ESA Science Highlights and Engagement

Nora Lützgendorf
Nordic-Baltic Astronomy Days 2026
Turku, 27 May 2026

Science Highlights

XMM-Newton catches giant black hole's X-ray oscillations

- **2022:** Detected ~18 min period object at >10 gravitational radii around SMBH (1ES 1927+654) → Extreme-mass ratio Inspiral (EMRI), possible **LISA** source
  - Predicted inspiral for January 2024

Masterson+, 2025, doi.org/10.1038/s41586-024-08385-x

Video: ESA

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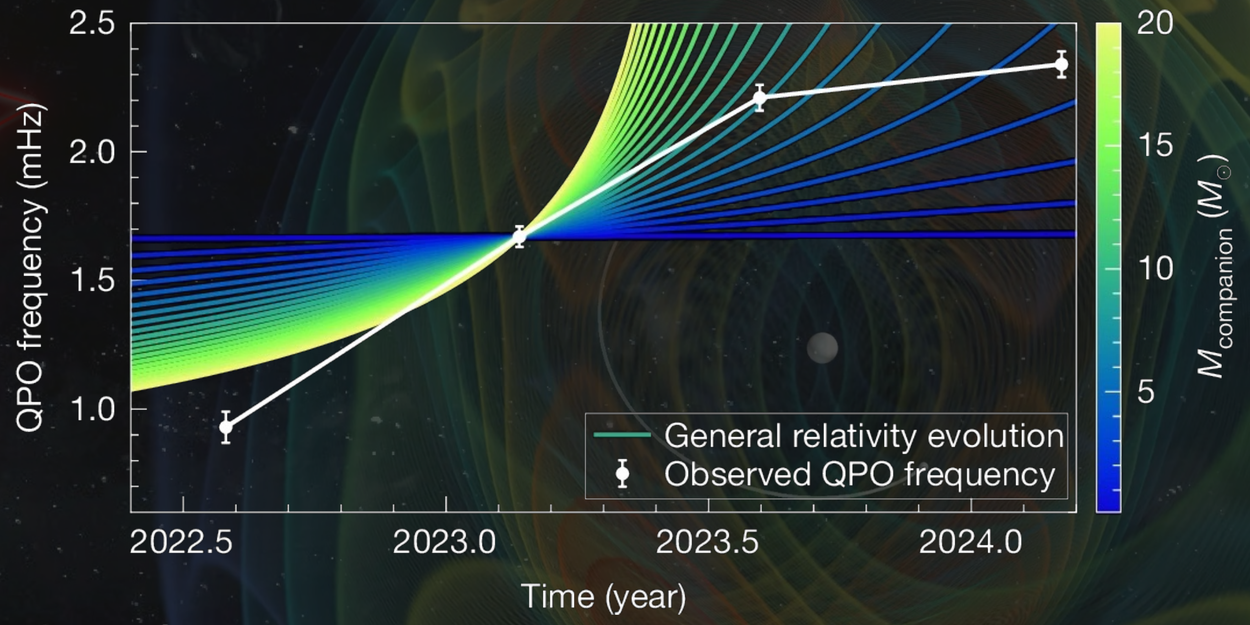
- **March 2024:** Object still present with 7.1 min orbit
  - Now orbiting at half the speed of light!
  - Defies all models!



Masterson+, 2025, doi.org/10.1038/s41586-024-08385-x

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XMM-Newton catches giant black hole's X-ray oscillations

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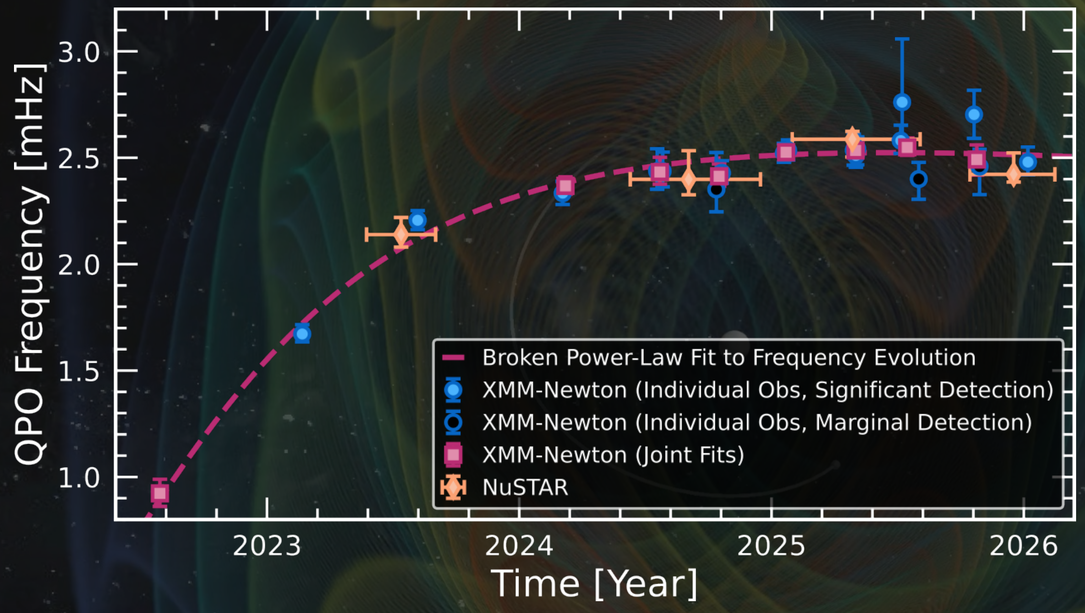
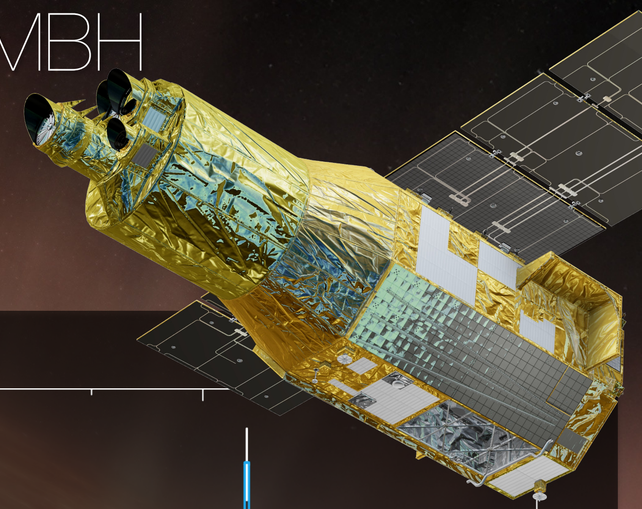
- **March 2024:** Object still present with 7.1 min orbit
  - Now orbiting at half the speed of light!
  - Defies all models!
- **Jan 2026:** Frequency plateaued
  - Compact object less likely



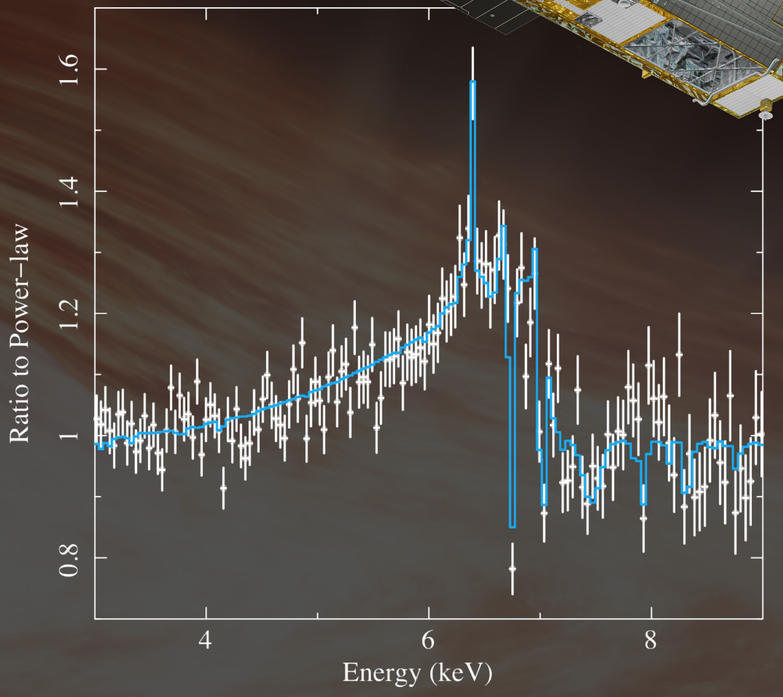
Masterson+, 2026, doi.org/10.48550/arXiv.2604.16688

