



Overview of the ESA Euclid mission in the context of ESA Science

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ESA UNCLASSIFIED - For ESA Official Use Only

8th July 2025 – FORTH

→ THE EUROPEAN SPACE AGENCY



WHO 23 Member States, 2500+ staff members and total workforce of 6000+

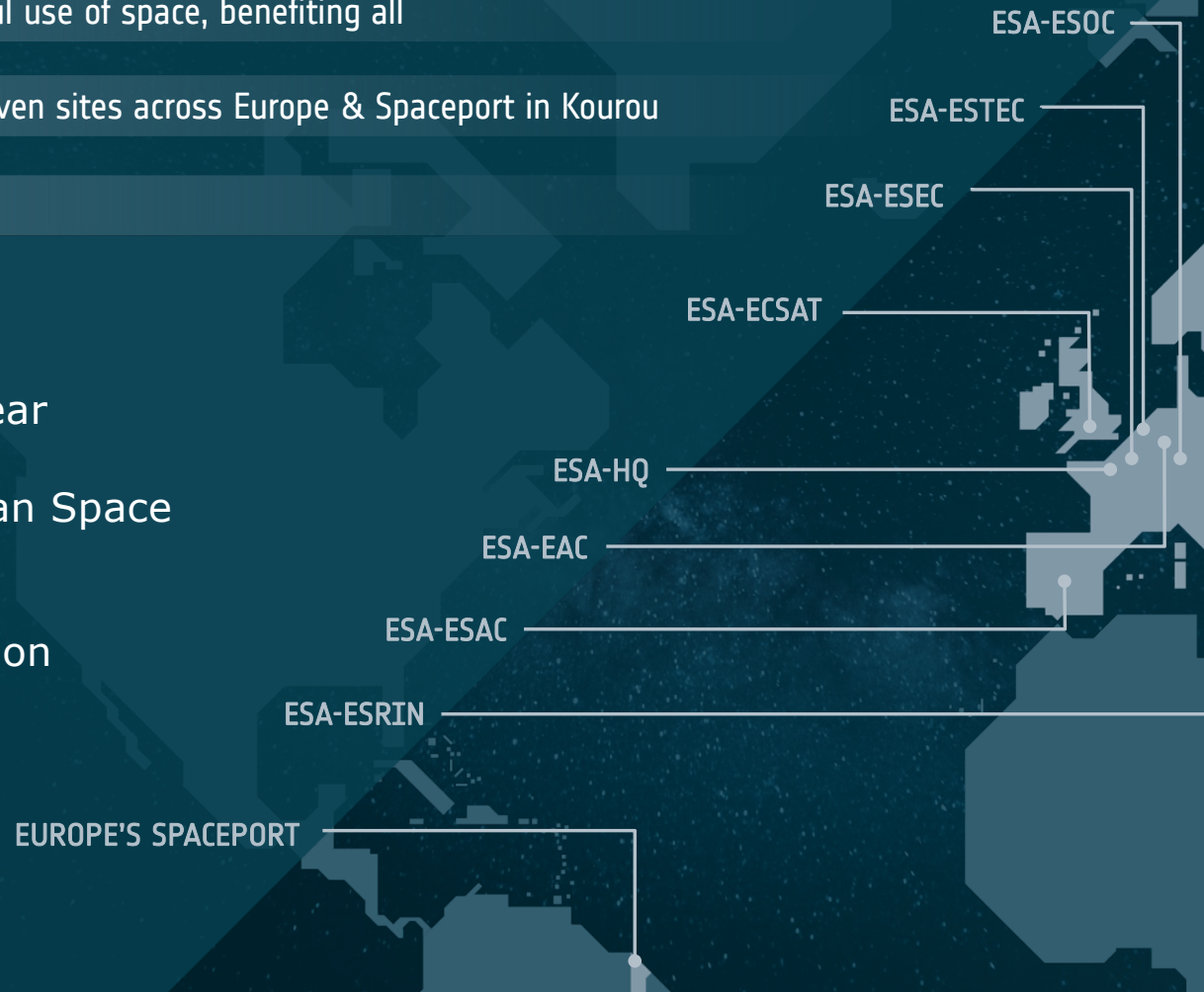
WHY For the peaceful use of space, benefiting all

WHERE HQ in Paris, seven sites across Europe & Spaceport in Kourou

BUDGET €7.79 billion

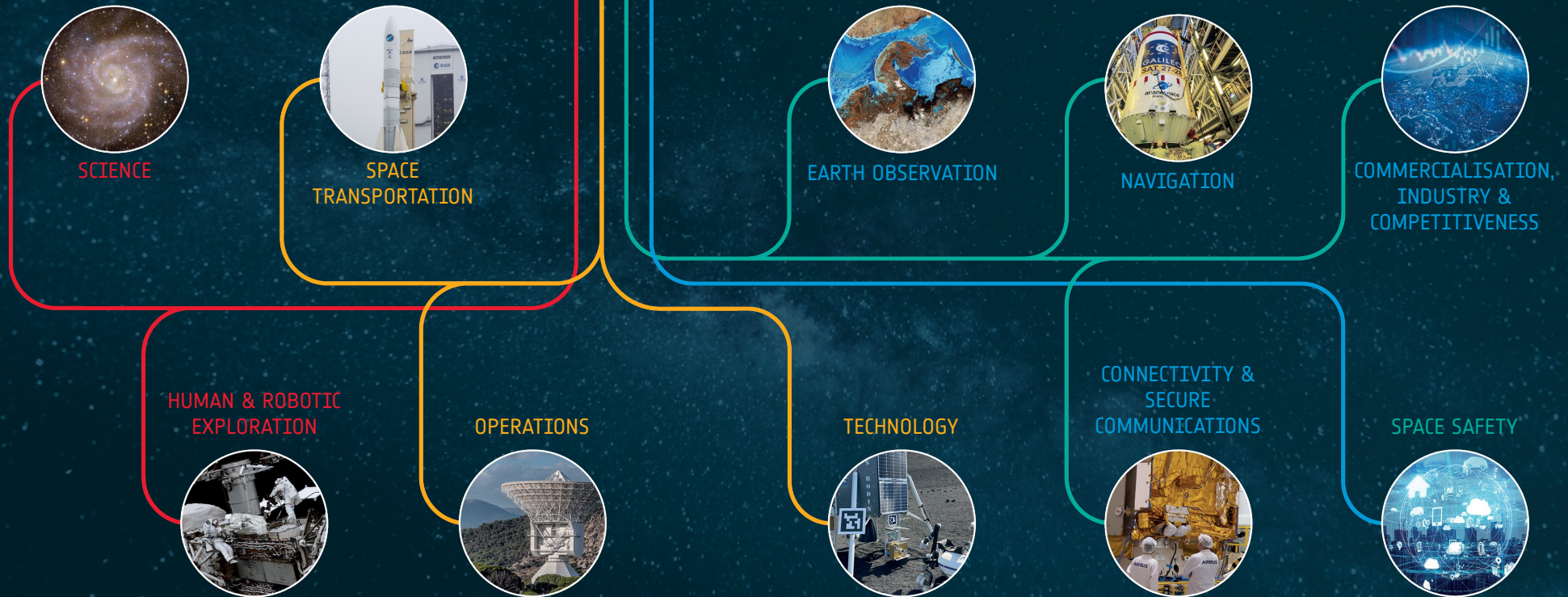
50th anniversary this year

1975: merge of European Space
Research Organization
and European Launcher
Development Organization



INSIDE ESA

Four pillars. One ESA.



SCIENCE & EXPLORATION

- What is the origin of the Solar System and stars?
- What is the history of our Universe and the fundamental forces governing it?
- Are we alone?

