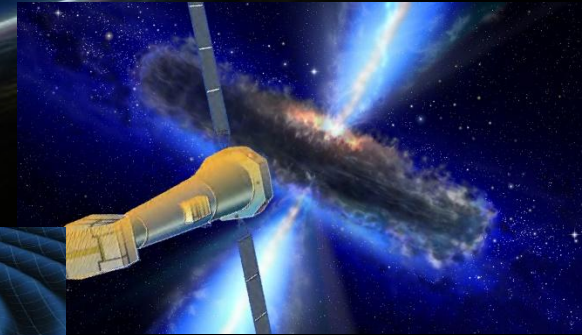
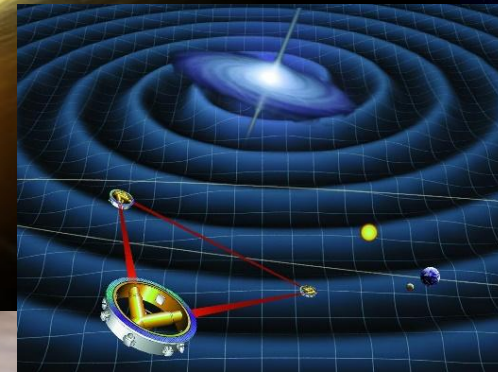
14 partners



czechia



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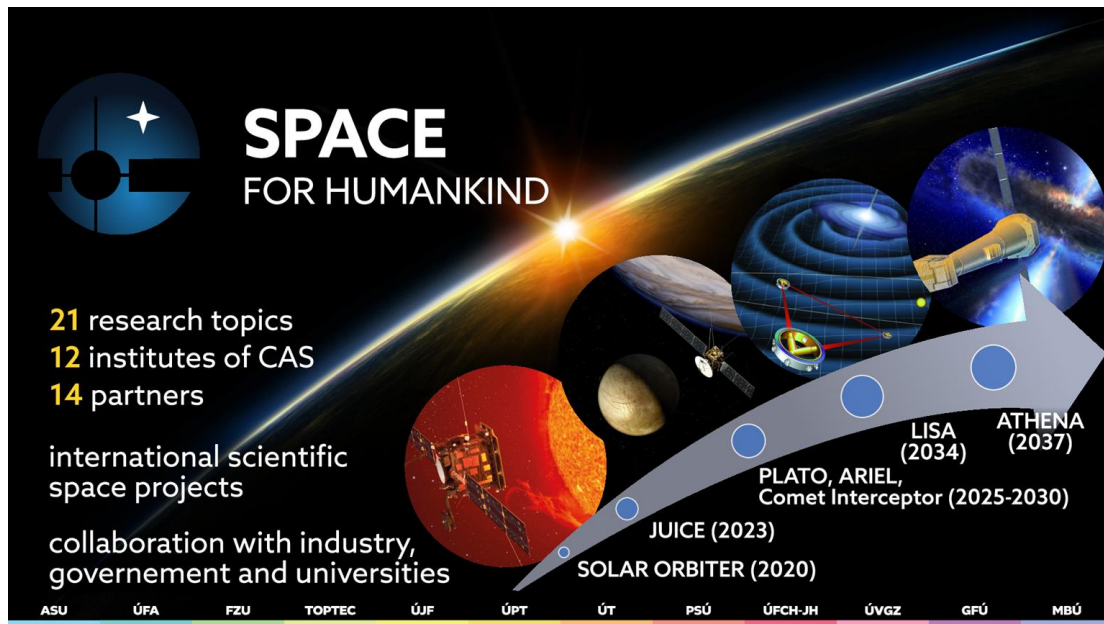
*2023: JUICE
Solar Orbiter

*2025-30: PLATO, ARIEL,
Comet Interceptor, EnVision

*2030-35: LISA, Vigil

*2035-40: ATHENA

Major ESA space missions
with the Czech contribution



RESEARCH PROGRAMME

SPACE FOR THE HUMANKIND

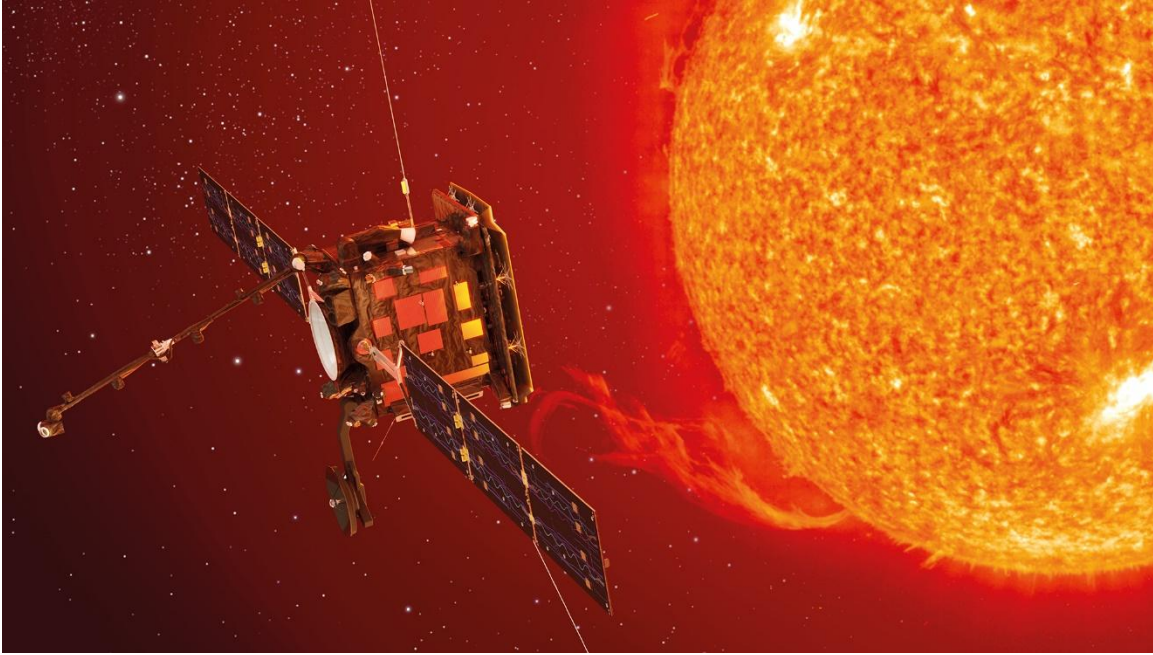
(since 2017)