Video: ESA

XRISM: Sharpest X-ray spectrum of a rapidly spinning SMBH

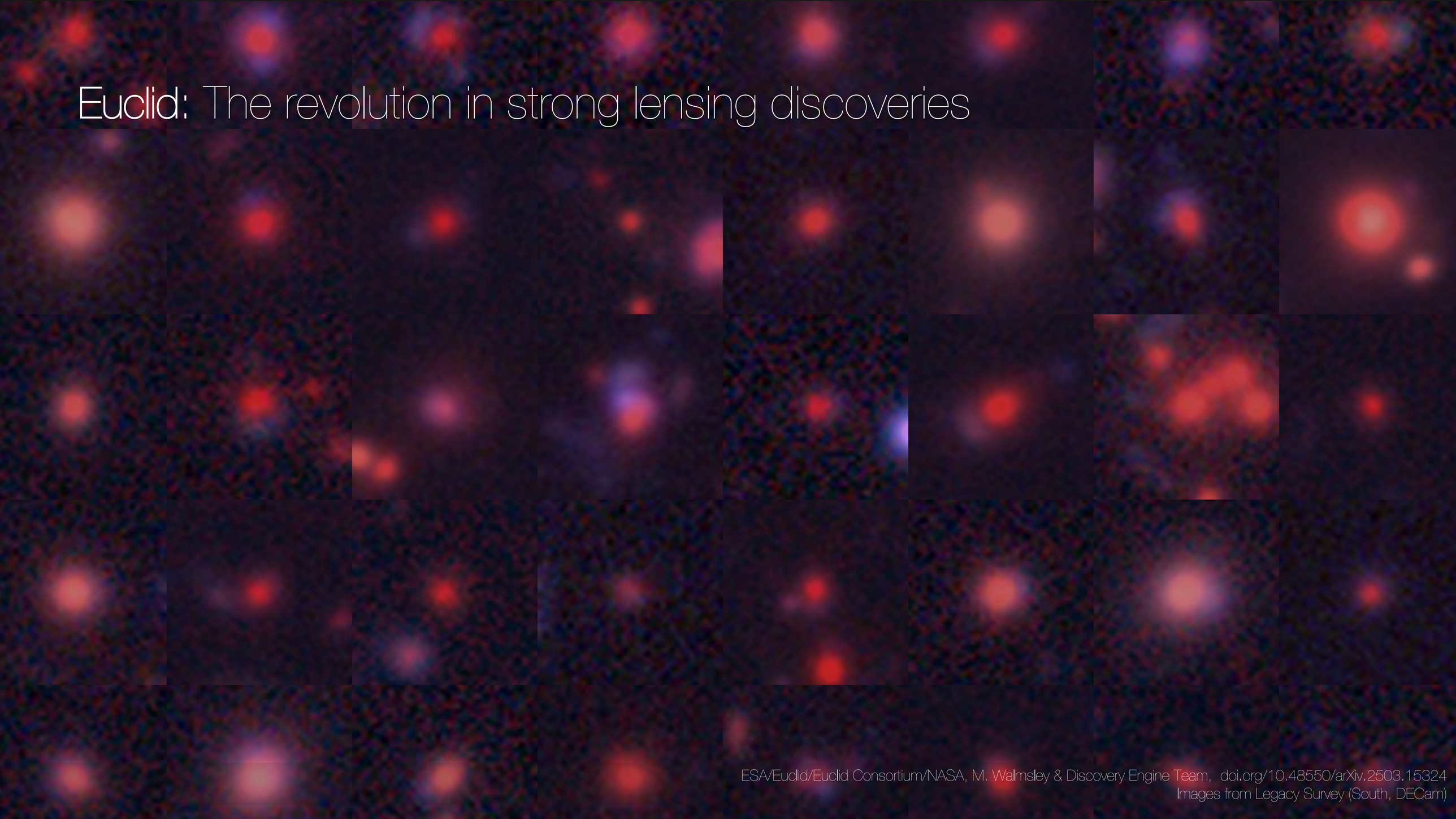


- Multi-X-ray observatory campaign with XMM-Newton, XRISM and NASA's NuSTAR
- XRISM provided high resolution X-ray spectrum
- Warped iron emission line provides 1st evidence of material orbiting near the event horizon



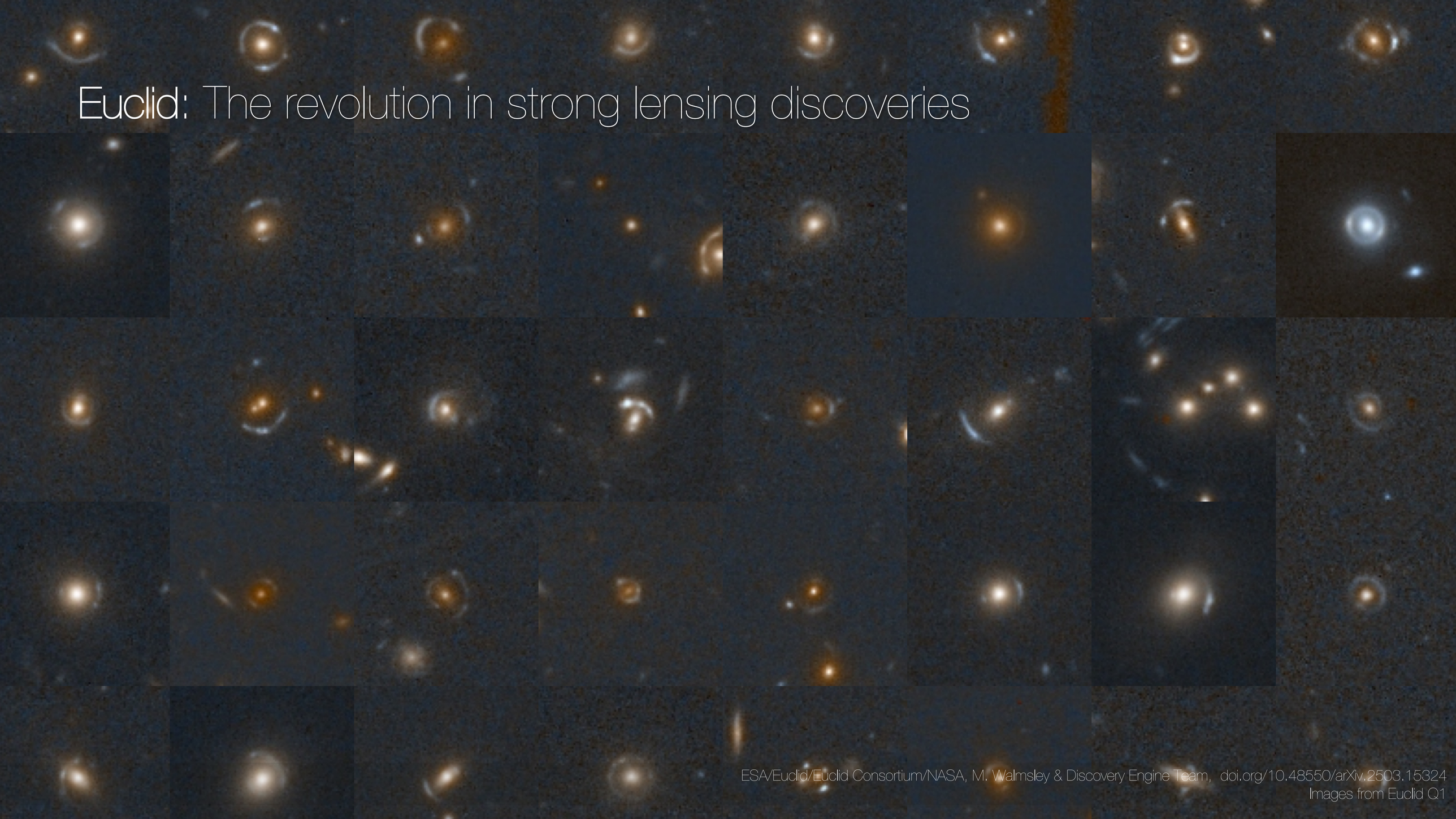
Brenneman+, 2025, ApJ, doi:10..3847/1538-4357/ae1225 Image Credit: CfA/Melissa Weiss

Euclid: The revolution in strong lensing discoveries



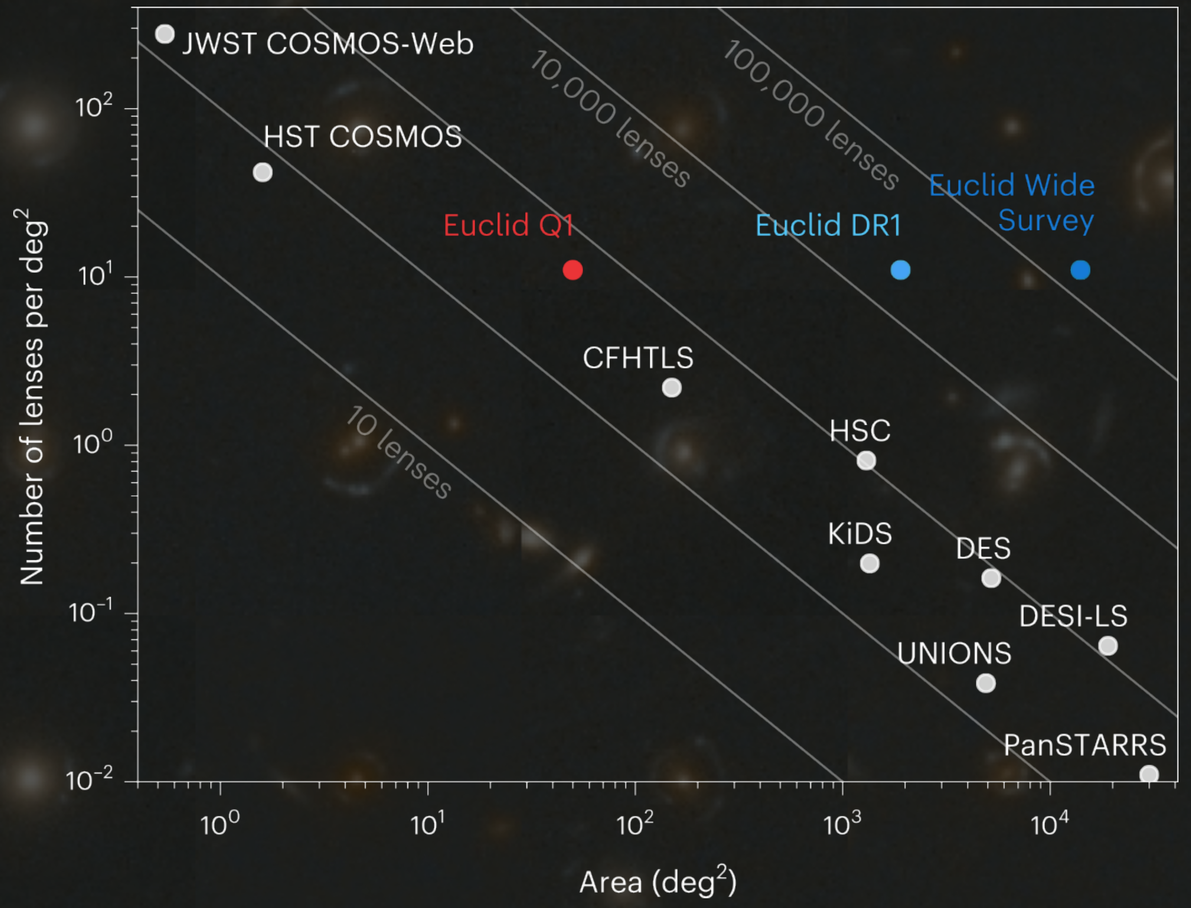
ESA/Euclid/Euclid Consortium/NASA, M. Walmsley & Discovery Engine Team, doi.org/10.48550/arXiv.2503.15324
Images from Legacy Survey (South, DECam)

Euclid: The revolution in strong lensing discoveries



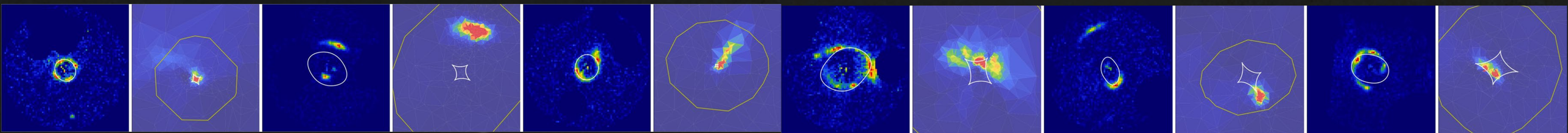
ESA/Euclid/Euclid Consortium/NASA, M. Walmsley & Discovery Engine Team, doi.org/10.48550/arXiv.2503.15324
Images from Euclid Q1

Euclid: The revolution in strong lensing discoveries



- Euclid's first data (0.45%) already found ~500 strong lenses, confirming a path to ~100,000 by mission end.
- This huge, diverse sample will revolutionize studies of dark matter, galaxy evolution, and cosmology.