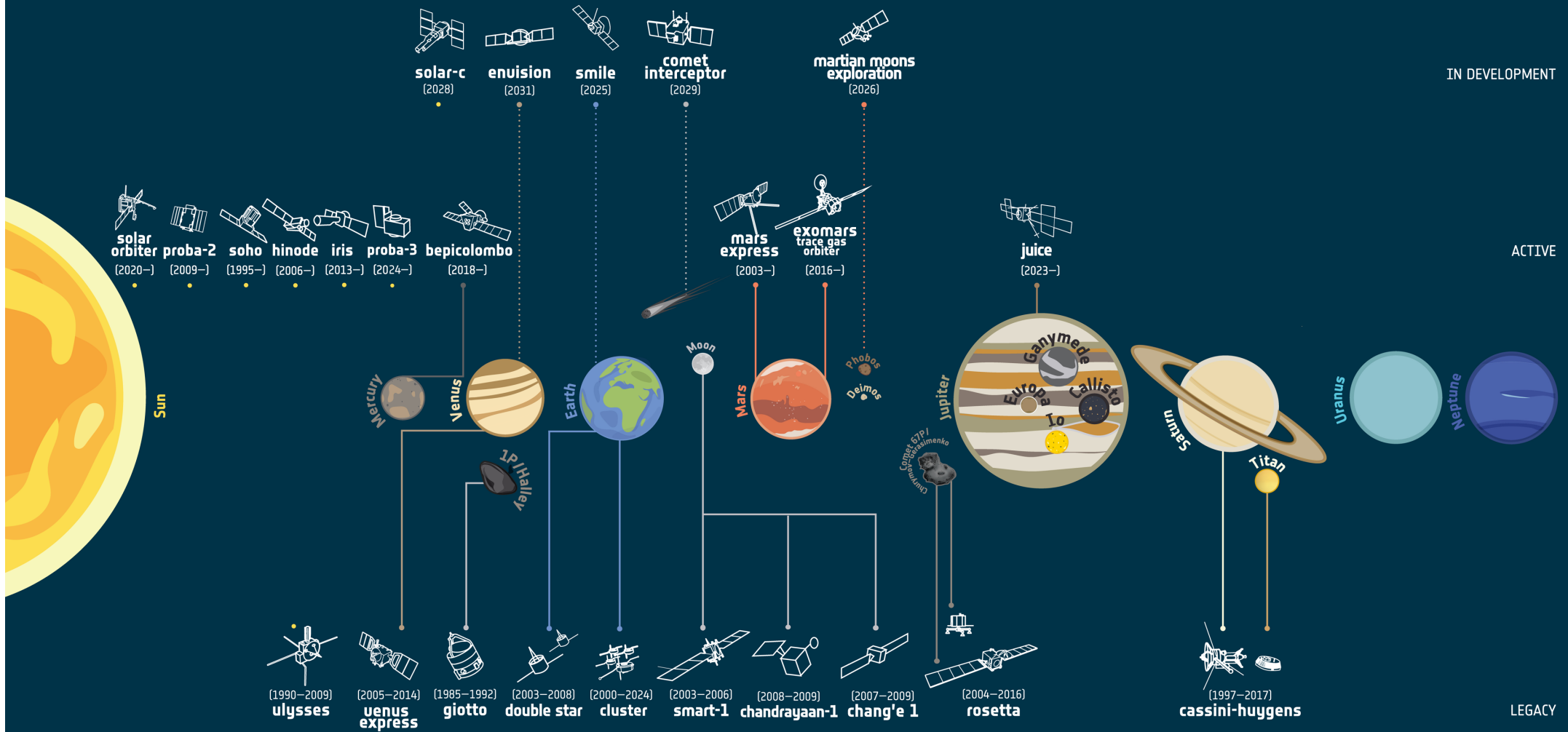
SOLAR SYSTEM EXPLORERS

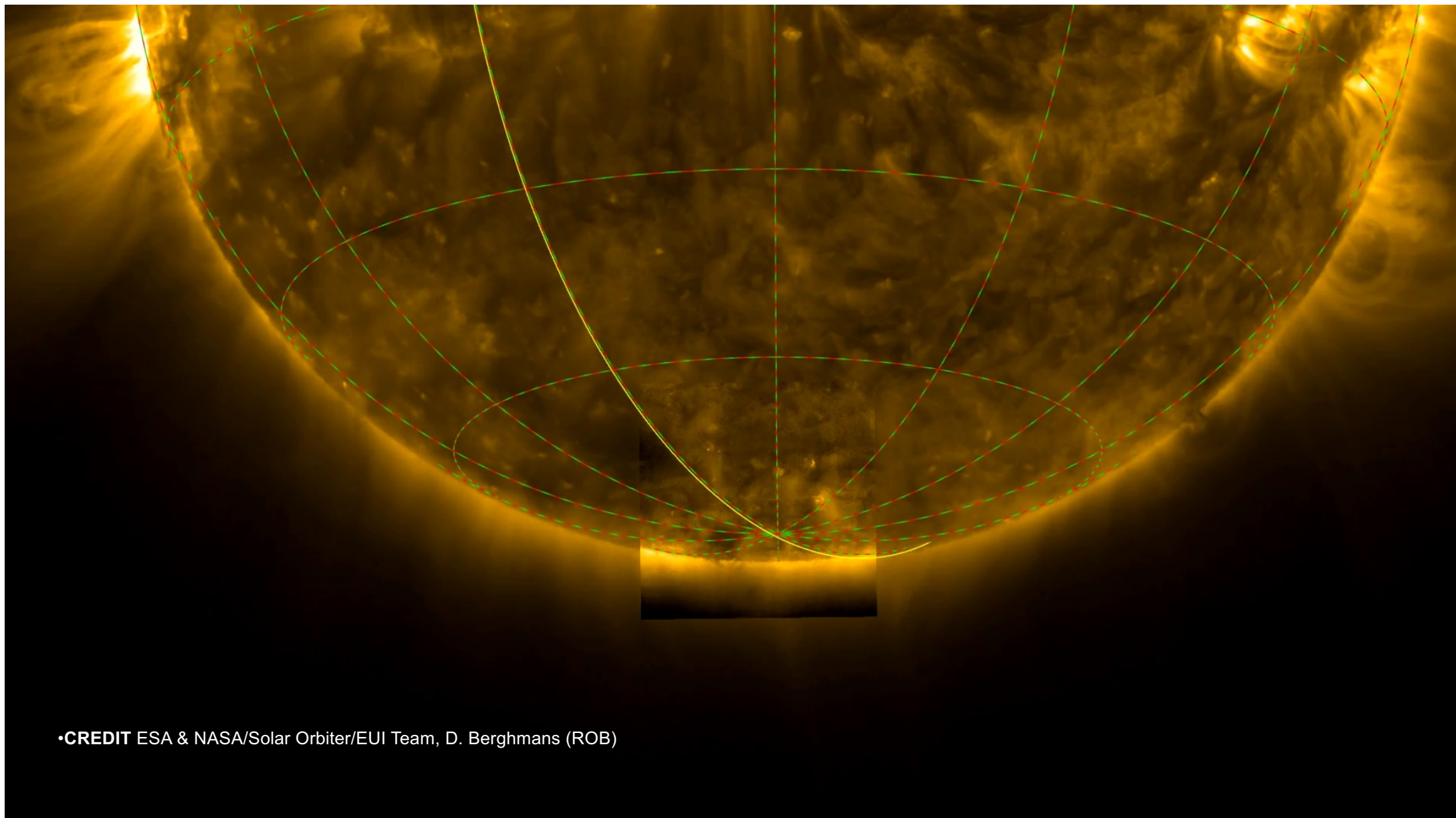


IN DEVELOPMENT

ACTIVE

LEGACY





•CREDIT ESA & NASA/Solar Orbiter/EUI Team, D. Berghmans (ROB)

COSMIC OBSERVERS



IN DEVELOPMENT

ACTIVE

LEGACY

microwaves

sub-millimetre

infrared

optical

ultraviolet

x-rays

gamma rays

gravitational waves



planck
(2009-2013)



herschel
(2009-2013)



iso
(1995-1998)



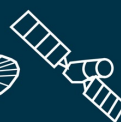
akari
(2006-2011)



hipparcos
(1989-1993)



gaia
(2013-2025)



corot
(2006-2014)



iue
(1978-1996)



exosat
(1983-1986)



hitomi
(2016)



suzaku
(2005-2015)



cos-b
(1975-1982)



integral
(2002-2025)



lisa pathfinder
(2015-2017)



microscope
(2016-2018)



webb
(2021-)



euclid
(2023-)



hubble
(1990-)



cheops
(2019-)



plato
(2026)



xrism
(2023-)



xmm-newton
(1999-)



einstein probe
(2024-)



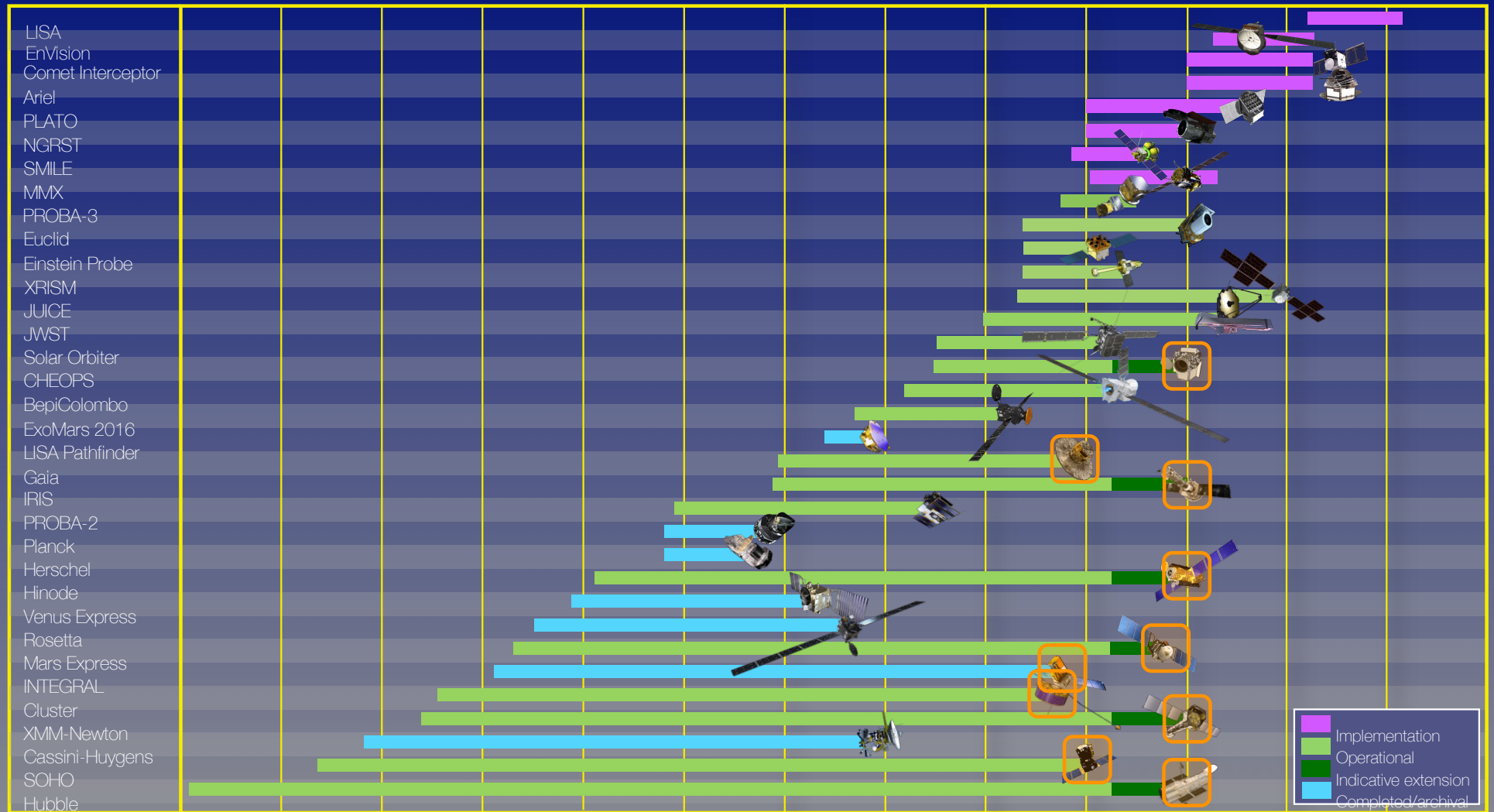
new athena
(~2037)



lisa
(~2035)

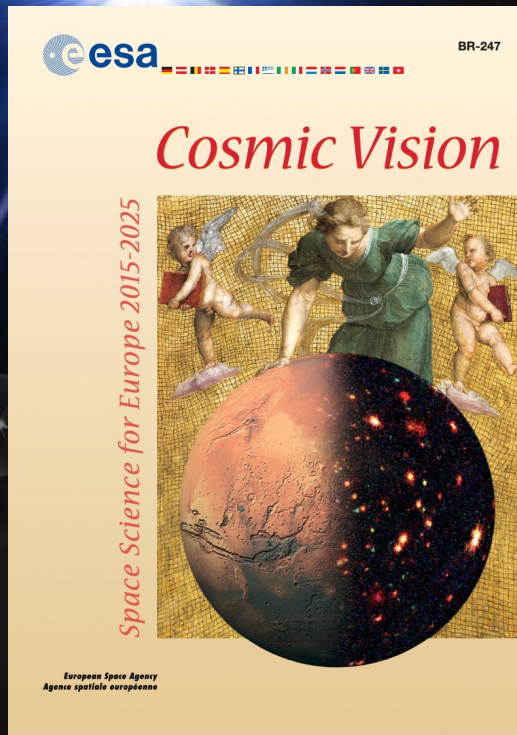
•CREDIT
ESA/Gaia/DPAC, Stefan Payne-Wardenaar

ESA Space Science Missions



Latest update: January 2024

ESA Cosmic Vision 2015 - 2025



- what are the conditions for planet formation and the emergence of life?
- how does the Solar System work?
- what are the fundamental physical laws of the Universe?
- how did the Universe originate and what is it made of?