Research Topics

- **Earth observations**
 - remote sensing, ionosphere, magnetosphere
- **Sun and Solar System Exploration**
 - Sun, Solar wind, asteroids, comets, Venus, Mars, Jupiter and its icy moons
- **Challenges and risks of the space environment**
 - human flights, space radiation
- **Research of distant Universe**
 - black holes, galaxies, exoplanets
- **Development of Space Technologies**

Goals

- To increase the involvement and collaboration of CAS institutes in space research
- To maximize benefits from membership of the Czech Republic in the European Space Agency (ESA) and the European Southern Observatory (ESO)
- To strengthen links between the CAS and industry
- Promotion of space research and astronomy to the professional and general public



Czech contribution to ESA scientific missions

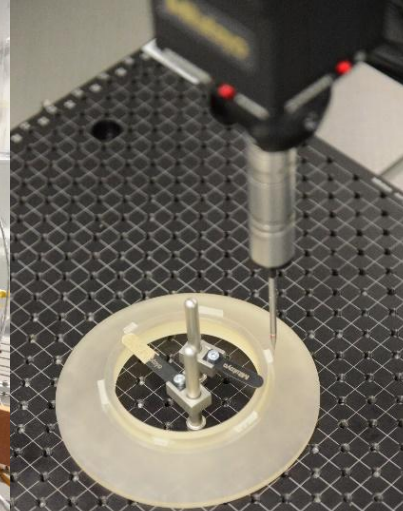
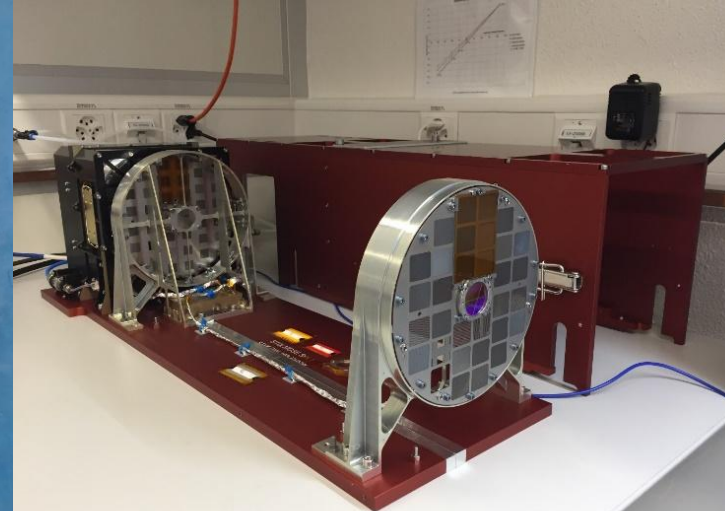
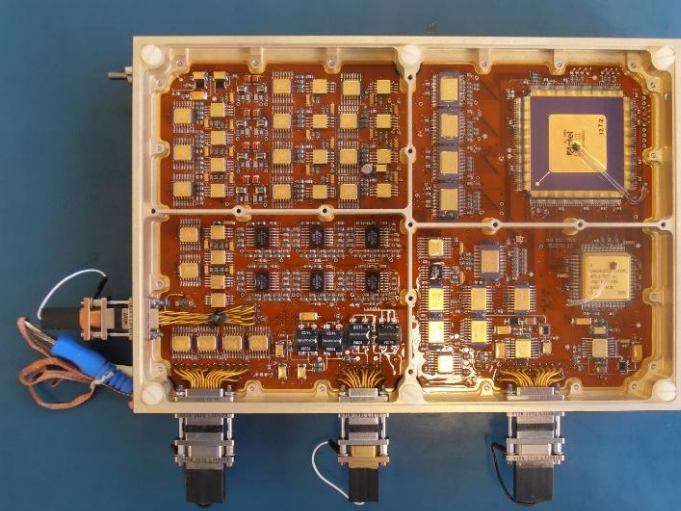
Examples and outputs

- **Solar Orbiter**
 - will observe the Sun from a unique perspective (polar orbit)
 - Czech contribution to 4/10 scientific instruments

