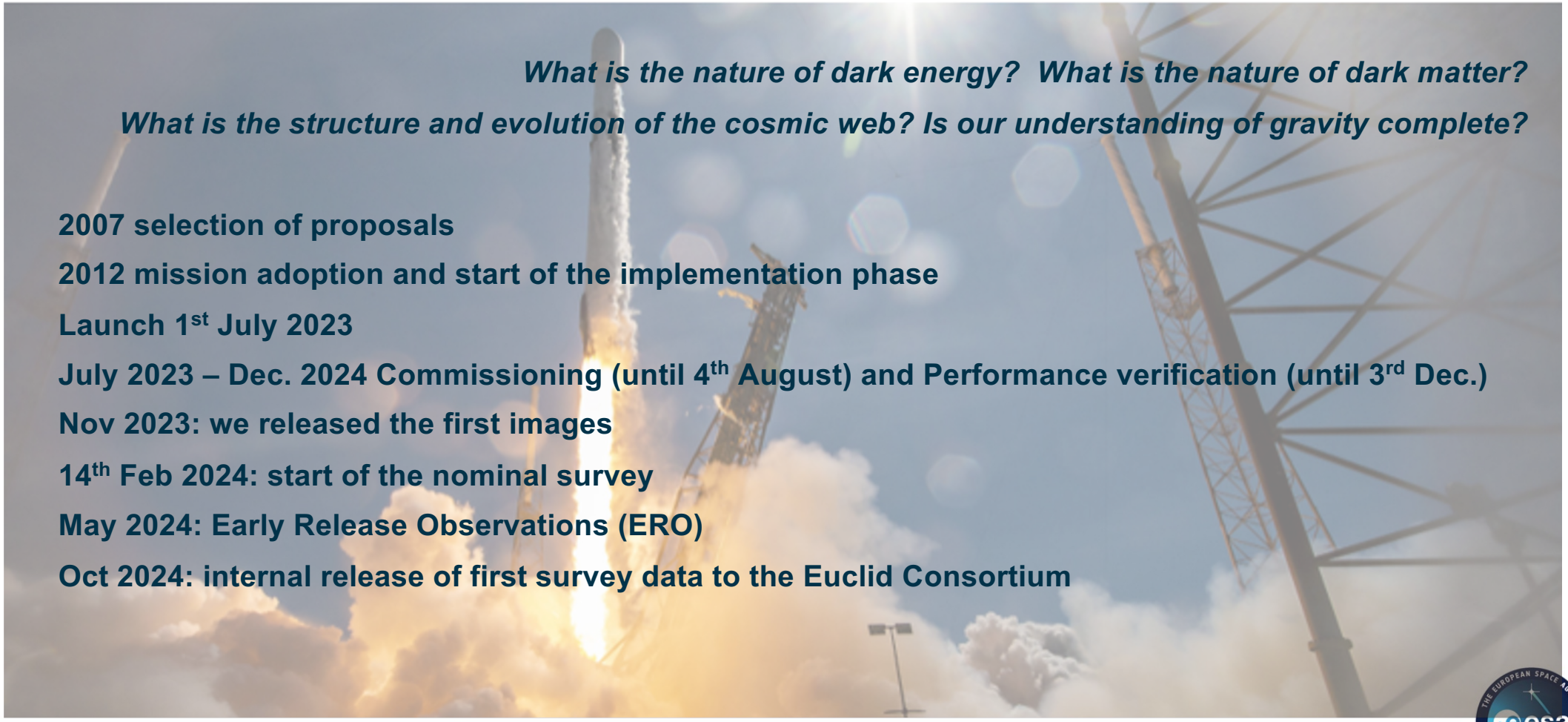
ESA Euclid Overview

Valeria Pettorino, ESA Euclid Project Scientist, ESA/ESTEC

24/03/2025

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

July 2023 – Dec. 2024 Commissioning (until 4th August) and Performance verification (until 3rd Dec.)