COSMIC VISION [launches spanning 2019 - 2037]

SMALL/FAST



S1 - CHEOPS
[2019]



SMILE
[2025]



F1 - Comet Interceptor
[2029]



F2 - ARRAKIS
[2030]

MEDIUM



M1 - Solar Orbiter
[2020]



M2 - Euclid
[2023]



M3 - PLATO
[2026]



M4 - Ariel
[2029]



M5 - Envision
[2031]

LARGE



L1 - JUICE
[2023]



L2 - New Athena
[2037]



L3 - LISA
[2035]

- in study
- in development
- in operations

Large missions science themes for ESA's future: Voyage 2050



3 Science Themes for Voyage 2050 Large missions

Moons of the giant planets
From temperate exoplanets to the Milky Way
New physical probes of the early Universe

**Medium size
missions
candidates:
M7 mission
candidates**

M7

M-MATISSE

Plasma Observatory

THESEUS

Call for one Medium-size (M8) mission opportunity (to be launched around 2041) and for one Fast mission (F3, to be launched around 2034), plus proposals for mini-Fast (mini-F) mission concepts

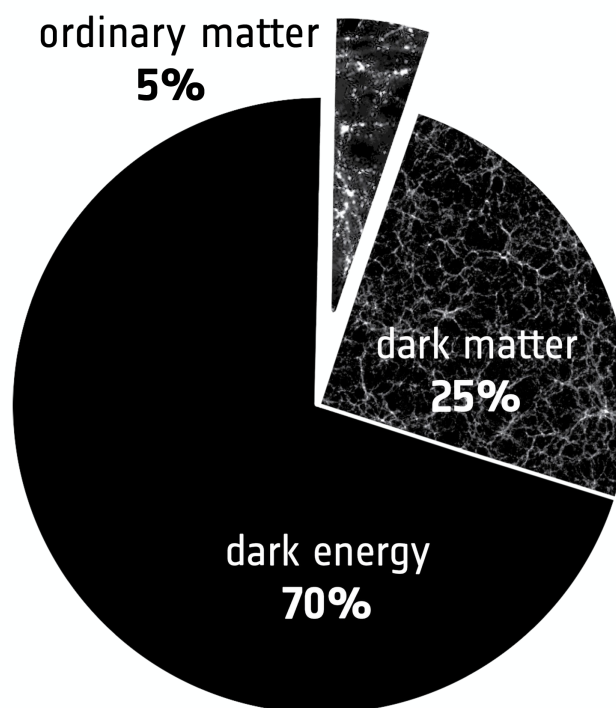


ESA EUCLID



→ THE EUROPEAN SPACE AGENCY

What is the universe made of?



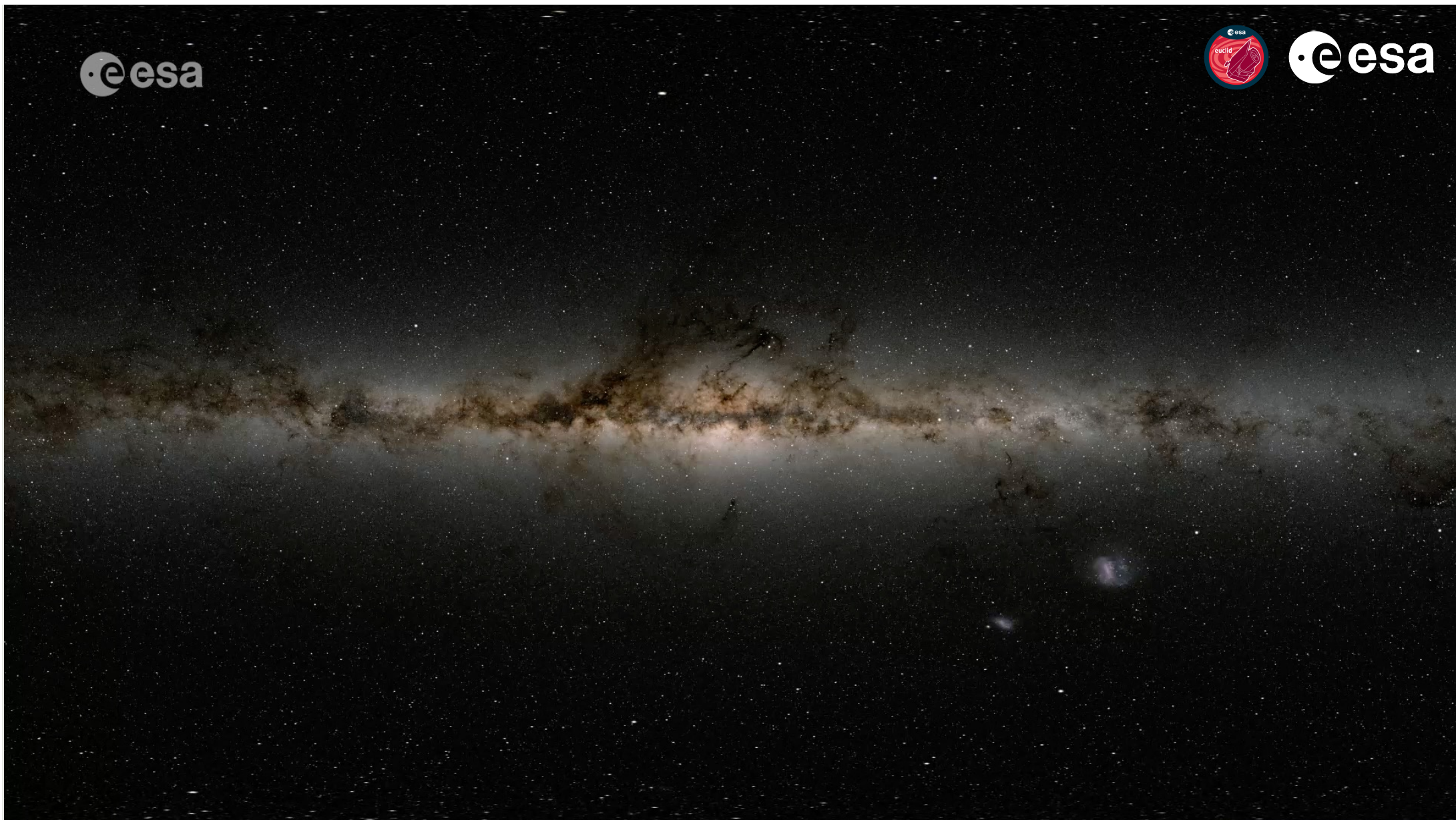
The cosmic web

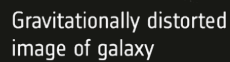


EUCLID CONSORTIUM FLAGSHIP SIMULATION



→ THE EUROPEAN SPACE AGENCY







FROM GROUND

credit: Yuzheng Kang/Euclid Consortium





FROM SPACE

credit: Yuzheng Kang/Euclid Consortium



EUCLID'S VISIBLE AND INFRARED INSTRUMENTS

Euclid will examine visible and infrared light from distant galaxies using two scientific instruments on board. These instruments will measure the accurate position and shapes of galaxy in visible light, and their redshift (from which their distance can be derived) in infrared light. With these data, scientists can construct a 3D map of the distributions of both the galaxies and the dark matter in the Universe. The map will show how large-scale structure evolved over time, tracing the role of dark energy.

VIS

The visible instrument



Measures the shapes of billions of galaxies



550–900 nm wavelength



Mosaic of 36 CCDs, 4k x 4k pixels each

A mosaic of 600 megapixels



Special feature

very sharp images of galaxies

NISP

Near-infrared spectrometer and photometer



Measures brightness and intensity of light from galaxies



Used to calculate redshift/distance



900–2000 nm wavelength

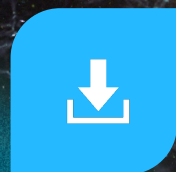


Mosaic of 16 detectors, 2k x 2k pixels each

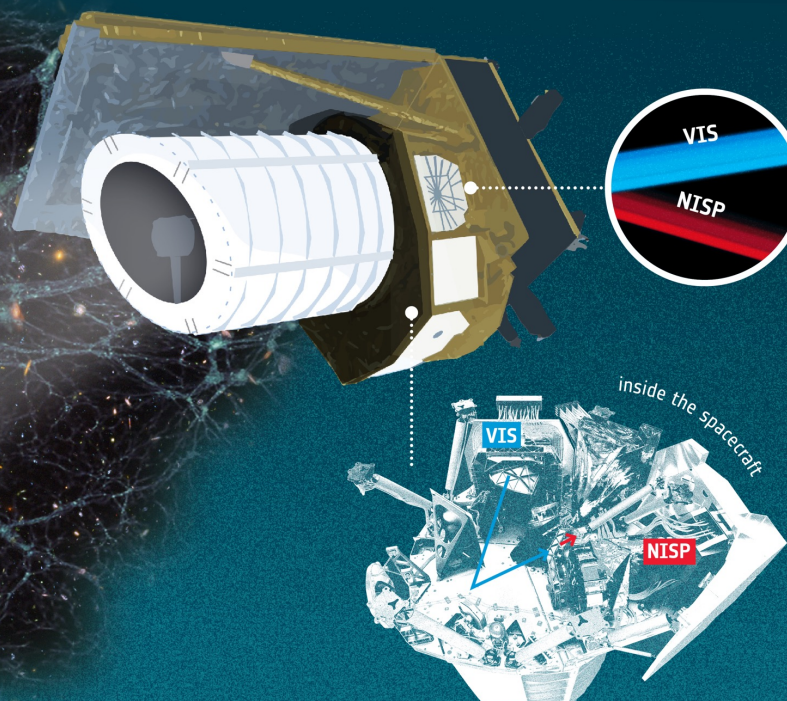


Special feature

largest infrared field-of-view from space



DATA
DOWNLOAD:
106 GB/DAY



ESA (acknowledgement: work performed by ATG under contract to ESA)

EUCLID SPACECRAFT

Euclid is designed to provide both excellent quality imaging in the visible, and spectroscopy and photometry in the near-infrared. The sunshield keeps the telescopes and instruments shaded from the Sun to ensure thermal stability and highly sensitive measurements. It will make sure **VIS operates at -33 °C** and **NISP at -180 °C**. To store the large data volume that will be accumulated during observations, Euclid has a mass memory of 4 terabits.