RPW/TDS: space electronics

STIX: power supply & onboard software

METIS: precise optics – mirror for coronagraph

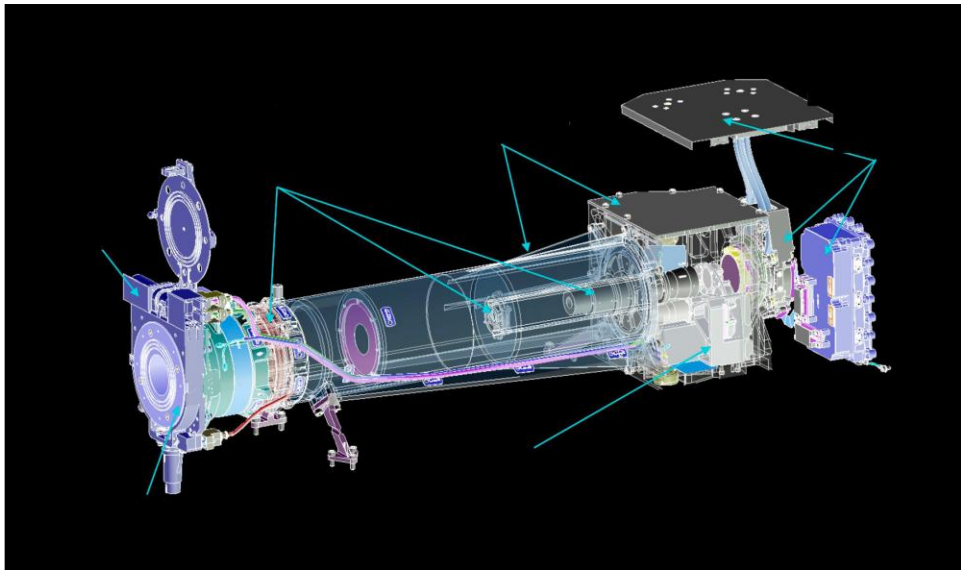
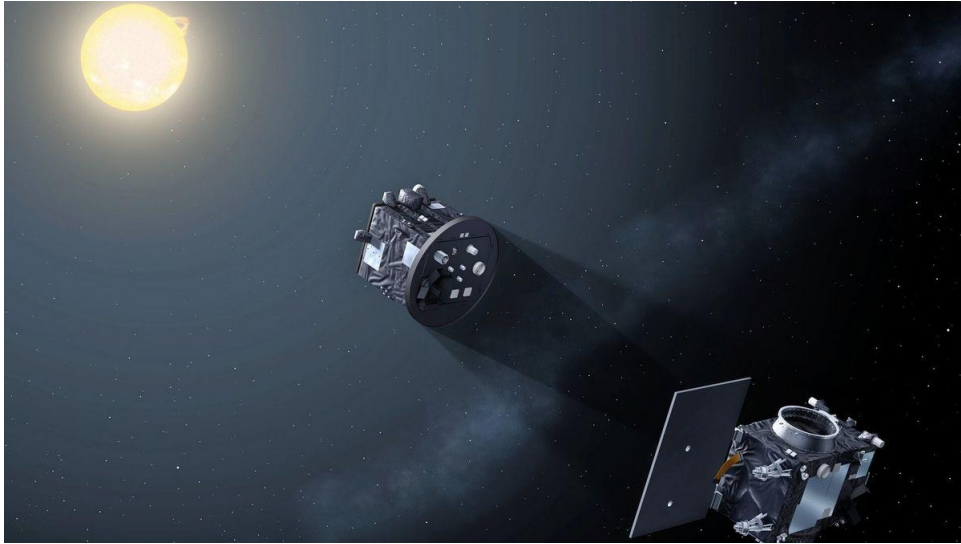


Czech contribution to ESA scientific missions

Examples and outputs

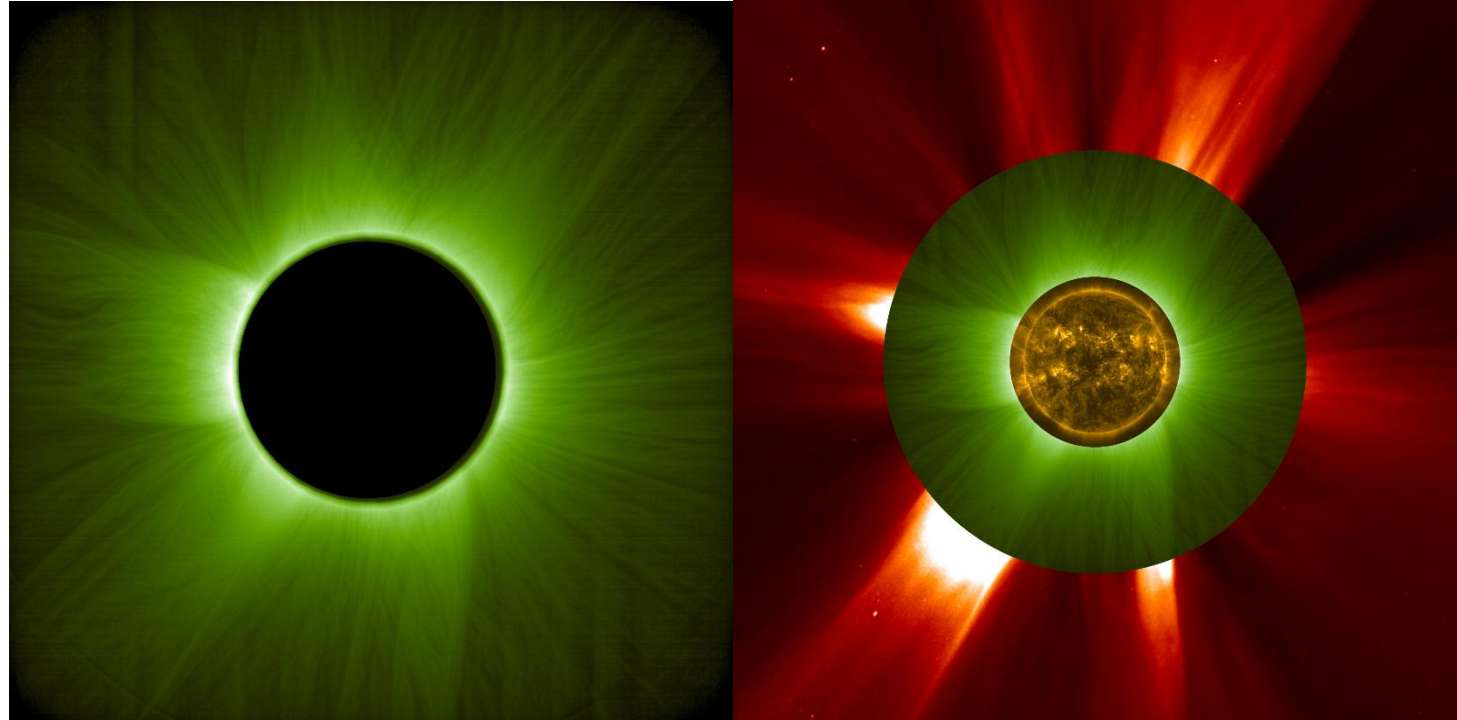
➤ PROBA 3

- Constellation of 2 satellites (launched Dec 24),
creating an artificial Solar eclipse