Nov 2023: we released the first images

14th Feb 2024: start of the nominal survey

May 2024: Early Release Observations (ERO)

Oct 2024: internal release of first survey data to the Euclid Consortium

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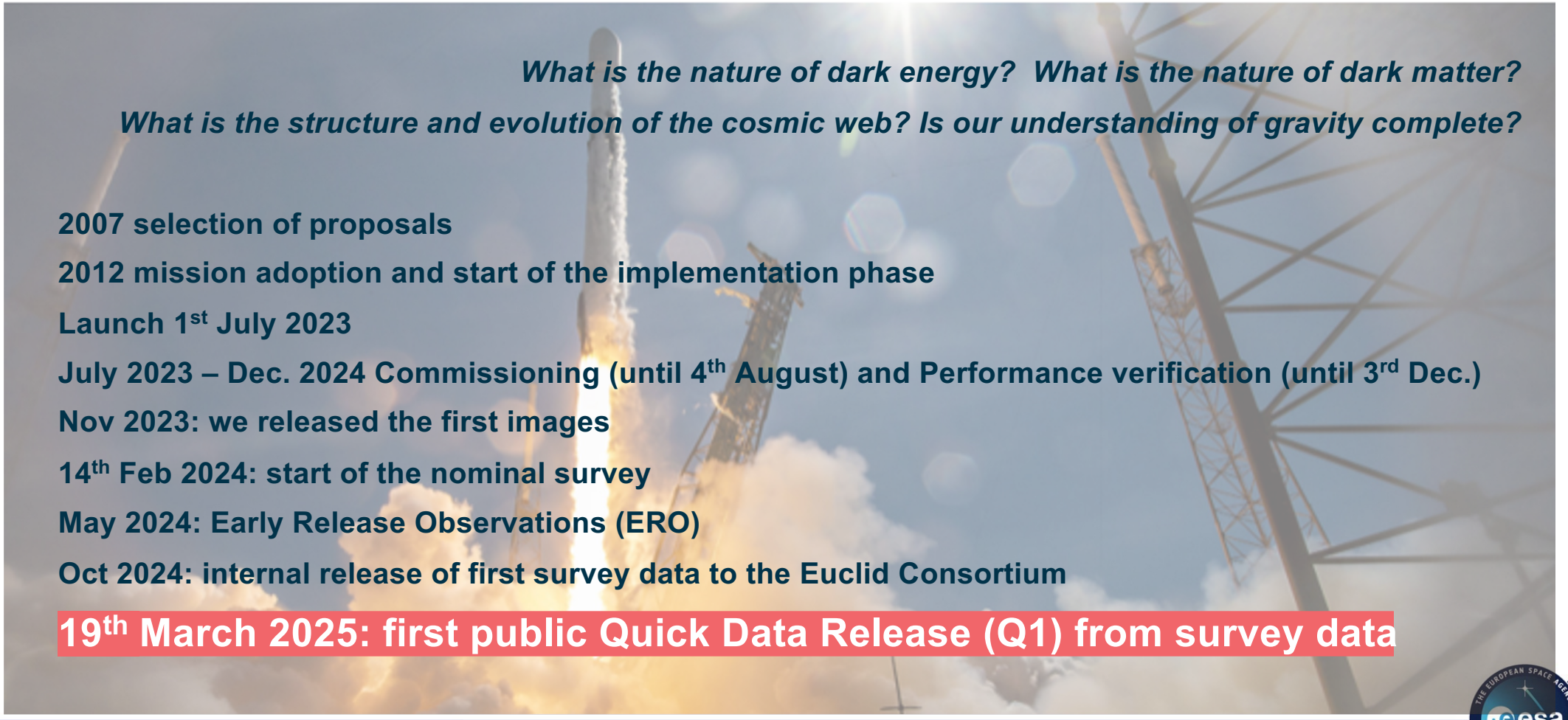

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19th March 2025: first public Quick Data Release (Q1) from survey data