Lines+ 2025, Nature Astronomy, doi.org/10.1038/s41550-025-02616-5



SKY-SCANNING COMPLETE FOR ESA'S MILKY WAY MAPPER GAIA

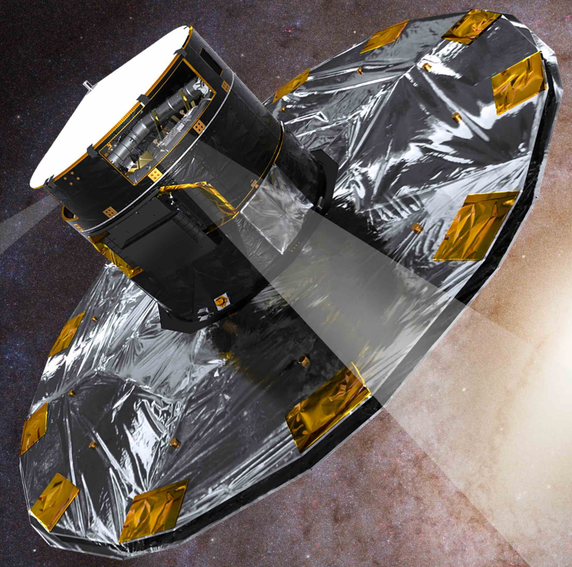
From 24 July 2014 to 15 January 2025, Gaia made more than three trillion observations of two billion stars and other objects, which revolutionised the view of our home galaxy and cosmic neighbourhood.

3 TRILLION
Observations

2 BILLION
Stars & other objects observed

938 MILLION
Camera pixels on board

15 300
Spacecraft 'pirouettes'



580 MILLION
Accesses of Gaia catalogue so far

13 000
Refereed scientific publications so far

2.8 MILLION
Commands sent to spacecraft

142 TB
Downlinked data (compressed)

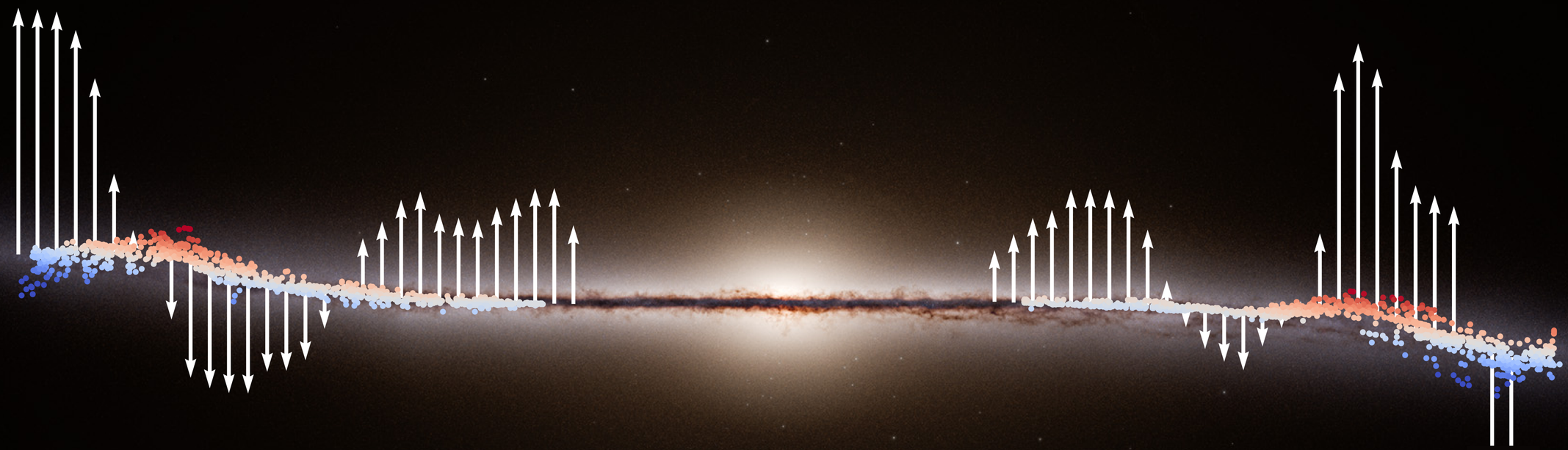
500 TB
Volume of data release 4
(5.5 years of observations)

55 KG
Cold nitrogen gas consumed

3827
Days in science operations

50 000 HOURS
Ground station time used

Gaia discovers our galaxy's great wave



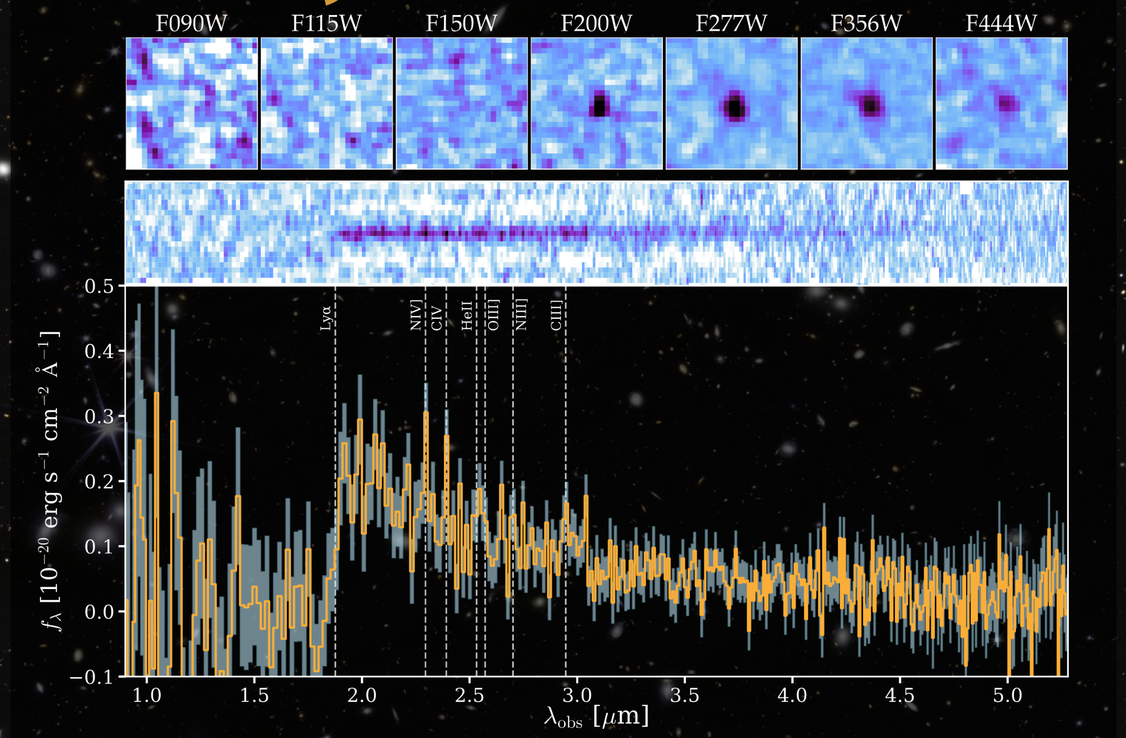
- Gaia measured three-dimensional structure and kinematics of young stars and revealed a giant wave rippling outward from the centre of the Milky Way
- The origin and relationship with other dynamical signatures of the Milky Way remain to be determined

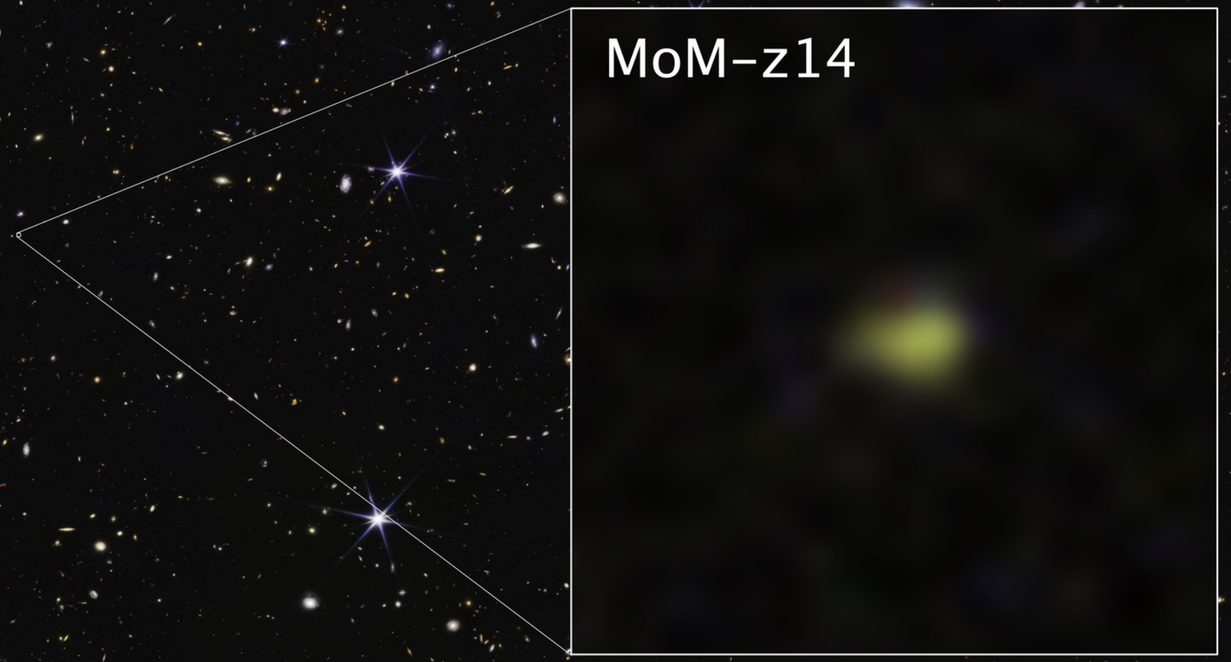
ESA/Gaia/DPAC, S. Payne-Wardenaar, E. Poggio et al (2025) doi.org/10.1051/0004-6361/202451668
https://www.esa.int/Science_Exploration/Space_Science/Gaia/Gaia_discovers_our_galaxy_s_great_wave

JWST pushes boundaries of observable Universe closer to Big Bang

RECORD BREAKER

Spectroscopic confirmation of a galaxy at z = 14.44,
again breaking Webb's record for the most distant galaxy.