Door and optics for coronagraph ASPICS

First image →





Czech contribution to ESA scientific missions

Examples and outputs

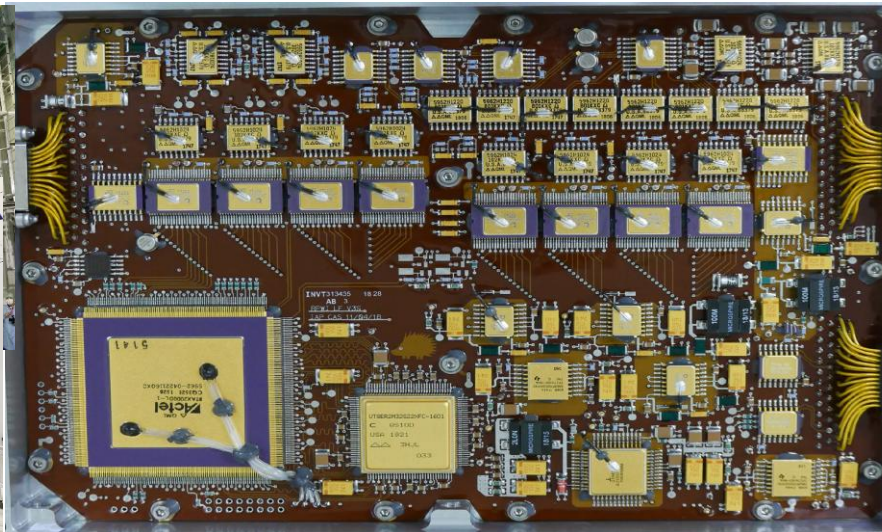
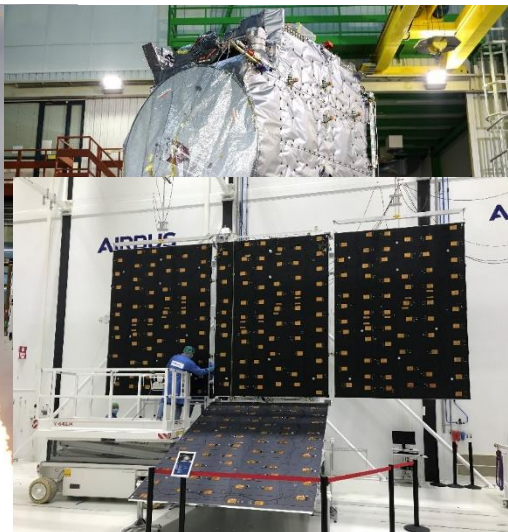
➤ JUICE

will explore the icy moons of Jupiter (with the focus on Ganymedes, the only moon in the Solar System with its own magnetic field)

Start JUICE, 14th April 2023

Low-Frequency Receiver: flight model

Low-Voltage Power Supply





Czech contribution to ESA scientific missions

Examples and outputs

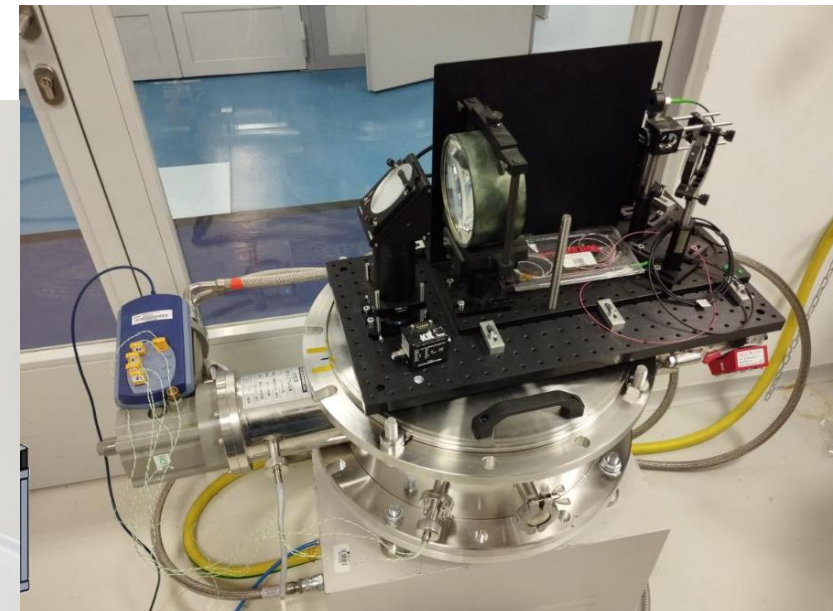
- **PLATO, ARIEL**
will study exoplanets and their atmospheres