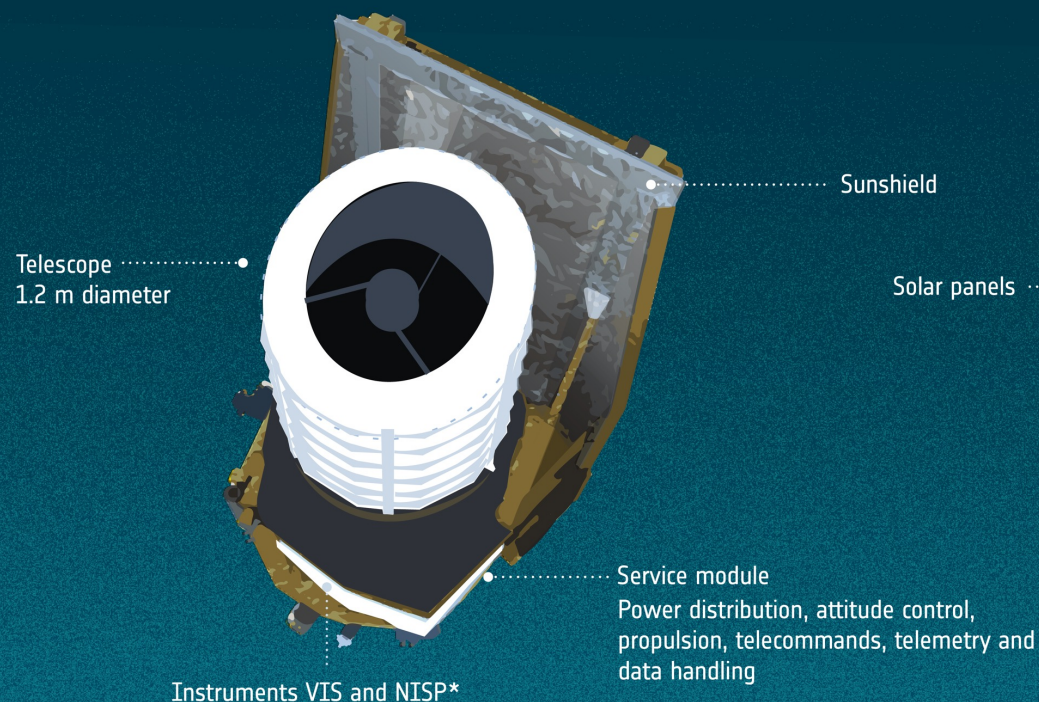
Euclid's mass in orbit will be

2 tonnes

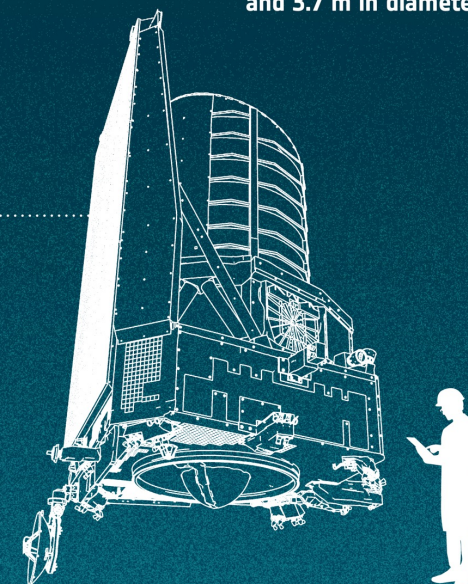
- 800 kg payload module
- 850 kg service module
- 40 kg balancing mass
- 210 kg propellant

* VIS: VISible instrument

NISP: Near-Infrared Spectrometer and Photometer

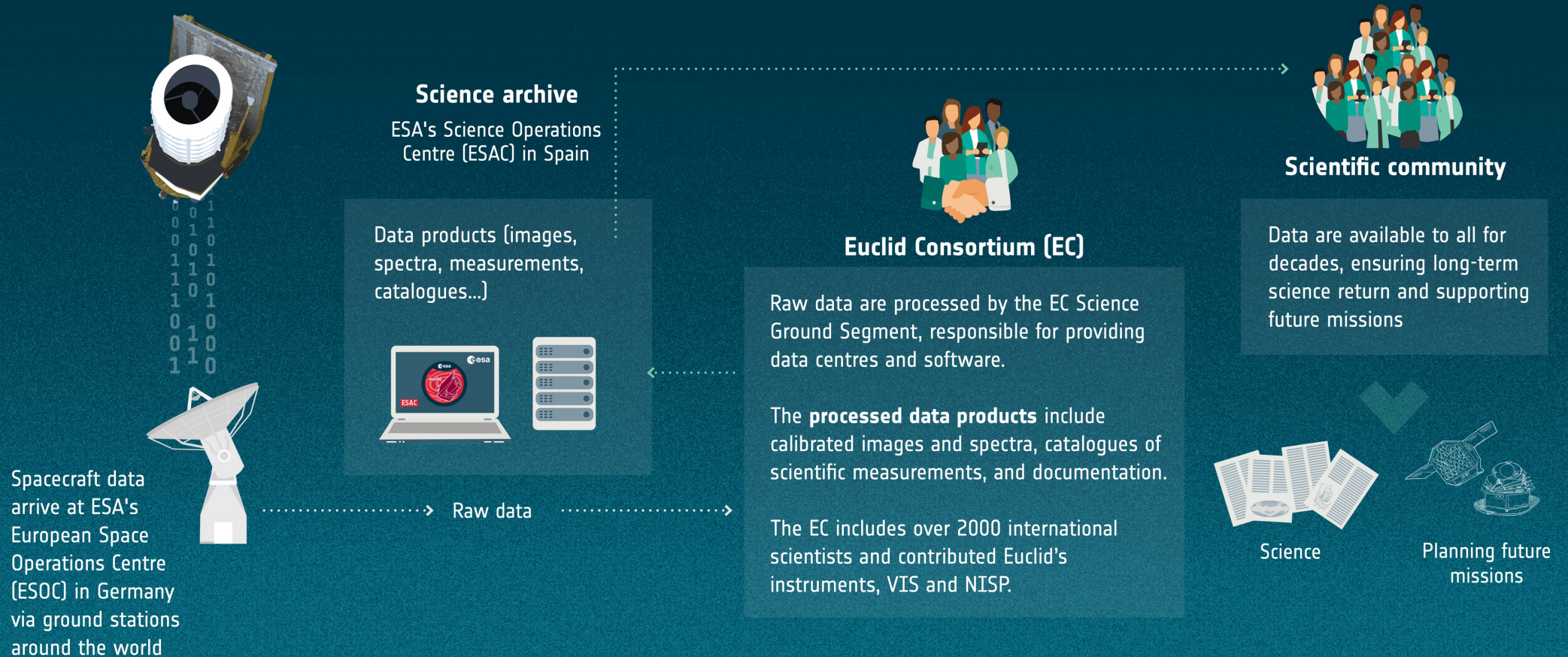


The Euclid spacecraft is 4.7 m tall
and 3.7 m in diameter



ESA (acknowledgement: work performed by ATG under contract to ESA)

ASTRONOMY SCIENCE ARCHIVE: MAXIMISING SCIENCE FROM OUR MISSIONS



ESA (acknowledgement: work performed by ATG under contract to ESA)

Status of the Euclid mission

What is the nature of dark energy? What is the nature of dark matter?

What is the structure and evolution of the cosmic web? Is our understanding of gravity complete?