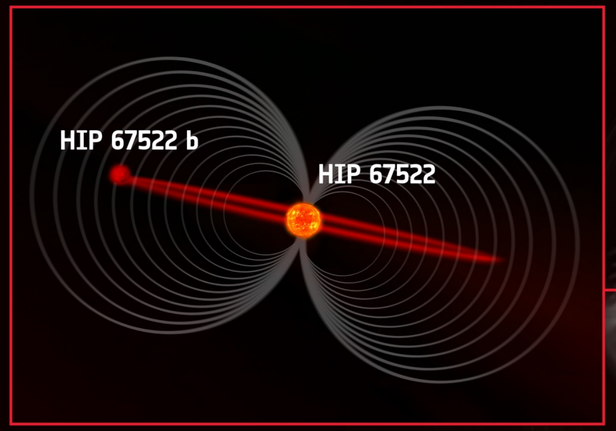
Naidu+, 2026, Open Journal, https://doi.org/10.48550/arXiv.2505.11263

NASA, ESA, CSA, STScI, R. Naidu (MIT), Image processing: J. DePasquale (STScI)

CLINGY PLANETS CAN TRIGGER OWN DOOM

01.

HIP 67522 b orbits close to its host star HIP 67522, inside the star's large and powerful magnetic field

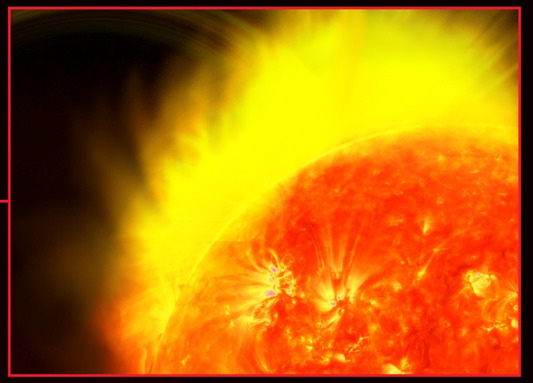


02.

The planet stores magnetic energy as it orbits the star, and sends this back as waves along the star's magnetic field lines

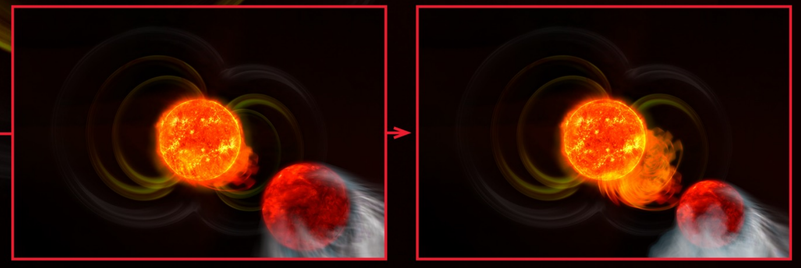
03.

Where the waves meet the star's surface, they trigger the release of a flare of light



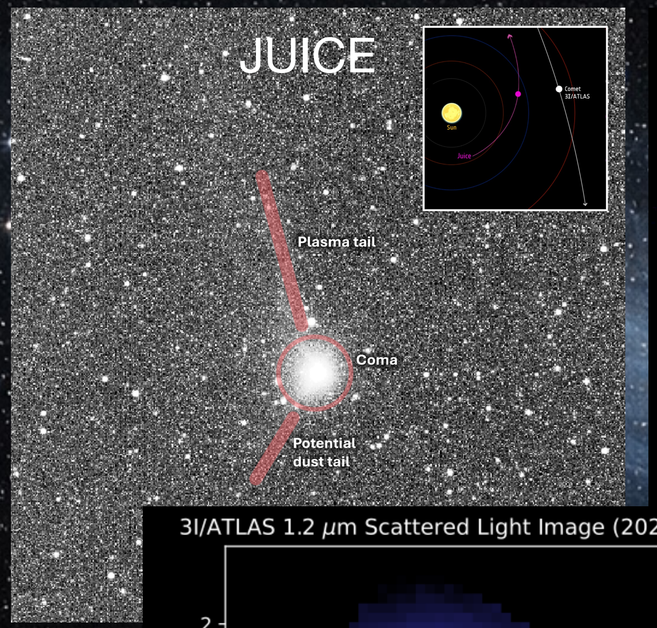
04.

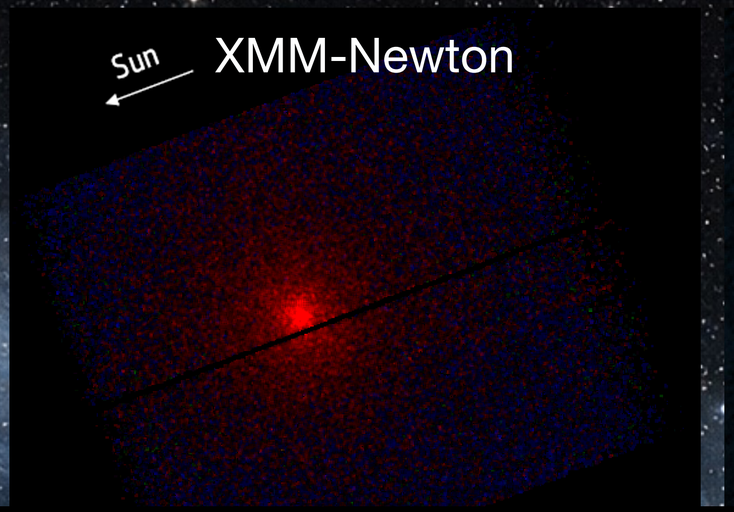
These flares blast away the planet's wispy atmosphere, causing it to shrink every year

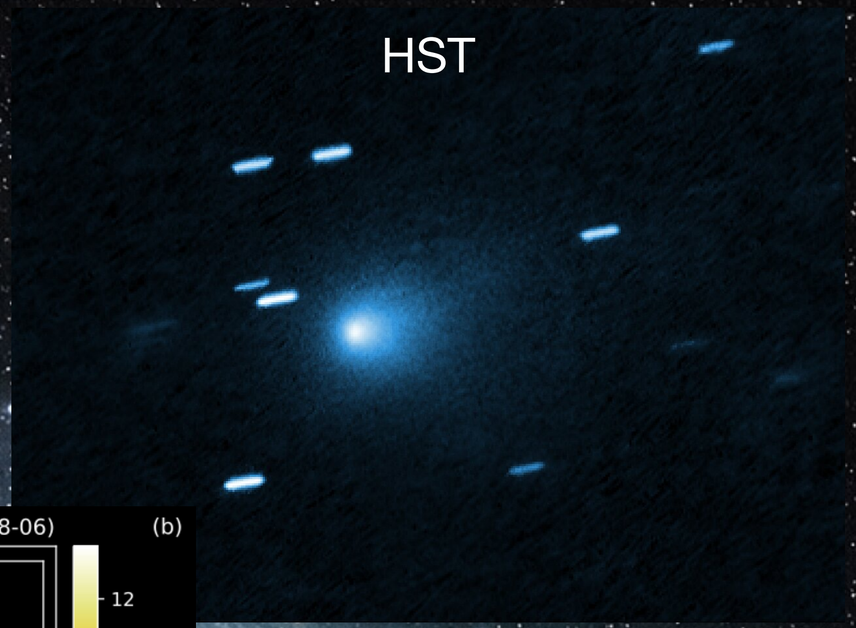


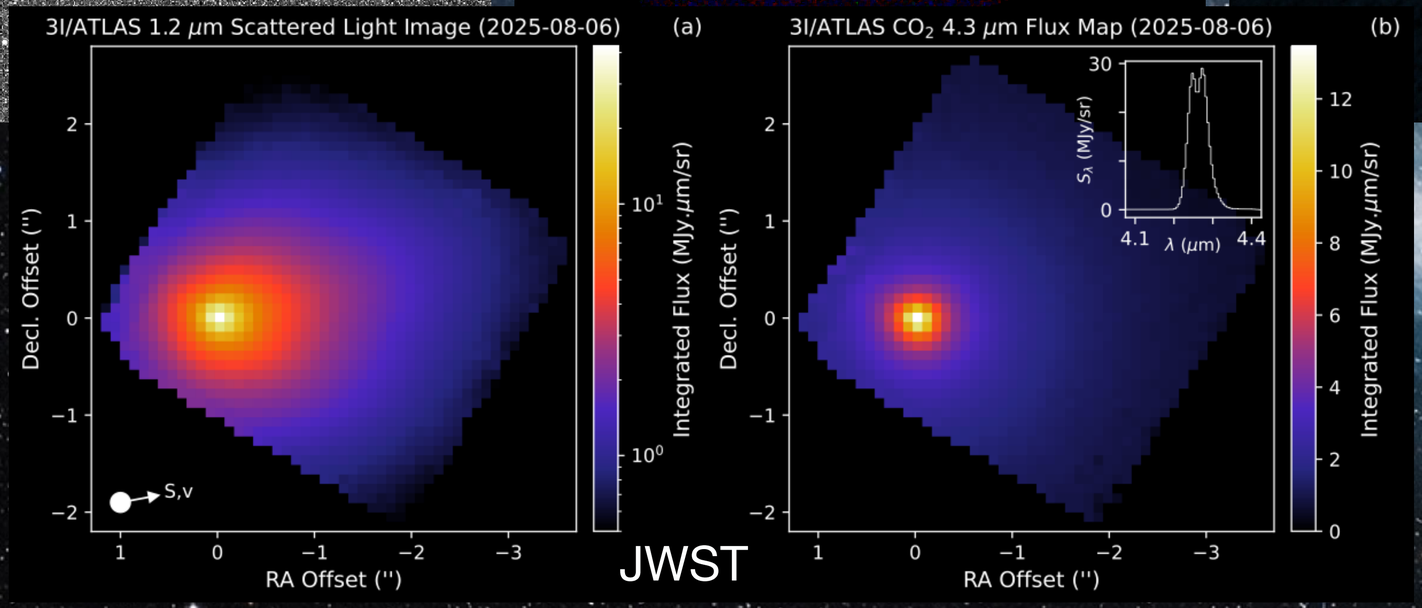
ESA | Ilin et al., 2025, Nature, doi:10.1038/s41586-025-09236-z