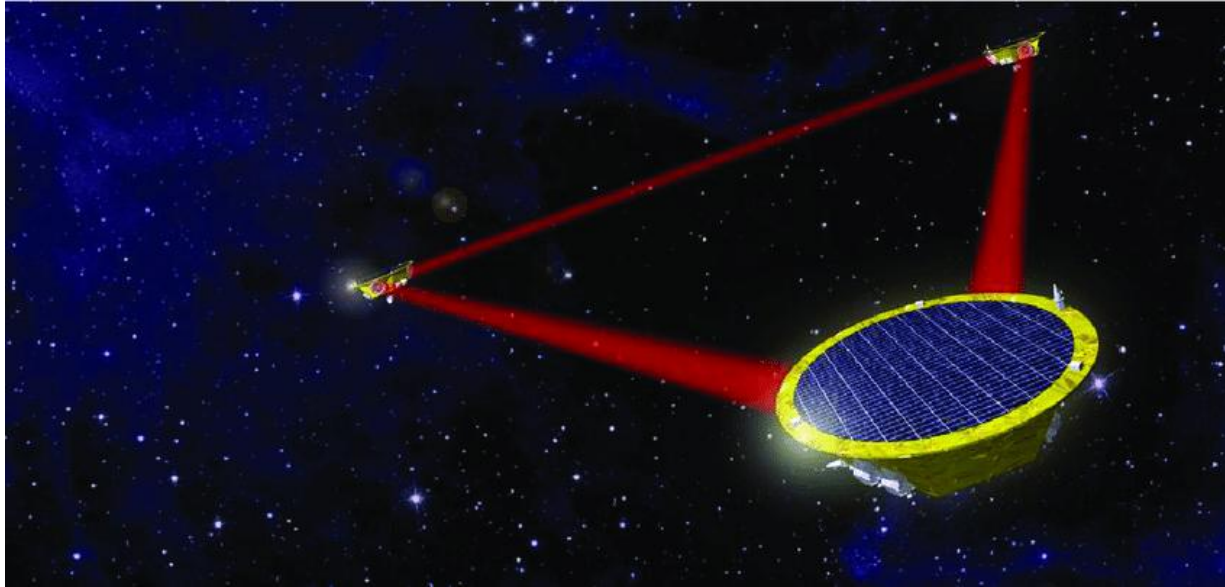
Precise mirrors in cryogenic environment
developed for the ARIEL mission

PLATOSpec, renovated telescope at ESO, Chile



PLATO service module, SAB Aerospace, Brno





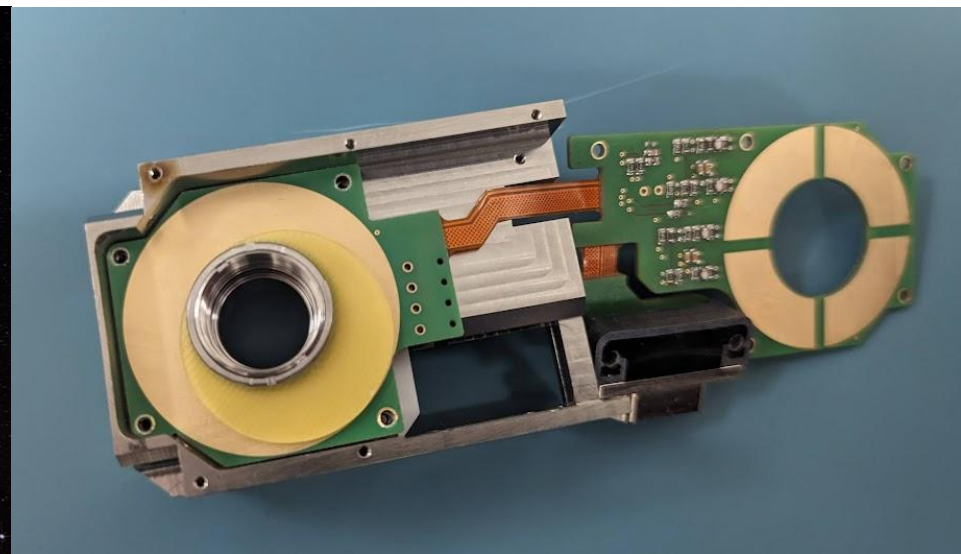
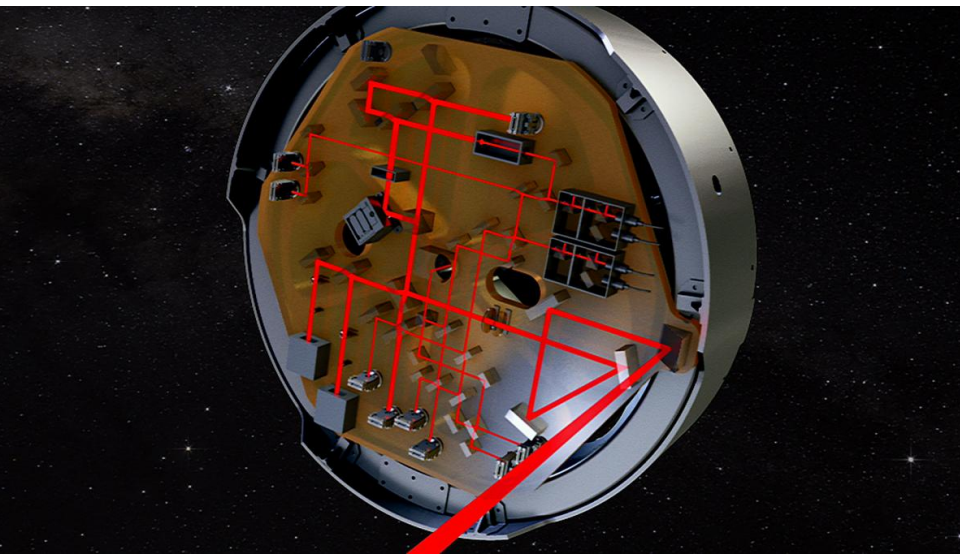
Czech contribution to ESA scientific missions