2007 selection of proposals

2012 mission adoption and start of the implementation phase

Launch 1st July 2023

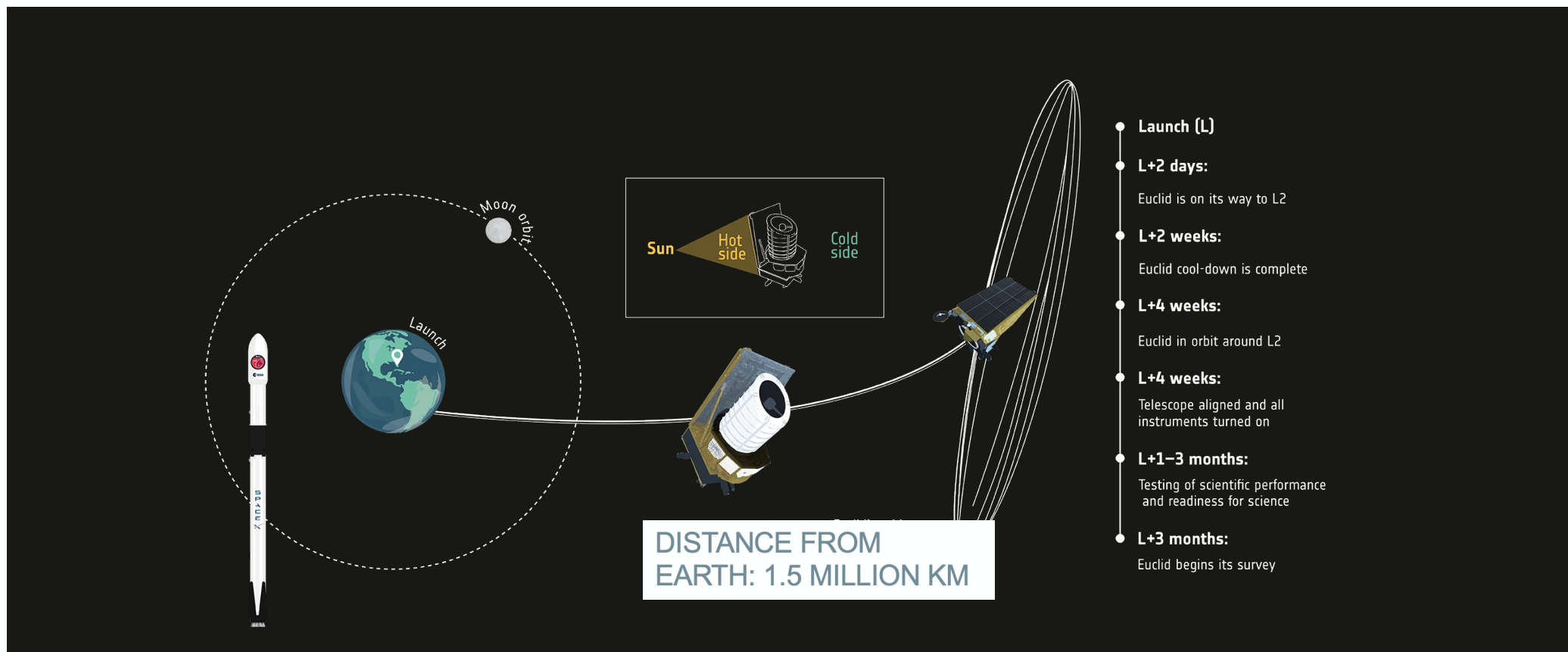




T - 00:00:06
EUCLID

STARTUP LIFTOFF MAX Q

Euclid journey



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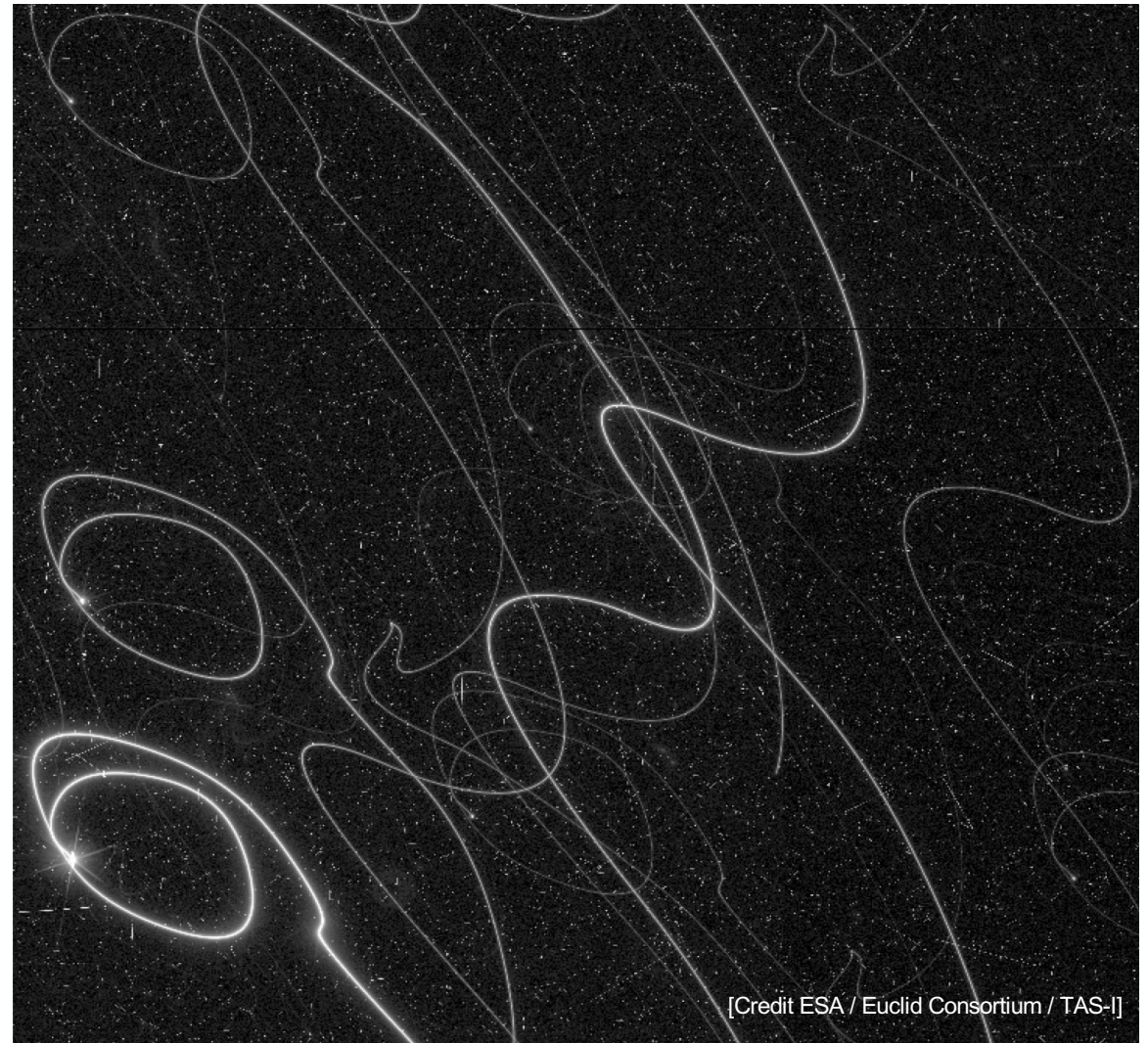
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July 2023 – Dec. 2023 Commissioning (until 4th August) and Performance verification (until 3rd Dec.)



STAY STILL
while taking
a picture



[Credit ESA / Euclid Consortium / TAS-I]

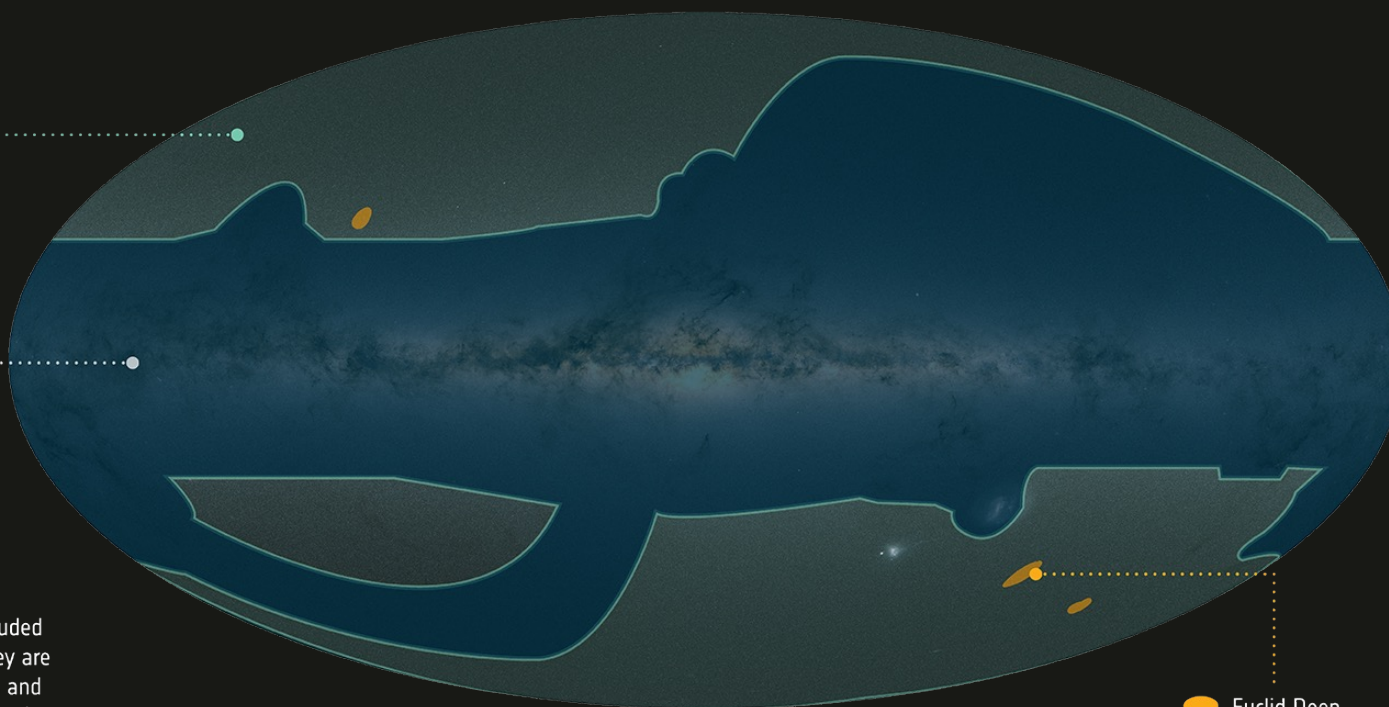


→ THE EUROPEAN SPACE AGENCY

A map of the sky

● Portions of the sky that will be covered by the wide survey

Other regions: These are excluded from observations because they are dominated by Milky Way stars and interstellar matter, or by diffuse dust in the Solar System – the so-called zodiacal light



● Euclid Deep Fields, covering 10% of observations



SURVEY DURATION:
6 YEARS



AREA OF SKY:
14,000 DEG²



NUMBER OF GALAXIES:
1.5 BILLION



An ESA-led collaboration



ESA Euclid (survey status, data)
Euclid Consortium:

www.cosmos.esa.int/web/euclid
www.euclid-ec.org

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14th Feb 2024: start of the nominal survey

May 2024: Early Release Observations (ERO), image and data release



Young star-forming region of Messier 78



EARLY RELEASE OBSERVATIONS

Credit: ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre (CEA Paris-Saclay), G. Anselmi

Early Release Observations

sky.esa.int

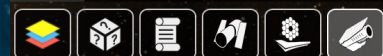


Credit: ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre (CEA Paris-Saclay), G. Anselmi

J2000 05 46 45.804 +00 00 04.46 FoV: 2.0° X 1.1° DSS2 color

Sci. Mode ☐ En Feedback

Search...



ESA/Euclid Outreach Images

Hide
Footprints ☐

Object Name

Title

filter column...

filter column...