JUICE, XMM-Newton, HST and JWST observe 3I/ATLAS

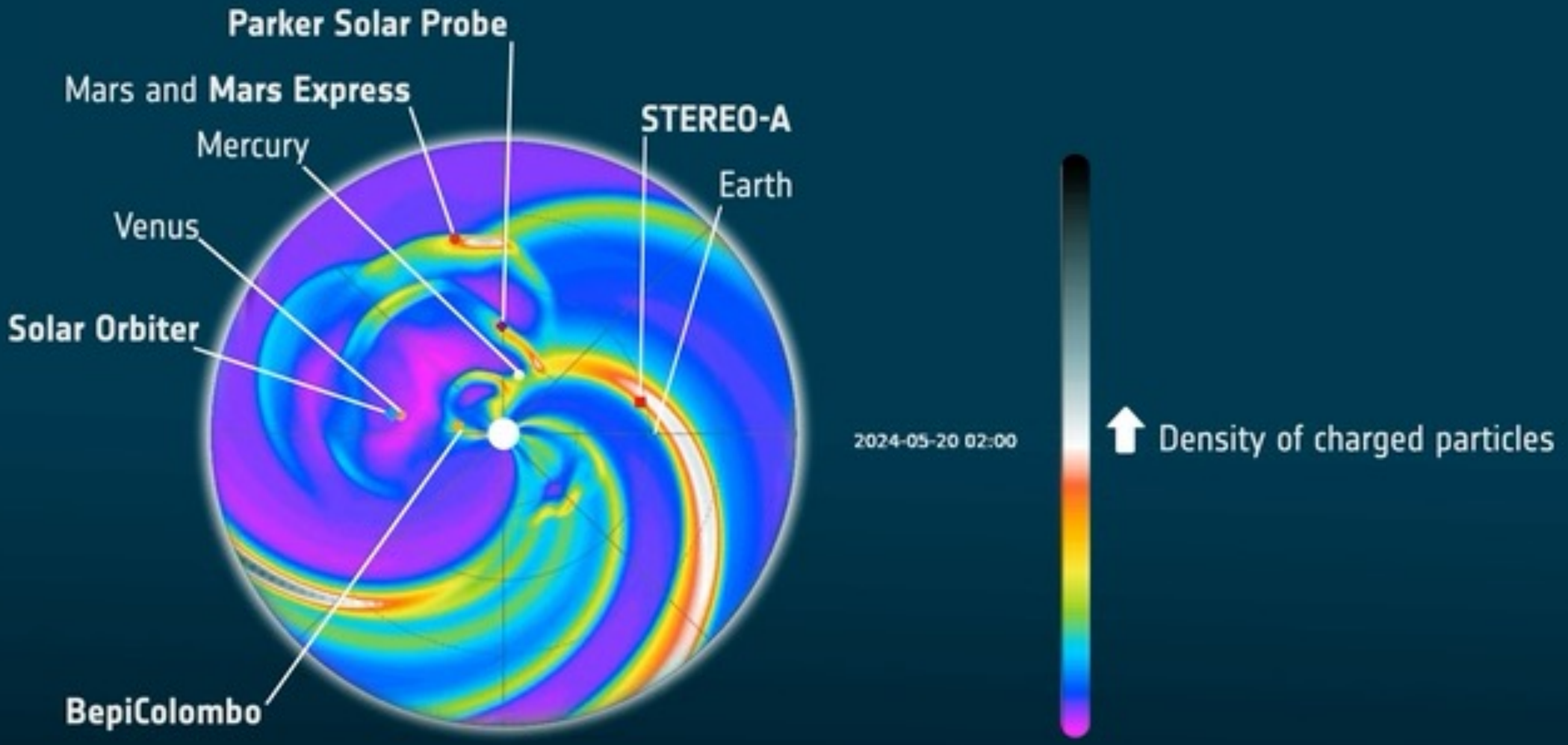








Mars Express records largest-ever ionospheric response to solar storm



ESA web release, 5 March 2026

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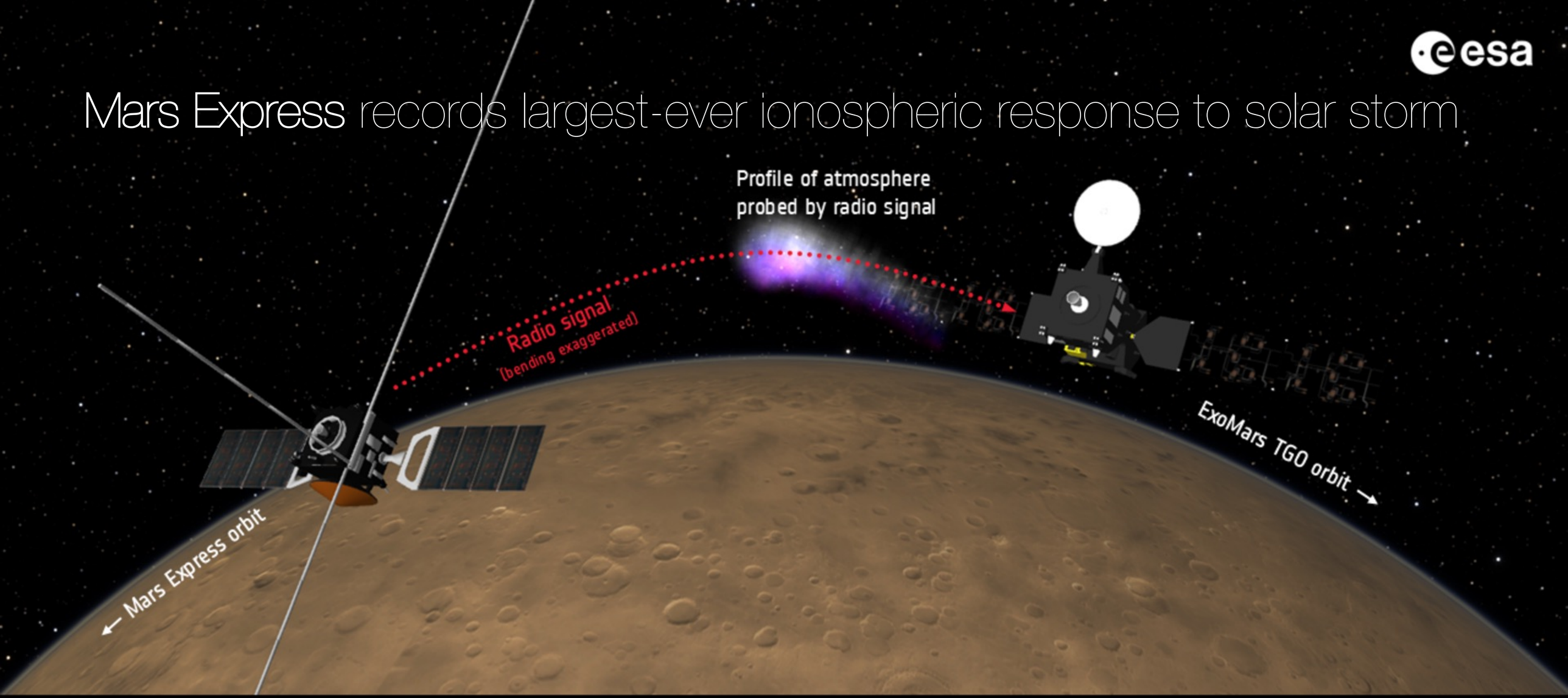
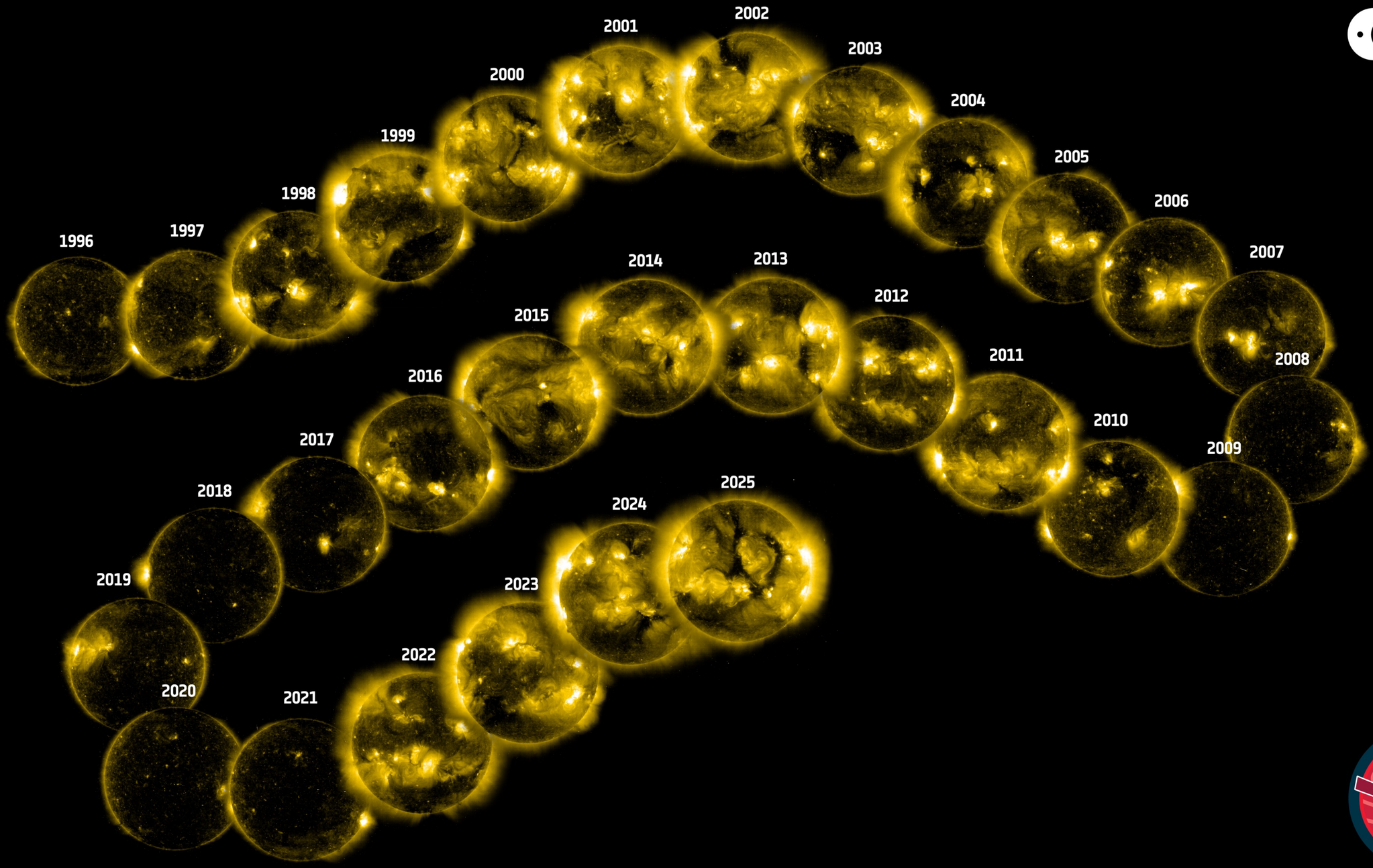