Examples and outputs

- **LISA**
 - ESA-NASA-JAXA observatory to measure gravitational waves in space
 - will detect mergers of super-massive black holes

LISA Optical Bench

Czech contribution: *Fibre Switch Unit Actuator* (demonstration model) – will allow to switch between two laser beams



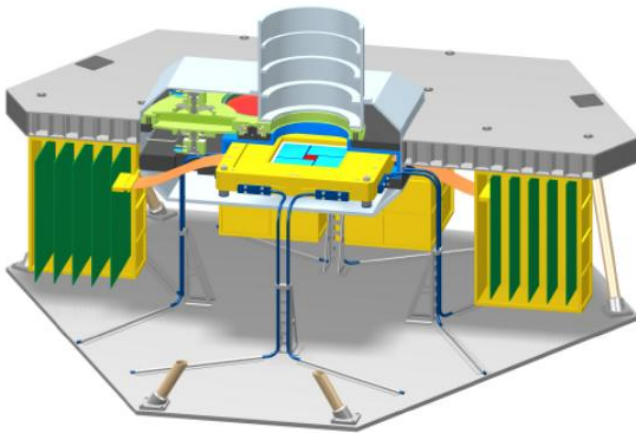


Czech contribution to ESA scientific missions

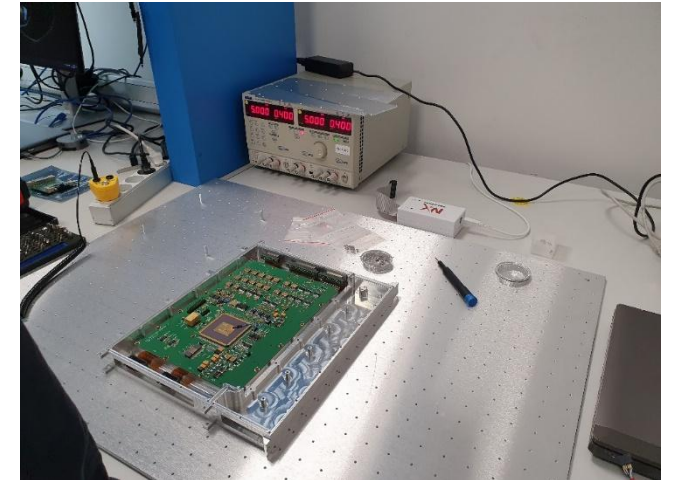
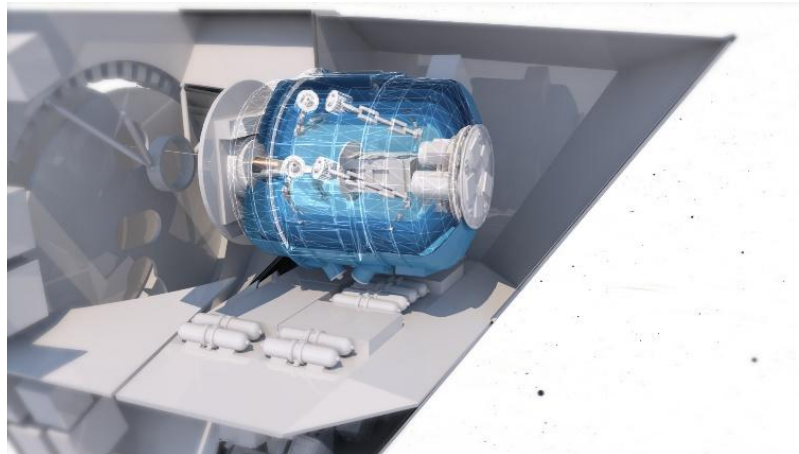
Examples and outputs

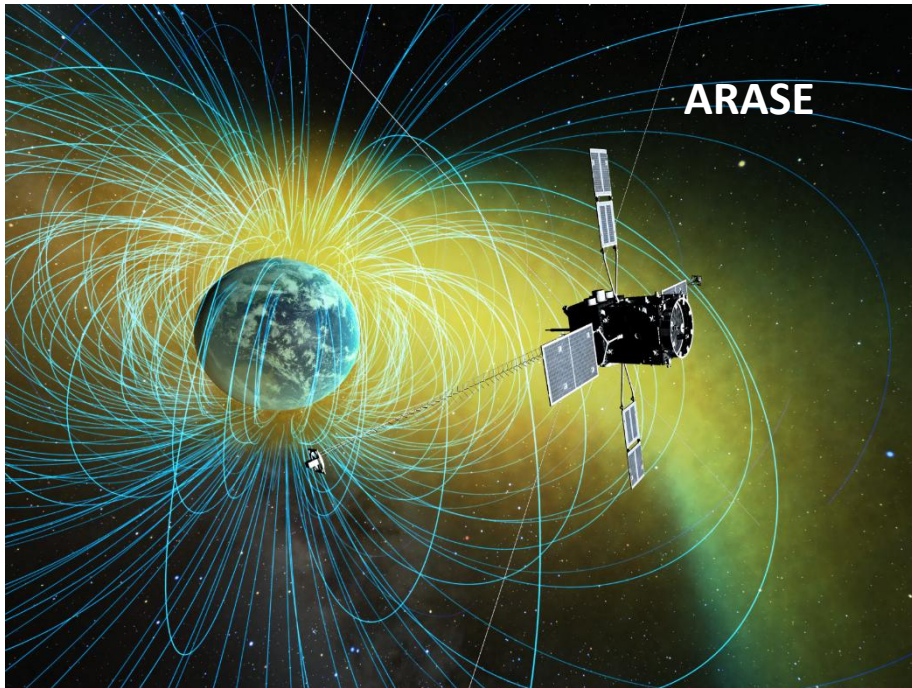
- **newATHENA**
 - will study the Hot and Energetic Universe
 - How did the super-massive black holes originate?
 - How was the large-scale structure of the Universe formed?