Outside Field of View (13 images)

Abell 2764 galaxy cluster	Abell 2764 galaxy cluster (enhanced view)
Perseus galaxy cluster	Perseus cluster of galaxies
NGC6744 spiral galaxy	NGC6744 spiral galaxy (enhanced view)
Horsehead Nebula	The Horsehead Nebula
NGC6397 globular cluster	The globular cluster NGC 6397
NGC6744 spiral galaxy	NGC6744 spiral galaxy (24x24k resolution)
El Dorado galaxy group	El Dorado galaxy group (24x24k resolution)

Rows: 15

Messier 78 nebula (24x24k resolution)

This image is released as part of the Early Release Observations from ESA's Euclid space mission. All data from these initial observations are made public on 23 May 2024 – including a handful of unprecedented new views of the nearby Universe, this being one.

This breathtaking image features Messier 78 (the central and brightest region), a vibrant nursery of star formation enveloped in a shroud of interstellar dust. This image is unprecedented – it is the first shot of this young star-fo...

Show More

Image Opacity

And first scientific results using ERO data

Li et al 2025 discusses the discovery and analysis of a potential dark galaxy, referred to as Candidate Dark Galaxy-2 (CDG-2), in the Perseus Cluster

An **almost dark galaxy**, a type of galaxy that is extremely faint and difficult to detect because it has very few stars and is dominated by dark matter. These galaxies are characterized by having most of their stellar populations contained within globular clusters (GCs) rather than being spread out in a diffuse stellar component like in typical galaxies.

Image CREDIT ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre (CEA Paris-Saclay), G. Anselmi

<https://arxiv.org/pdf/2506.15644>



FIRST VIEWS FROM THE EUCLID WIDE SURVEY

208 gigapixels
260 observations
2 weeks
132 square degrees
1% of the wide survey

Video available 2.2M views in 6 months

ESA/Euclid/Euclid Consortium/NASA, CEA Paris-Saclay, image processing by J.-C. Cuillandre, E. Bertin, G. Anselmi.



Video here:

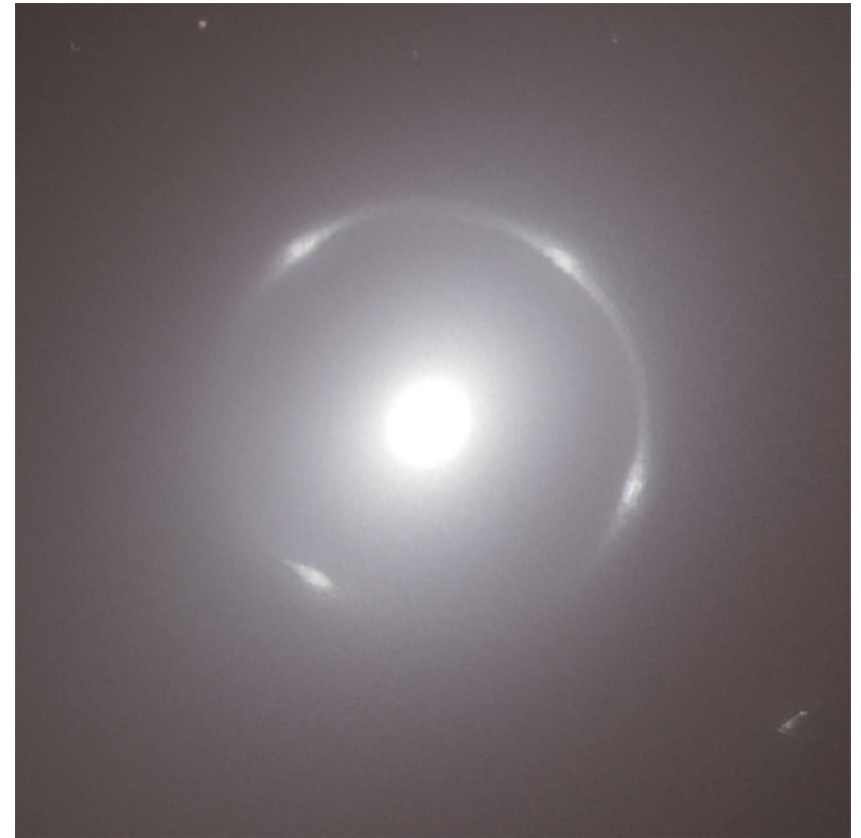
https://www.esa.int/ESA_Multimedia/Videos/2024/10/Euclid_survey_s_sneak_preview



→ THE EUROPEAN SPACE AGENCY

Euclid: A complete Einstein ring in NGC 6505

- Scientists (B. Altieri, ESA archive scientist) discovered a complete Einstein Ring within galaxy NGC 6505, within the images of the testing phases observed in September 2023
- NGC 6505 is a well-known galaxy only around 590 million light-years from Earth, and Euclid's discovery of a complete Einstein ring here was unexpected.
- Combining the strong lensing measurements with analysis of the spectroscopic data, Conrath et al 2025 estimate a dark matter fraction inside the Einstein radius of about 11%.
- ESA press release (+ Euclid Consortium, NASA):
https://www.esa.int/Science_Exploration/Space_Science/Euclid/Euclid_discovers_a_stunning_Einstein_ring
- In the news (The Guardian, CNN, APOD, etc)

C. M. O’Riordan et al (2025, *Astronomy & Astrophysics*. DOI: 10.1051/0004-6361/202453014)

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19th March 2025: first public Quick Data Release (Q1) from survey data



The Q1 Euclid data release

19th March 2025: first survey data release

Time: 1 week of observations

Area: 63.1 deg² of the Euclid Deep Fields (EDFs).

Data: 35 TB, with visible and near-infrared imaging and spectroscopic data, ground-based photometry, masks.

Sources: 26 millions galaxies, for a total of almost 30 millions of sources.

Scientific papers: 27 scientific papers + 7 reference papers describing the complex processing

Data Access: available through the [Euclid science archive at ESAC](#), with tools for querying and visualizing data and through [ESA Datalabs](#), including tutorials.

Q1 Data Release Overview: Aussel et al 2025

with a detailed description of the data processing pipeline, including calibration, stacking, and catalog extraction.



Where to start

<https://www.cosmos.esa.int/web/euclid/home>

Home Data Mission People and Teams News Science Results Resources Timeline Meetings Helpdesk

Quick Data Release Q1
Euclid Early Release Observations
Euclid DOI overview page

Planned maintenance: [Cosmos](#) / [SciTech](#) portal infrastructure: Monday 24 March from 7:00am CET - 8:30am CET.

Euclid Quick Data Release 1
19 March 2025



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Where to start

<https://www.cosmos.esa.int/web/euclid/euclid-q1-data-release>



Euclid Quick Data Release 1
19 March 2025

EUCLID Q1 CONTENTS
Information on Euclid Quick Data Release 1 contents.

EUCLID Q1 PAPERS
Papers related to Euclid Quick Data Release 1.

MEET THE EUCLID Q1 AUTHORS
Interviews with some of the authors of selected Euclid Quick Data Release 1 Papers.

EUCLID Q1 DOCUMENTATION
The documentation for Euclid Quick Data Release 1, describing the processing of the data from raw to Euclid Q1 data products.

EUCLID Q1 DATA ACCESS
How to access the Euclid Quick Data Release 1.

EUCLID Q1 DATA MODEL
Information of the Euclid data model.

EUCLID Q1 KNOWN ISSUES
A list of the issues found with Euclid Q1 data after publication. If you find an issue with the data, please contact the [Euclid Helpdesk](#).

EUCLID Q1 AUXILIARY DATA
A list of Euclid mission reference data that is not contained in the Euclid Science Archive.

TUTORIALS
Help is available to guide you through the process of getting the data you need.

EUCLID Q1 DATA LICENSE, DOI, AND CREDITS
When using Euclid Q1 data, please acknowledge the work of the people involved and provide credits and necessary citations. Each release comes with its own [credit lines](#) and [Digital Object Identifier \(DOI\)](#).

EUCLID Q1 SOFTWARE TOOLS
There is no release of software of the EC for the Q1 data release.

PUBLIC OUTREACH MATERIAL
An overview of press releases and news on the ESA Euclid Mission and science.

EUCLID Q1 EVENTS
Events related to the Q1 data release.

QUESTIONS AND HELPDESK
[Contact the Euclid Helpdesk](#)

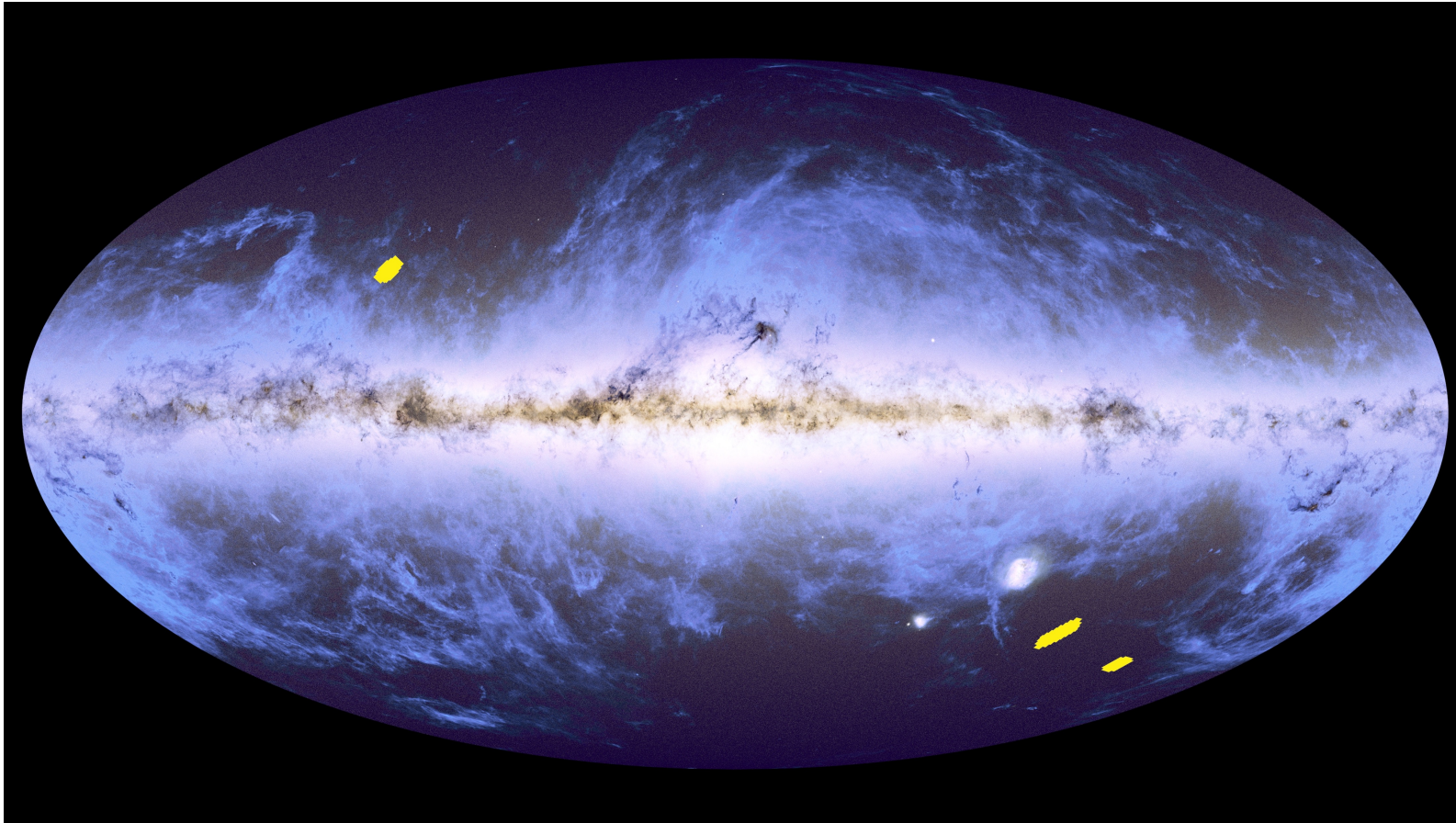
Jos De Bruijne, Cristina Hernandez De La Torre,
Sandor Kruk, Bruno Altieri, Sara Nieto, Anna Rudolsfen, VP