1. Mars Express beams a radio signal towards ExoMars TGO, which is about to ‘set’ behind Mars

2. The radio signal travels through Mars’s upper atmosphere, causing it to bend (refract)

3. By measuring how much the signal bends, we discover what makes up the different layers of atmosphere

J. Parrott+, 2026, *Nature Communications*, doi.org/10.1038/s41467-026-69468-z ESA web release, 5 March 2026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ESA | NASA
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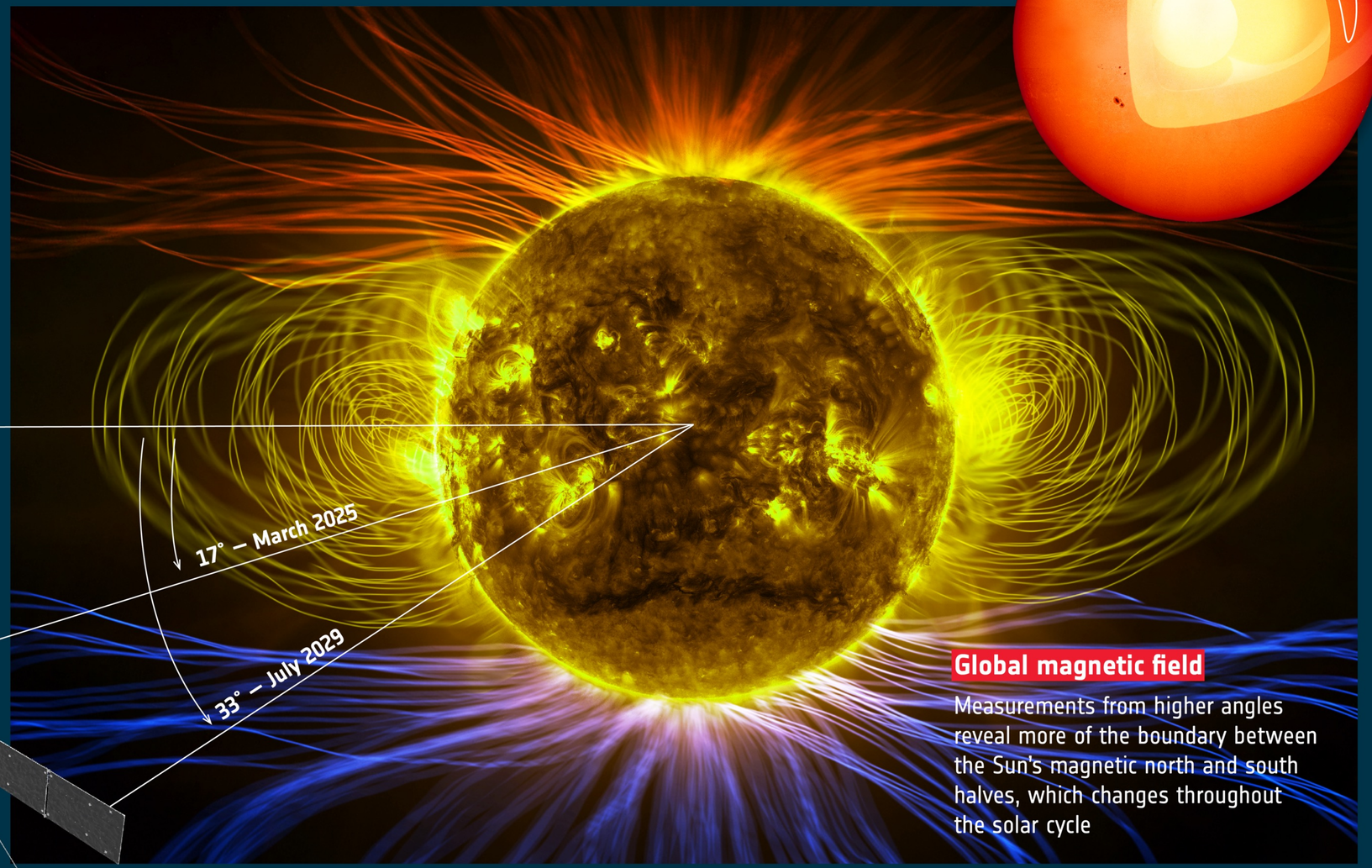
WHY SOLAR ORBITER IS ANGLING TOWARDS THE SUN'S POLES

The planets and almost all spacecraft to date orbit around the Sun's equator. Since February 2025, the ESA-led Solar Orbiter spacecraft's orbit is tilted out of this plane, giving us the first-ever clear views of the Sun's polar regions. Over the next few years, it will watch the Sun from ever-higher angles.

First polar views

Getting the first-ever views of the Sun's poles may reveal polar vortices (swirling gas) or other unexpected patterns, and the impact of the Sun's magnetic field opening up to space in these regions



Global magnetic field

Measurements from higher angles reveal more of the boundary between the Sun's magnetic north and south halves, which changes throughout the solar cycle

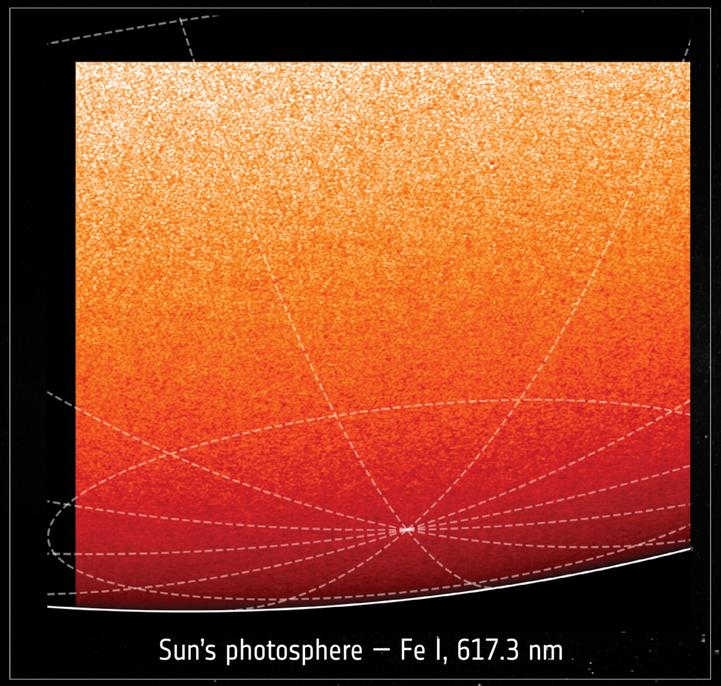
The solar dynamo

Tracking movement at and below the surface near the poles will improve models of how the Sun's magnetic field is generated and changes over time, crucial for predicting the solar cycle

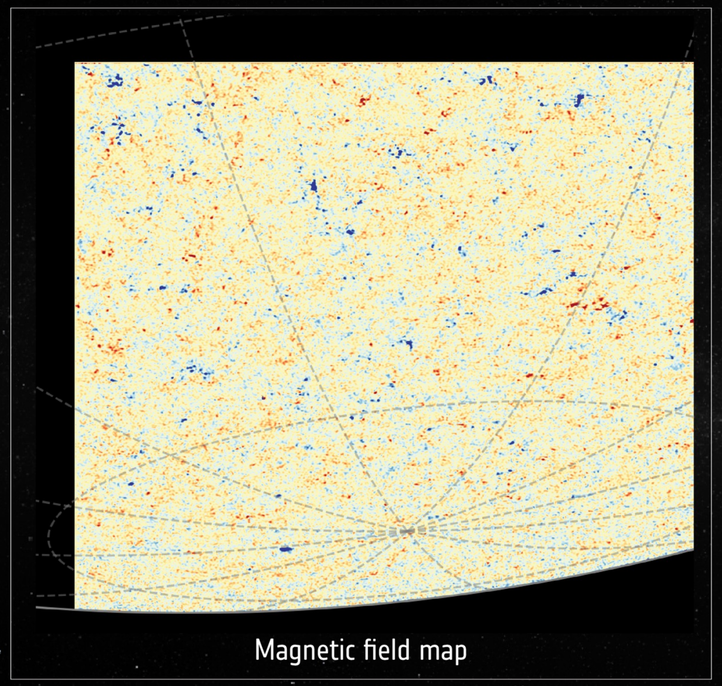
Space weather

Tracking the movement and makeup of solar wind and solar storms away from the Sun's equator will improve space weather forecasts