Wide-Field Imager: *Galvanic Isolation Modules*
(power supply)



X-ray Integral Field Unit (X-IFU): X-ray calorimeter (similar technology concept to Japanese X-ray instrument XRISM/Resolve), *Row Addressing and Synchronisation*





Czech-Japanese collaboration in space research

Wide research collaboration in space physics and Solar system

➤ Solar physics

- Space mission **Hinode**, rocket experiment CLASP, future Solar-C
- Coordination of time between **Proba-3** and Hinode
- Col: Kyoto University, National Astronomical Observatory of Japan

➤ Space plasma physics

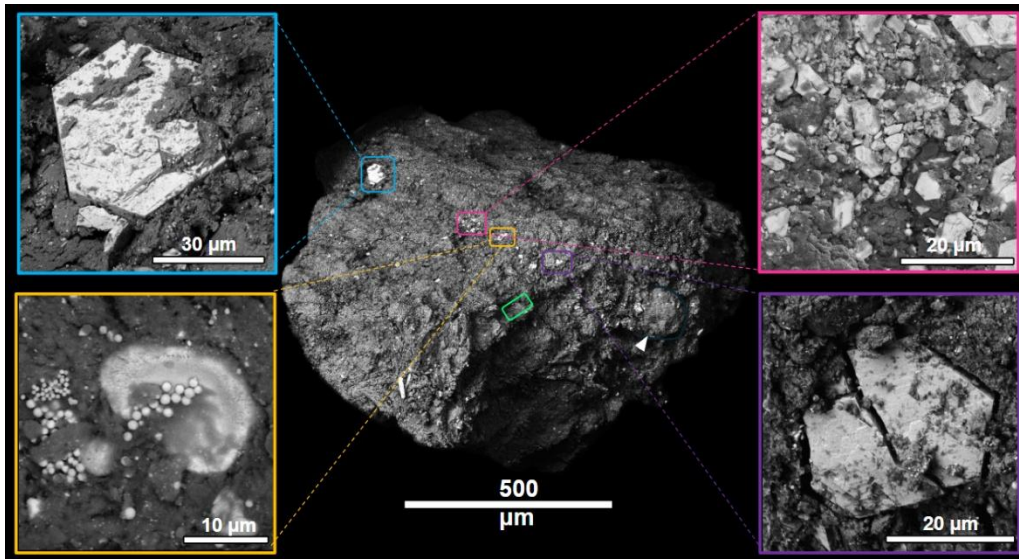
- Space missions **Akebono**, **ARASE**
- Col: Nagoya, Kanazawa, Tohoku, Chiba, Kyoto

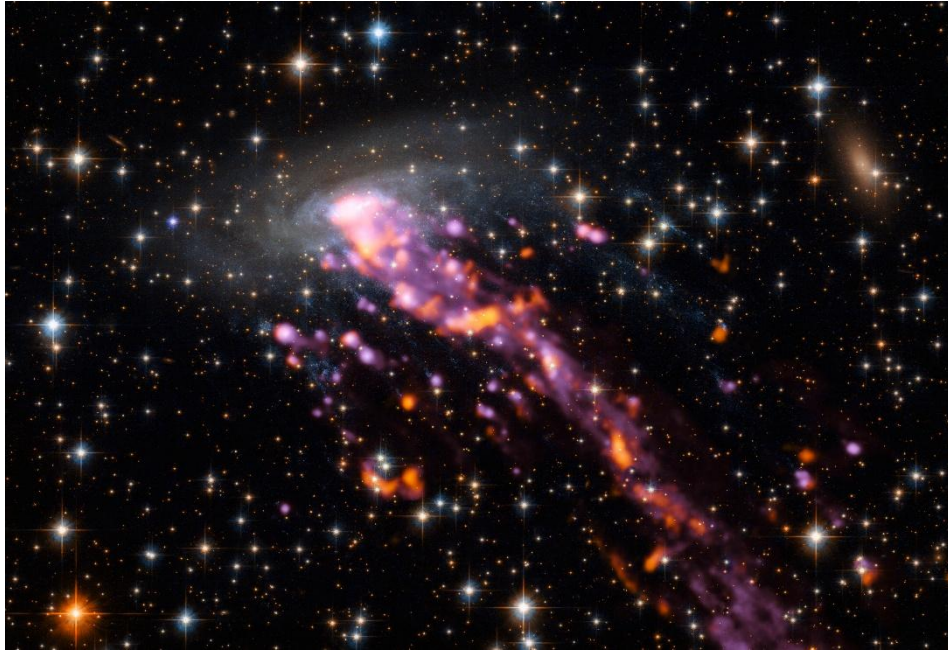
➤ Solar System Exploration

- **Hayabusa2**: analysis of Ryugu asteroid samples
- Collaboration in ESA missions **JUICE**, **Comet Interceptor**
- Col: Tokyo Institute of Technology, Tohoku University

➤ Cosmic rays

- **Heavy Ion Medical Accelerator** in Chiba
- Col: National Institutes for Quantum Science and Technology