Video on Q1 here: <https://www.cosmos.esa.int/web/euclid/q1-public-outreach-material>



The Euclid deep fields



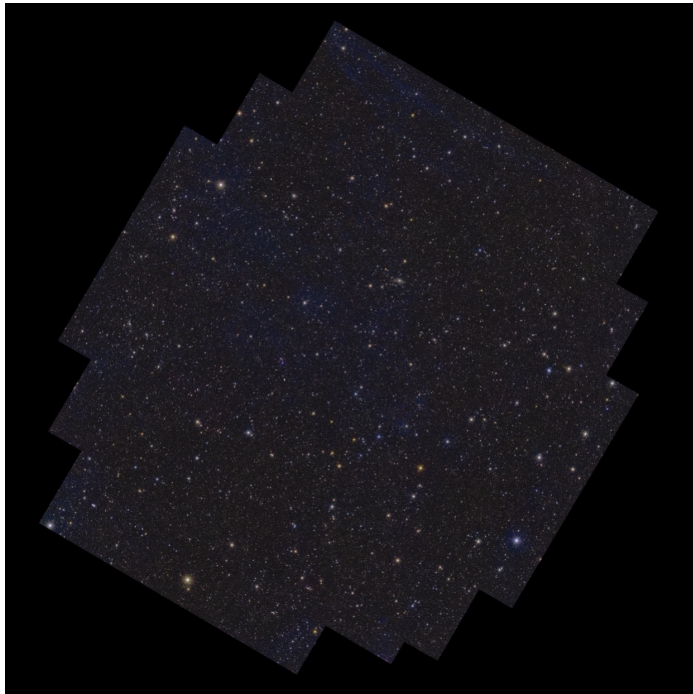
Credits: ESA/Euclid/Euclid Consortium/NASA; ESA/Gaia/DPAC; ESA/Planck Collaboration



The Euclid deep fields

<https://sky.esa.int/>

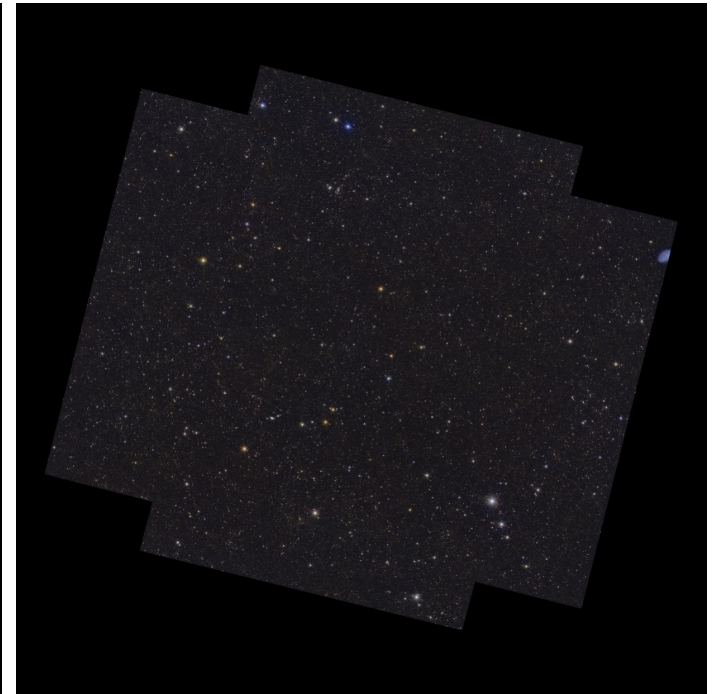
A single visit over the Euclid Deep Fields



Euclid Deep Field North
22.9 deg²



Euclid Deep Field South
28.1 deg²



Euclid Deep Field Fornax
12.1 deg²

Credits: ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre, E. Bertin, G. Anselmi



The dark cloud

<https://sky.esa.int/>

In order to test the performance of the Fine Guidance Sensor, two months after launch, Euclid observed an area with low number density of guide stars. Q1 includes observations of a star-forming area in Lynd's Dark Nebula 1641 in the Orion A Cloud (*dark cloud*): one field of view of approximately 0.5 deg^2 .



Star-forming area with young stellar objects

Credits: Aussel et al 2025, Data Release Overview



45



Q1 broad scientific areas

The area released in Q1 is not large enough for cosmological studies, but it is illustrative of how Euclid data are useful for a variety of purposes in astronomy.

Galaxy Morphology: *Walmsley et al, Huertas-Company et al, Siudek et al, Quilley et al*

Star-forming galaxies: *Enia et al, Girardi et al, Bisigello et al*

Passive galaxies and galaxy quenching: *Corcho-Caballero et al*

Active Galactic Nuclei evolution: *Matamoro Zatarain et al, Roster et al, Steven et al, Margalef-Bentabol et al, La Marca et al, Tarsitano et al*

Cosmic environment: *Cleland et al, Laigle et al, Gouin et al*

Strong Lenses: *Walmsey et al, Rojas et al, Lines et al, Li et al, Holloway et al, Busillo et al*