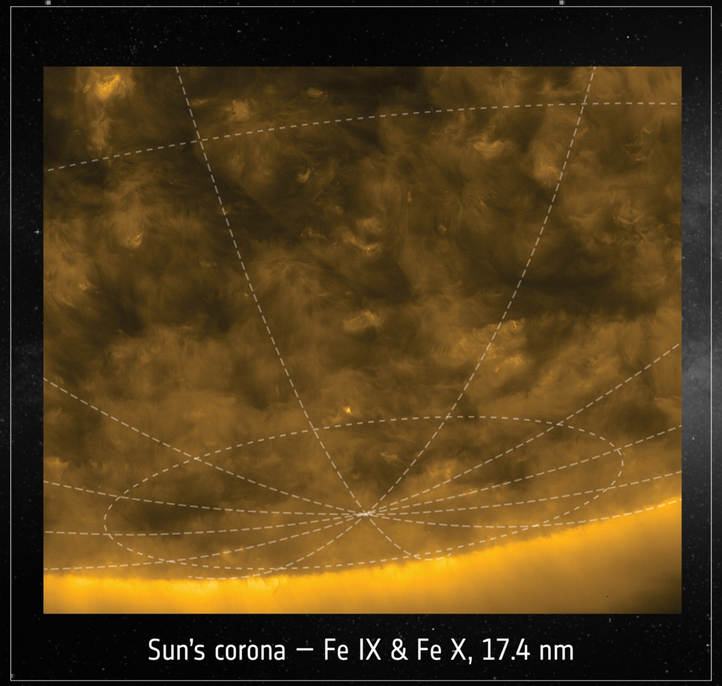
ESA | NASA
solar orbiter



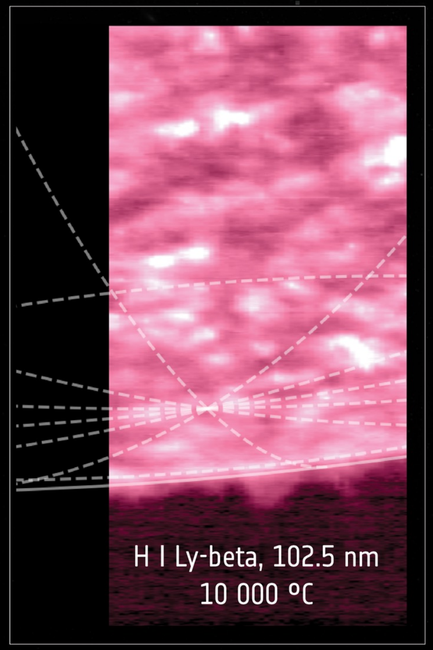
Sun's photosphere – Fe I, 617.3 nm

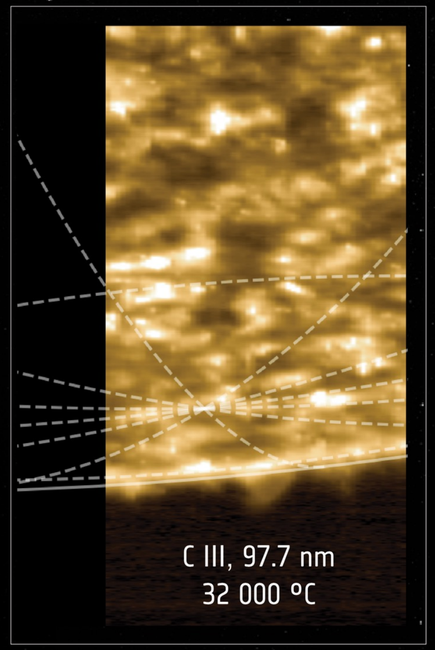


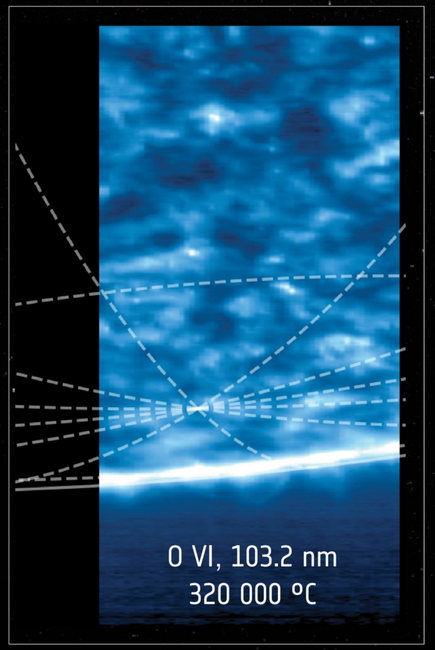
Magnetic field map

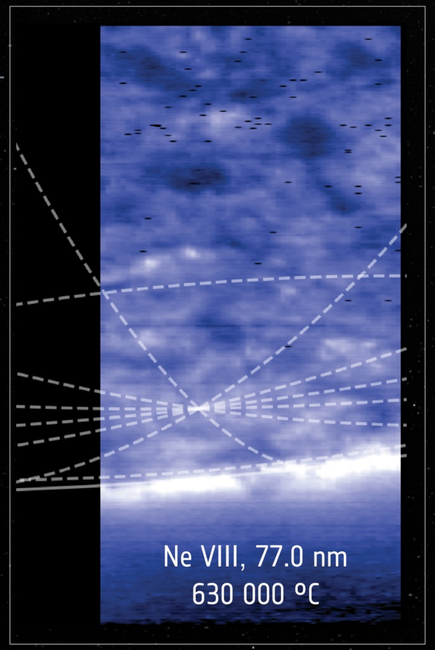


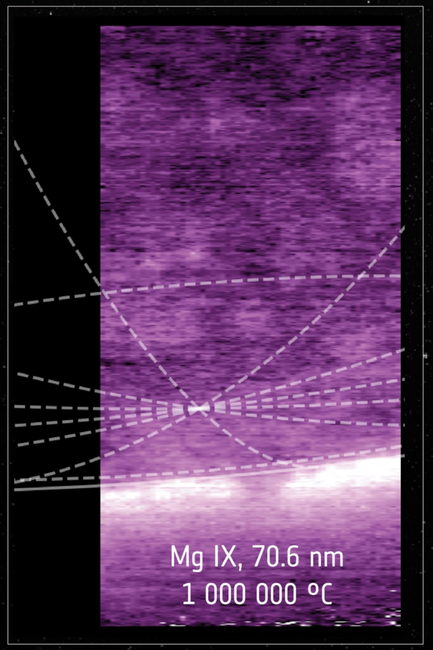
Sun's corona – Fe IX & Fe X, 17.4 nm



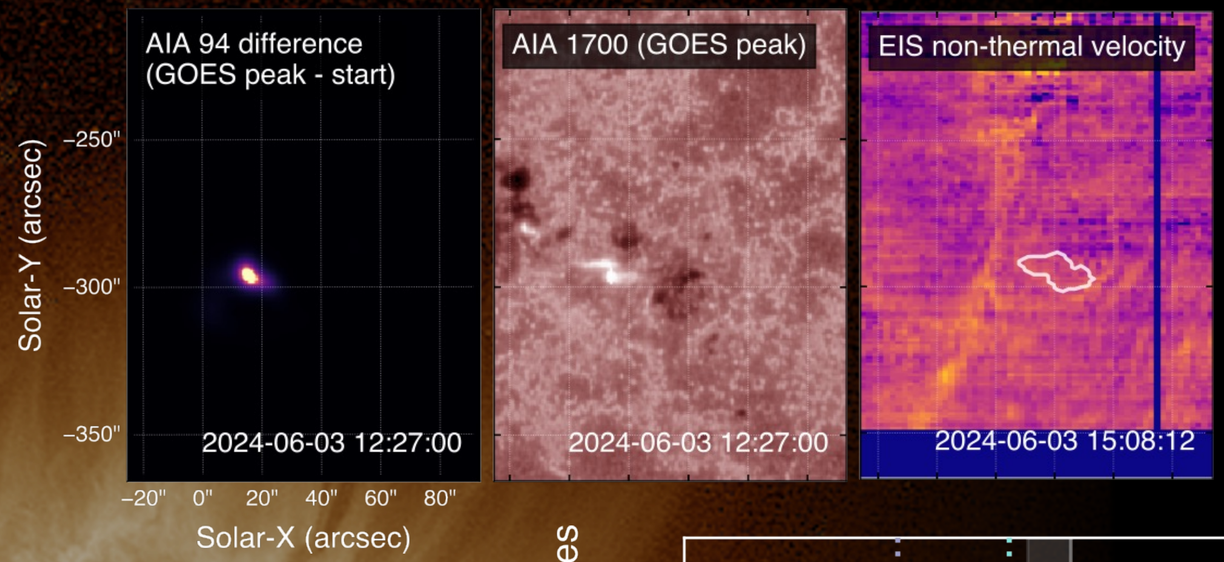


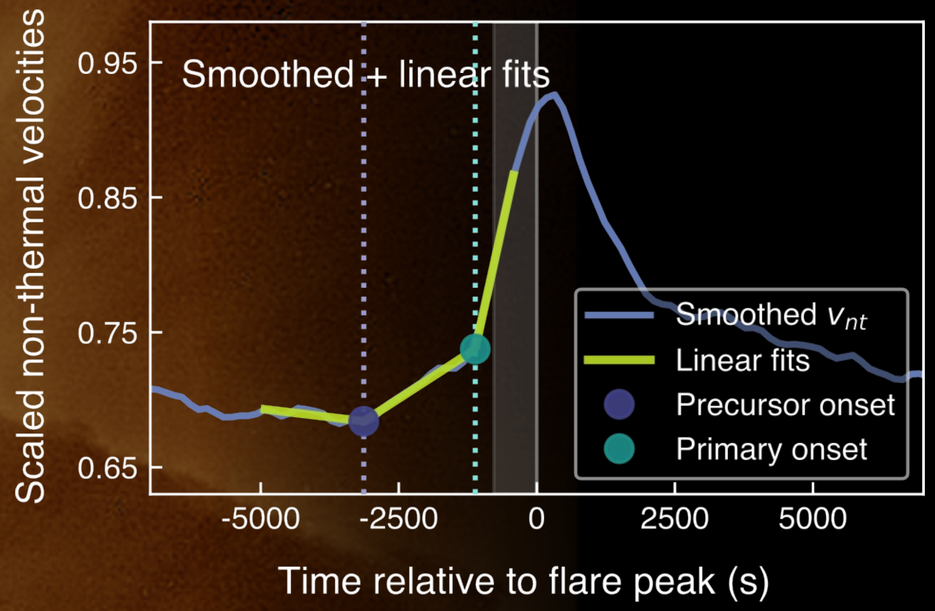






Hinode: a quiet warning before solar flares





- Hinode/EIS data (2011–2024) show excess non-thermal line widths as flare precursors
- Analysis of ~1,500 flares finds 25–75 minutes' early warning before soft X-ray peaks
- Precursor timing differs between eruptive and non-eruptive flares

To+, 2025, ApJ, doi.org/10.3847/1538-4357/ae07de

How to connect with ESA Science

Short and long-term visits

Faculty Visitor Programme

weeks - months

More flexible

Archive Visitor Programme

1-3 months

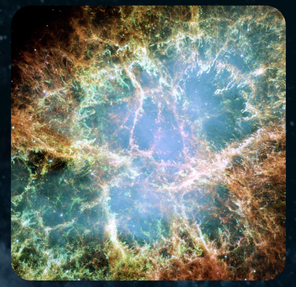
Member State institute

https://www.cosmos.esa.int/web/space-science-faculty/opportunities

Internships/Traineeships

weeks – 2 years

Member State national



Co-funded PhD studentships

0.5 – 1.5 years

Member State institute

Research Fellowship

2 – 3 years

Member State national

ESA Archival and Faculty Visitor Programme

ARCHIVAL VISITOR PROGRAMME

Who: All career levels, early career encouraged

Focus: Archive science, data analysis

Where: ESAC or ESTEC

Length: 1 to 3 months

Support: Travel, accommodation, meals covered

Offer: Archives access, expert support

Process: Anonymous review

When: Deadline spring and fall

Member State institute

FACULTY VISITOR PROGRAMME

Who: Scientists with collaboration plans

Focus: New or ongoing collaborations

Where: ESAC, ESTEC, or STScI

Length: Flexible, plan needed if over 2 weeks

Support: Travel and subsistence possible

Offer: Work with Faculty host

Process: Faculty proposal and defined outcome

When: Rolling, host first required

More flexible

https://www.cosmos.esa.int/web/space-science-faculty/members/directory

JOB OPPORTUNITIES AT ESA

ESA SPACE-SCIENCE RESEARCH FELLOWSHIP

OPENING LATE SUMMER

ESA SCI NEWSLETTER

🚀 WHAT?

Member State national

- Postdoctoral fellowship for ESA State nationals
- Your own research in space science
- Duration: 2 + 1 years (with extension proposal)

🌍 WHERE?

- ESTEC (Netherlands), ESAC (Spain) or STScI (USA)

🎯 WHY?