Czech-Japanese collaboration in space research

Wide research collaboration in astronomy and astrophysics

➤ High-energy astronomy

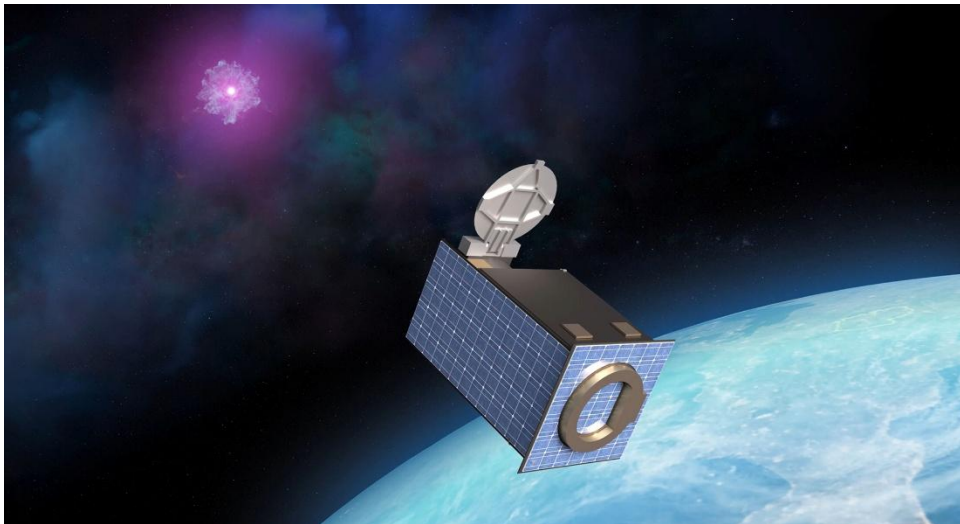
- Data analysis with [Suzaku](#), [XRISM](#) – X-ray astronomy
- Col: ISAS/JAXA, Tohoku University, NAOJ, Hiroshima University, University of Tokyo IPMU, Nagoya University

➤ Physics of galaxies

- ALMA JELLY Large programme – survey of nearby jelly-fish and ram pressure stripped galaxies, using the [Subaru](#) telescope
- Col: NAOJ

➤ Gravitational waves

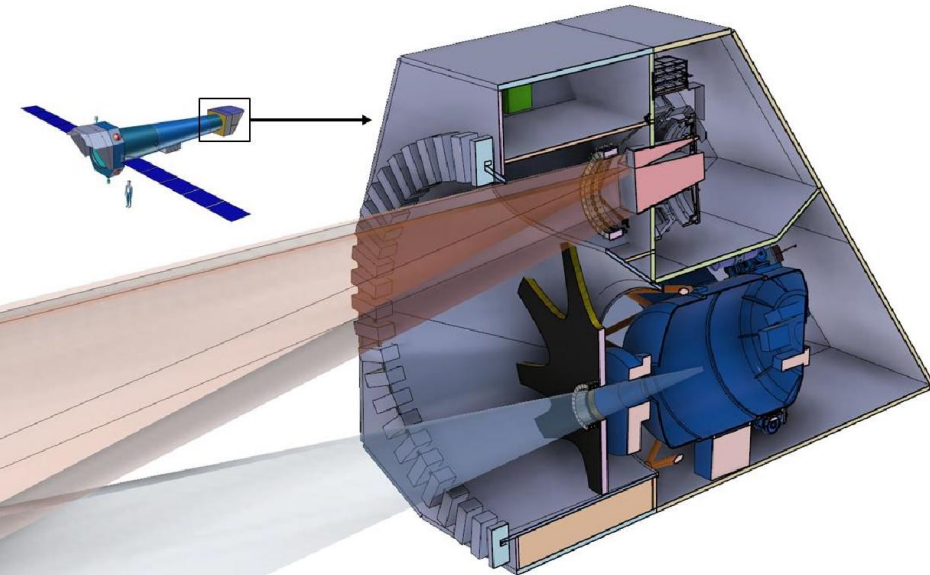
- Modelling: quasi-normal modes (characteristic oscillations of black holes)
- Optical frequency references for ultra-stable space-borne lasers, such as for [DECIGO](#)
- Col: iTHEMS RIKEN



Potential future Czech-Japanese collaboration

New rapidly growing areas of space interest

- **Earth observations**
 - Environmental monitoring
 - CAS: flying laboratory collecting data over Central European landscapes - potential for testing Japan 's remote sensing cameras
- **Space safety and sustainability**
 - Space situational awareness, debris mitigation and sustainable satellite technologies
- **Satellite miniaturization**
 - Czech Republic: several own small CubeSats (e.g., VZLU SAT 1, 2)
 - **Czech ambitious mission QUVIK**: UV telescope to detect transient kilonovae, to be launched in 2028 (budget ~ 30 MEur)
 - see Norbert Werner's talk



Organization of Czech Space Activities

➤ Ministry of Transport

- Coordinating space activities in the Czech Republic
- **Czech journey to space**
 - Planned mission of the Czech astronaut to [ISS](#)
 - Public outreach activities – ZeroG flight

➤ Ministry of Education

- Financial contribution to the ESA Science programme and **PRODEX** (PROgramme de Développement d'EXpériences scientifiques)
 - key support of the scientific instrumentation development
 - mainly with international collaboration for ESA missions, **but not limited to ESA** (e.g., Czech contribution to a Chinese mission eXTP)

➤ Czech Industry

- Qualified in many fields (optics, sensors, electronics, precise mechanics, flexible solar arrays, harness, software)

➤ Czech Academy of Sciences, Universities

- main research institutions with focus on scientific projects, space among the highest priorities

Potential of cooperation between

Czechia and Japan in space activities



Summary

➤ Czech Republic

- Is a member state of the **European Space Agency (ESA)** and contributes to all major future missions
- Has also its **own space programme**
- Is keen to **strengthen collaboration in space projects with Japan**



**Thank you for
your attention!!!**

チェコー日本間宇宙プロジェクトが成
就しますように。
(Cheko Nihon kan Uchuu purojekuto
ga jouju simasu youni)

We wish to succeed space
collaboration project
between Czechia and Japan

*Tanabata festival, Prague – Dolní Počernice,
20th of July 2025*