Galaxy Clusters: *Bergamini et al, Mai et al*

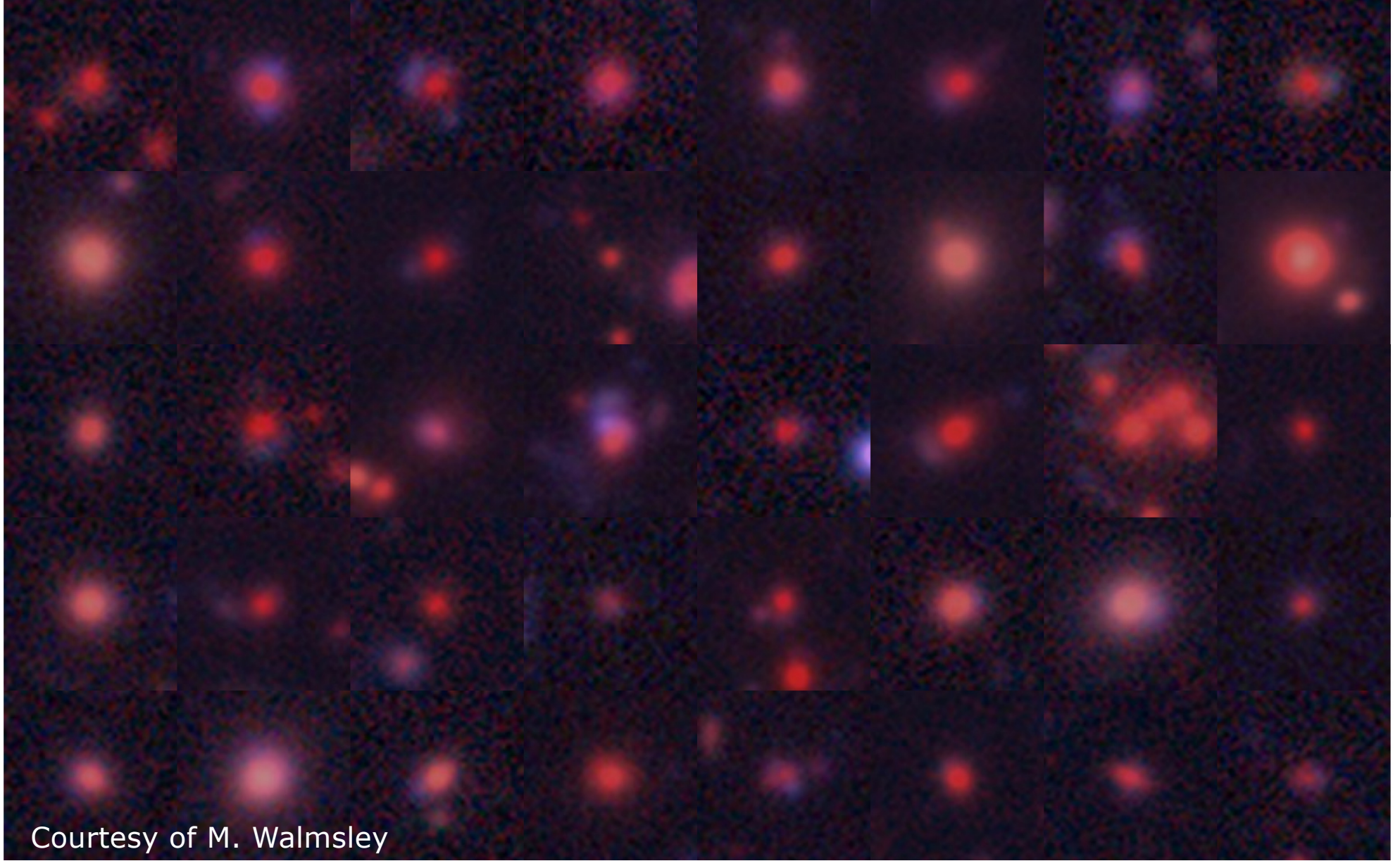
Transients: *Duffy et al*

Nearby galaxies: *Marleau et al*

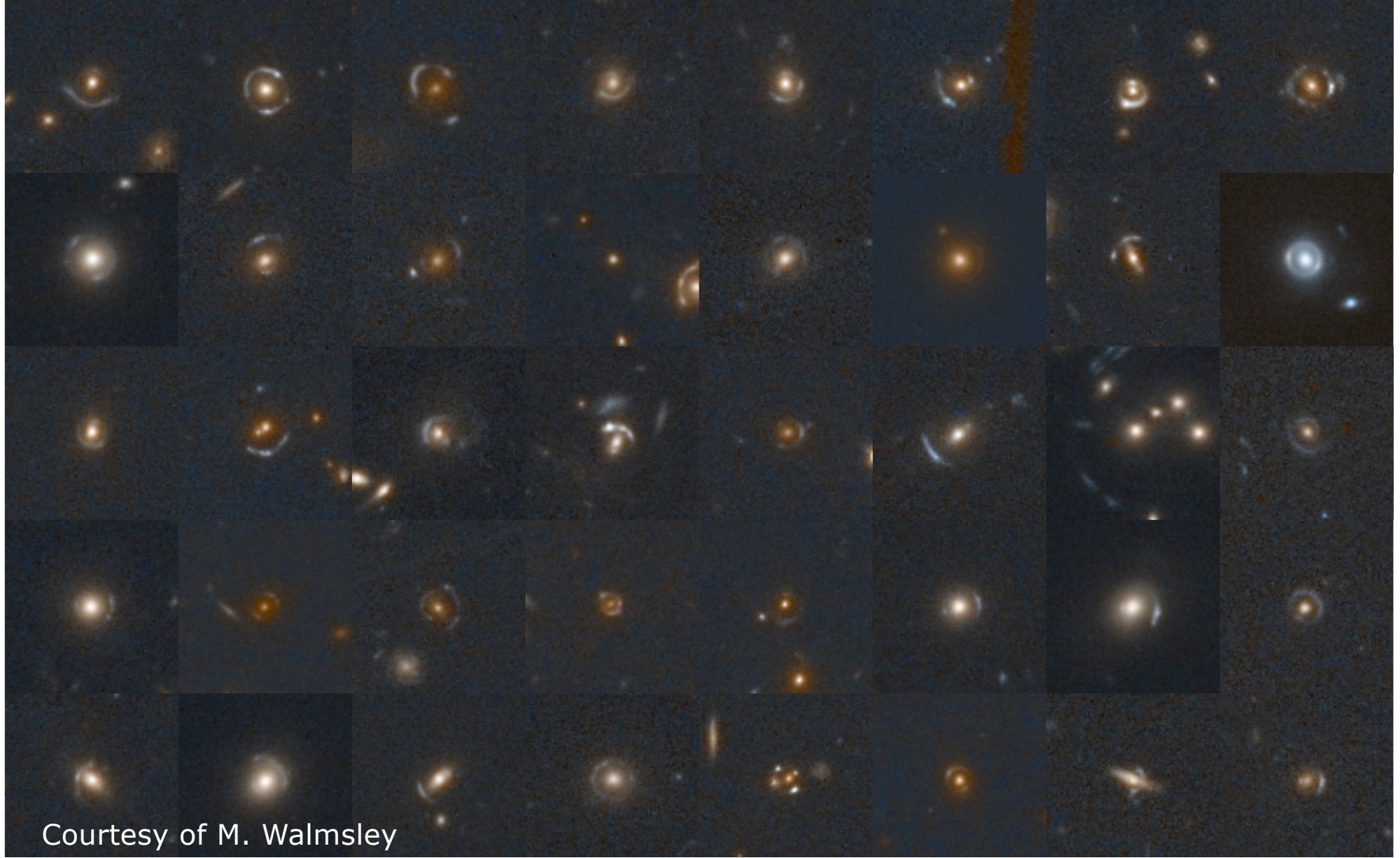




Images from Legacy Survey (South, DECam)



Courtesy of M. Walmsley



Courtesy of M. Walmsley

Strong lenses

Related papers: Walmsey et al, Rojas et al, Lines et al, Li et al, Holloway et al, Busillo et al



A first catalogue of 500 galaxy-galaxy strong lens candidates was created, almost all of which were previously unknown ([Walmsey et al](#)).

This type of lensing happens when a foreground galaxy and its halo of dark matter acts as a lens, distorting the image of a background galaxy along the line of sight towards Euclid.

Credits: ESA/Euclid/Euclid Consortium/NASA, image processing by M. Walmsley, M. Huertas-Company, J.-C. Cuillandre



Galaxy morphology

Related papers: Walmsley et al, Huertas-Company et al, Siudek et al, Quilley et al



As part of the data release, a detailed catalogue of more than 380 000 galaxies was published, which have been classified according to features such as spiral arms, central bars, and tidal tails that infer merging galaxies.

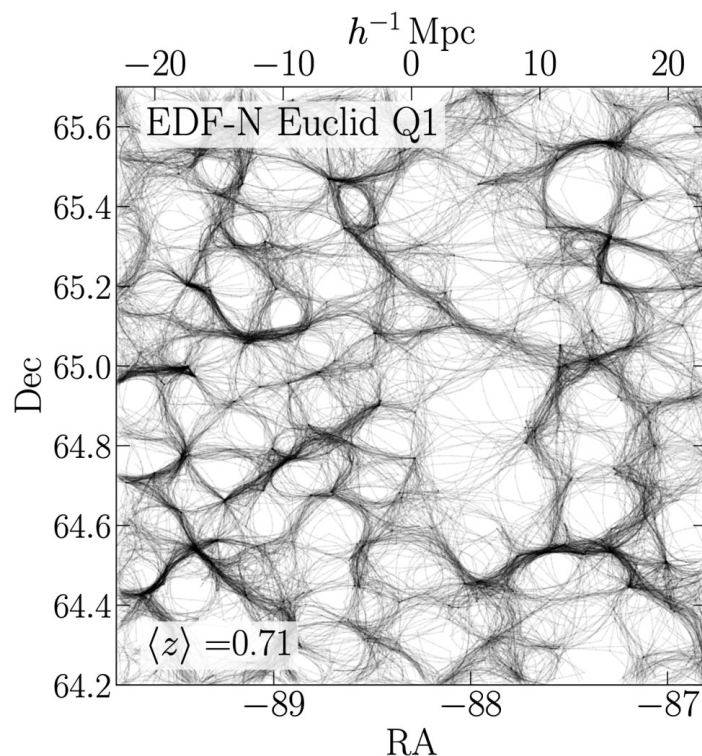
Galaxy Zoo & deep learning

Trace the abundance of stellar bars over time, which is influencing bulge growth and star formation: identified 7711 barred galaxies ([Huertas-Company et al](#))

Credits: ESA/Euclid/Euclid Consortium/NASA, image processing by M. Walmsley, M. Huertas-Company, J.-C. Cuillandre

Cosmic environment

Related papers: Cleland et al, Laigle et al, Gouin et al



Laigle et al, <https://arxiv.org/abs/2503.15333>, Fig. B3
Visualisation of the cosmic web reconstruction based on the Q1 data in the EDF-North.

The cosmic web plays a crucial role in cluster properties.

Gouin et al show that clusters predominantly made up of elliptical galaxies are more strongly connected to filaments than those dominated by disk galaxies. The more massive a cluster is, the stronger its connection to these cosmic filaments.

Laigle et al measure variations of morphologies depending on their proximity to these cosmic filaments. Shapes and orientation changes also depending on how close the galaxy is to filaments

Cleland et al studies how the environment plays a significant role in transforming galaxies from star-forming to passive.

Galaxy clusters

Related papers: Bergamini et al, Mai et al



The galaxy cluster in the centre is a zoom-in in the EDF-S

Credits: ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre, E. Bertin, G. Anselmi

Bergamini et al constructs the first catalogue of strong lensing galaxy clusters observed by Euclid. Most of these galaxy clusters had never been observed from space before and only a few were previously known to host strong lensing features.

What's next

Cosmology DR1 data release in October 2026

Quick Release 1

Time: 1 week

Area: 62.1 deg²

Data: 35 TB

Papers: 34

Data Release 1

1 year of observations

~1900 deg²

~2.5 PT data, including LE3 and higher-level products

first results on cosmology!

Euclid Deep Fields at the end of the survey:

EDF-North

32 visits (in the current survey plan)

EDF-South

35 visits

EDF-Fornax

52 visits

2 mag deeper than the Euclid Wide Survey



Early Career Opportunities at ESA

Calls open to nationals of ESA member & cooperating states only

Student internships (3-6 months)

- applications due ~Oct
- master students (penultimate/final year)

National trainee programme (1+1 year)

- timelines determined by national agencies
- master students (final year/recent graduates) from Belgium, Estonia, Germany, Ireland, Luxembourg, Portugal & Switzerland

ESA graduate programme (1 year)

- applications due ~Jan/Feb for start in Sep
- master students (final year/recent graduates)

ESA co-funded research for PhD students & postdocs (1-1.5 years)

- applications accepted throughout the year

ESA Research Fellowships for postdocs (2+1 years)

- Call in the fall

ESA Junior Professionals (4 years)

- Call in May, for graduates with 2-3 years of professional experience (including PhD)





- **independent postdoctoral fellowship for ESA State nationals**
- research project covering any topic in space science
- 2 + 1 years (proposal for 3rd year extension)

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

- **100% research time** (optionally <20% functional work, e.g. archive/data science, citizen science, operations, calibration, communication)
- insights into ESA environment & activities
- mentoring from senior ESA Science Faculty members
- training available (e.g. spacecraft design, soft skills, management)
- 3500-4600€ net monthly salary (depending on location & experience)
- comprehensive health coverage

contact: fellowship@cosmos.esa.int



→ THE EUROPEAN SPACE AGENCY

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The newsletter contains calls for proposals, announcements of opportunity, news on developments of the Science Programme, research fellowship announcements, calls for memberships, job announcements, major mission updates, conference announcements, etc.

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