- 100% research time (optional <20% functional work)
- Access to ESA missions & environment
- Mentoring from senior ESA Faculty
- Monthly salary: €3000–€4600 (based on location & experience)

esa

Contact: fellowship@cosmos.esa.int

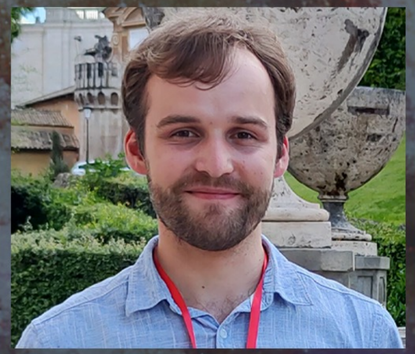
esa

→ THE EUROPEAN SPACE AGENCY

RESEARCH FELLOWS IN SPACE SCIENCE 2026

Ekaterina Ilin

Emma Esparza-Borges



Gregor Rihtaršič

Peter Stephenson

Paola I. Tiranti

Jiří Žák

The ESA Advisory Structure

ESA Executive
DG, D/SCI

Science Programme Committee (SPC)

Member States

Decision Body

Scientific advice & recommendations

Space Science Advisory Committee (SSAC)

Astronomy Working Group (AWG)

Solar System and Exploration WG (SSEWG)

Physical Sciences Working Group (PSWG)

Scientists

European Scientific Community

Member State institute

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Physical Sciences Working Group (PSWG)

Scientists

European Scientific Community

Member State institute

CALL FOR EXPRESSION OF INTEREST TO BECOME A MEMBER OF THE

ASTRONOMY WORKING GROUP (AWG)

SOLAR SYTEM AND EXPLORATION WORKING GROUP (SSEWG)

SPACE SCIENCE ADVISORY COMMITTEE (SSAC)

- Need to be affiliated with member state institute
- Appointment for 3 years
- 3 meetings a year (ESTEC/ESAC/HQ)
- Plus additional meetings for selection and adoption reviews

https://www.cosmos.esa.int/web/expression-of-interest-for-science-advisory-members-2026

Deadline: 1 July 2026, 12:00 (noon) CEST

esa

DIRECTOR OF SCIENCE TOWN HALL MEETING

Wednesday June 24, FROM 14:00 CET

PROGRAMME

Introduction :	14:00 - 14:10
Director's address:	14:10 - 15:00
Q&A:	15:00 - 16:00

- Great way of interacting with the Director of Science directly!

https://www.cosmos.esa.int/web/dsci_townhall

ESA SCI Newsletter

The ESA-SCI Newsletter

www.cosmos.esa.int/web/scinews

ESA SCIENCE NEWSLETTER

ISSUE #04/2026 - 6 MAY 2026

Save the Date - 2026 ESA Directorate of Science Town Hall

This is a first announcement of the 2026 Director of Science Town Hall, to be held virtually on 24 June, from 14:00 to 16:00 CEST.

The ESA Science Town Halls provide an opportunity for direct exchange between the Directorate's Executive and the broader scientific community. The 2026 Town Hall will include the latest updates on ESA's Science Programme and provide a preview of upcoming developments. There will also be an opportunity to address your questions about the programme.

Registration will open on 1 June.

Read more

Call for Expressions of Interest to become Member of the AWG/SSEWG and/or SSAC

ESA's science advisory structure is the main channel for ensuring an effective relationship between ESA and the scientific community in Europe. It is an essential element for interpreting the views and needs of the scientific community regarding access to space experimentation and use of Science Programme data.

The Director of Science issues an annual call inviting scientists affiliated with institutions in the ESA Member States to express their interest in becoming members of the Space Science Advisory Committee (SSAC), the Astronomy Working Group (AWG), and the Solar System and Exploration Working Group (SSEWG).

If you have already applied to a previous call there is no need to reapply unless there has been a substantial change in your affiliation and/or profile.

The deadline is 1 July 2026 at 12:00 (noon) CEST.

Read more

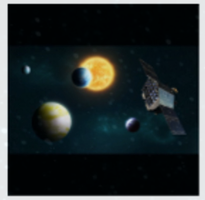
Research Fellows in space science 2026

ESA has selected 6 new Fellows to pursue their own independent research in space science, starting in 2026.

The 2026 Research Fellows in space science are Emma Esparza-Borges, Ekaterina Ilin, Gregor Rihtaršič, Peter Stephenson, Paola I. Tiranti, and Jiří Žák. Their research spans a broad range of topics in the fields of heliophysics, planetary science, astrophysics, and fundamental physics. For example, they will investigate the nature of dark matter using galaxy cluster collisions, learn how Jupiter's atmosphere works using the observations of the famous Great Red Spot, and explore the evolutionary pathways of exoplanets.

The next call for the ESA Research Fellowship in Space Science is expected to open in August 2026.

Read more

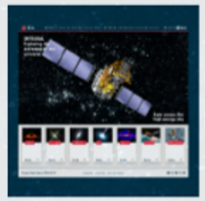


Plato's Guest Observers Programme: AO-1 Call now open

ESA is looking forward to Plato (PLAnetary Transits and Oscillations of stars), scheduled for launch in under a year. Plato will monitor a wide field for several years, delivering imagettes and light curves for hundreds of thousands of stars. Its goals include detecting terrestrial planets in habitable zones and advancing asteroseismology, with most data becoming public shortly after validation.

ESA now invites Guest Observer proposals for complementary science. The First Announcement of Opportunity opened on 7 April and will close on 21 May, offering 8% telemetry for new targets, upgraded modes, and a proprietary access period. Proposers are encouraged to review the available material, join community initiatives, and submit their research ideas.

Read more

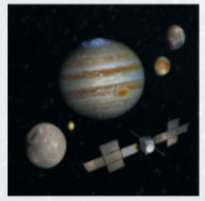


Integral legacy user validation & feedback exercise on 22 June 2026

The final phases of development of the Integral Legacy Archive (ISLA) are well underway, and representatives of the scientific community will convene on 22 June 2026, 10:30-12:00 CEST for an online presentation of the archive with opportunity to advise on usability or user friendliness. Inspired by the presentation, ideas may come up how externals can help, e.g., contribution of community products.

Members of the public are welcome. Information on how to join is available on the webpage.

Read more



Vacancy: Science Operations System Engineer for Juice

ESA's Directorate of Science is looking for a Science Operations System Engineer, to be based at ESAC (Madrid, Spain).

In this role, the Science Operations System Engineer is supporting the design, implementation, testing and maintenance of science ground segment systems, and they will be initially assigned to the Juice mission.

The Juice Science Operations Centre at ESAC (Madrid, Spain) is responsible for the science planning, data processing and archiving activities of ESA's contribution to the missions's science operations. The Science Operations System Engineer will work in close collaboration with the development and operations team, Project Scientist, Mission Operations Centre at ESOC, and Instrument Teams.

The deadline for applications is 15 May 2026.

Read more

Recent science highlights:

- First Proba-3 science: surprisingly speedy solar wind
- Hubble turns 36 with a dazzling Trifid Nebula portrait

Upcoming ESA conferences:

The X-ray Universe 2026

8-11 June 2026, Elche, Spain

This conference is the seventh meeting in the "The X-ray Universe" series, aimed at encompassing a broad range of high-energy astrophysics topics, from solar system studies to cosmology. It will provide a showcase for results and discoveries from XMM-Newton and other missions, discussing as well the scientific potential of future missions and the evolution of the scientific analysis landscape.

PV 2026 - Ensuring Long-Term Preservation and Adding Value to Scientific and Technical Data

23-25 June 2026, ESAC, Villanueva de la Canada, Madrid, Spain and online

PV 2026 bring together the community to present and discuss the experiences, feedback and prospects for efficient scientific and technical data management systems along a variety of themes including long-term data preservation, adding value to data and facilitation of data use, impact of AI and ML, governance, funding and policy for long term preservation, and metrics for data archives usage.

European Astronomical Society Annual Meeting 2026 - ESA mission session

29 June - 03 July 2026, Lausanne, Switzerland

Multiple Symposia and Special sessions at the EAS 2026 meeting are explicitly dedicated to ESA missions, including:

- Symposium S7: Gaia, at the dawn of Gaia DR4, preparing for DR5 and beyond
- Symposium S10: Euclid: the first 2000 square degrees of the cosmos
- Special Session SS21: Preparing for PLATO's science data: mission insights and community engagement
- Special Session SS22: Getting ready for Science with the Nancy Grace Roman Space Telescope

European Astronomical Society Annual Meeting 2026 - Lunch Sessions LS2 and LS4: ESA Science Programme and ESA Archives

29 June - 03 July 2026, Lausanne, Switzerland

During two dedicated lunch sessions, ESA's Science Directorate will present an overview over its programme aimed at early career researches and update the European space science community on the services, tools, and assets offered by the ESA Space Science Archives.

- Lunch Session LS2: The ESA Science Programme
- Lunch Session LS4: The ESA Space Science Archives

Europlanet Science Congress - TP18: BepiColombo nears Mercury

7 - 11 September 2026, The Hague, The Netherlands

A dedicated topical session at the EPSC2026 will focus on the BepiColombo mission and the exploration of Mercury, bringing together the community to discuss the mission's latest results and scientific prospects as it prepares for orbital operations around the innermost planet. The session will highlight new insights into Mercury's interior, surface, exosphere and magnetosphere, placing BepiColombo's upcoming measurements on the front line of planetary research.

INTEGRAL Legacy Conference 2026

19 - 23 October 2026, Orsay, France

INTEGRAL is crucial in our understanding of high energy astrophysical phenomena, permitting studies of bright transient events, which made it a cornerstone for multi-messenger astronomy, and of elusive signals from faint gamma-ray sources. This has fostered collaborations with other missions that will enhance INTEGRAL's legacy in supporting new missions and answering new astrophysical questions.

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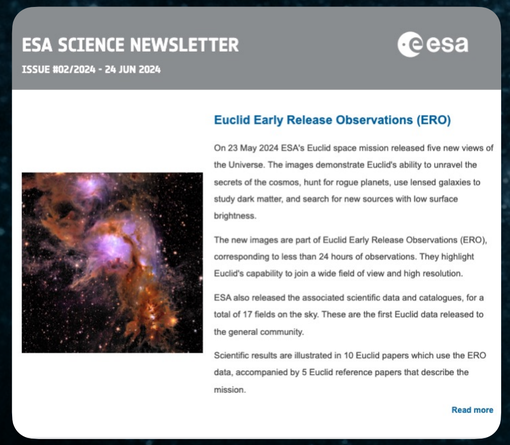
Thank you!

ESA Science Newsletter

www.cosmos.esa.int/web/sci news



ESA Space-Science Research Fellowship

www.cosmos.esa.int/web/space-science-faculty/opportunities/research-fellowships

Visiting Programmes

https://www.cosmos.esa.int/web/space-science-faculty/opportunities

Announcements of Opportunity

www.cosmos.esa.int/web/science-announcement-of-opportunities