Press release and video can be found here:

https://www.esa.int/Science_Exploration/Space_Science/Euclid/Euclid_opens_data_treasure_trove_offers_glimpse_of_deep_fields

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

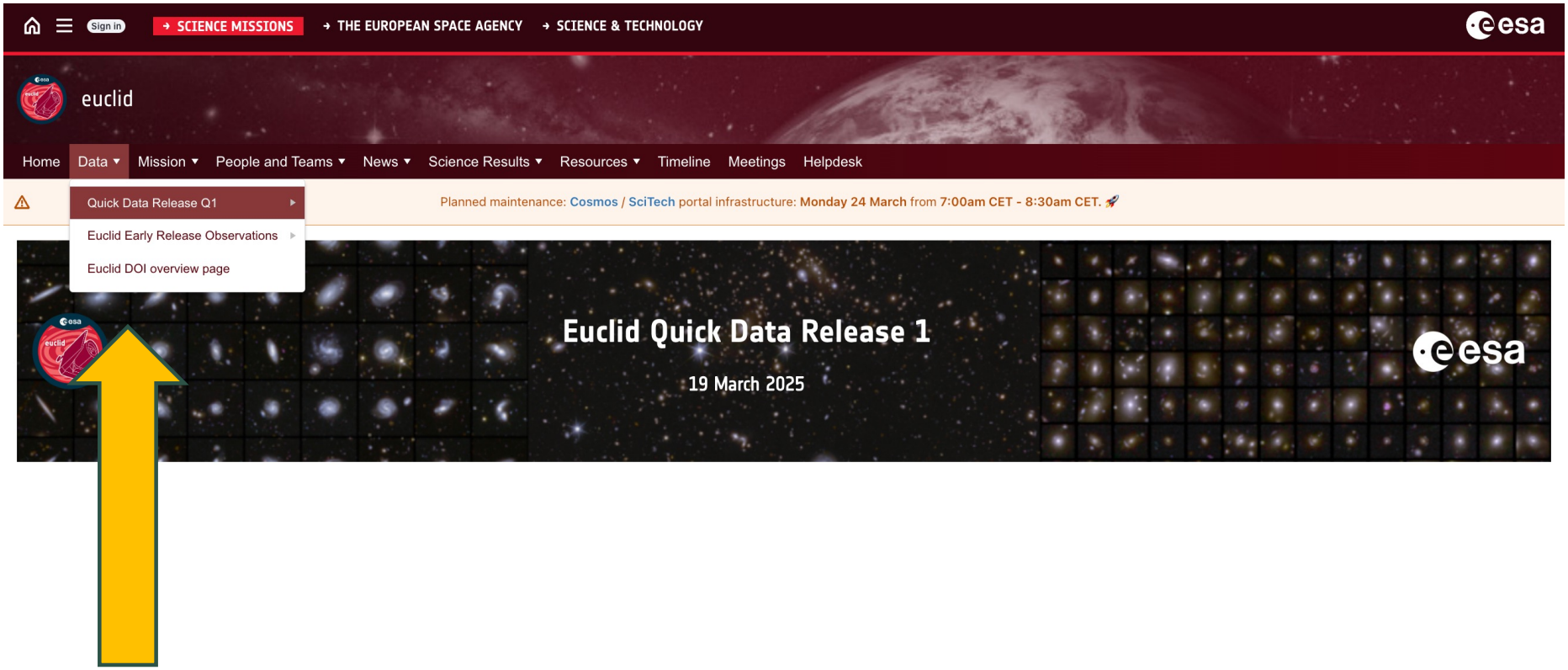
Data Access: available through the Euclid science archive at ESAC, with tools for querying and visualizing data and through ESA Datalabs, including tutorials.

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



Where to start

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

EUCLID Q1 CONTENTS

Information on Euclid Quick Data Release 1 contents.

EUCLID Q1 PAPERS

Papers related to Euclid Quick Data Release 1.

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

ESLAB talks related to Q1

Session 2: Euclid Q1 data release: science highlights [Monday]

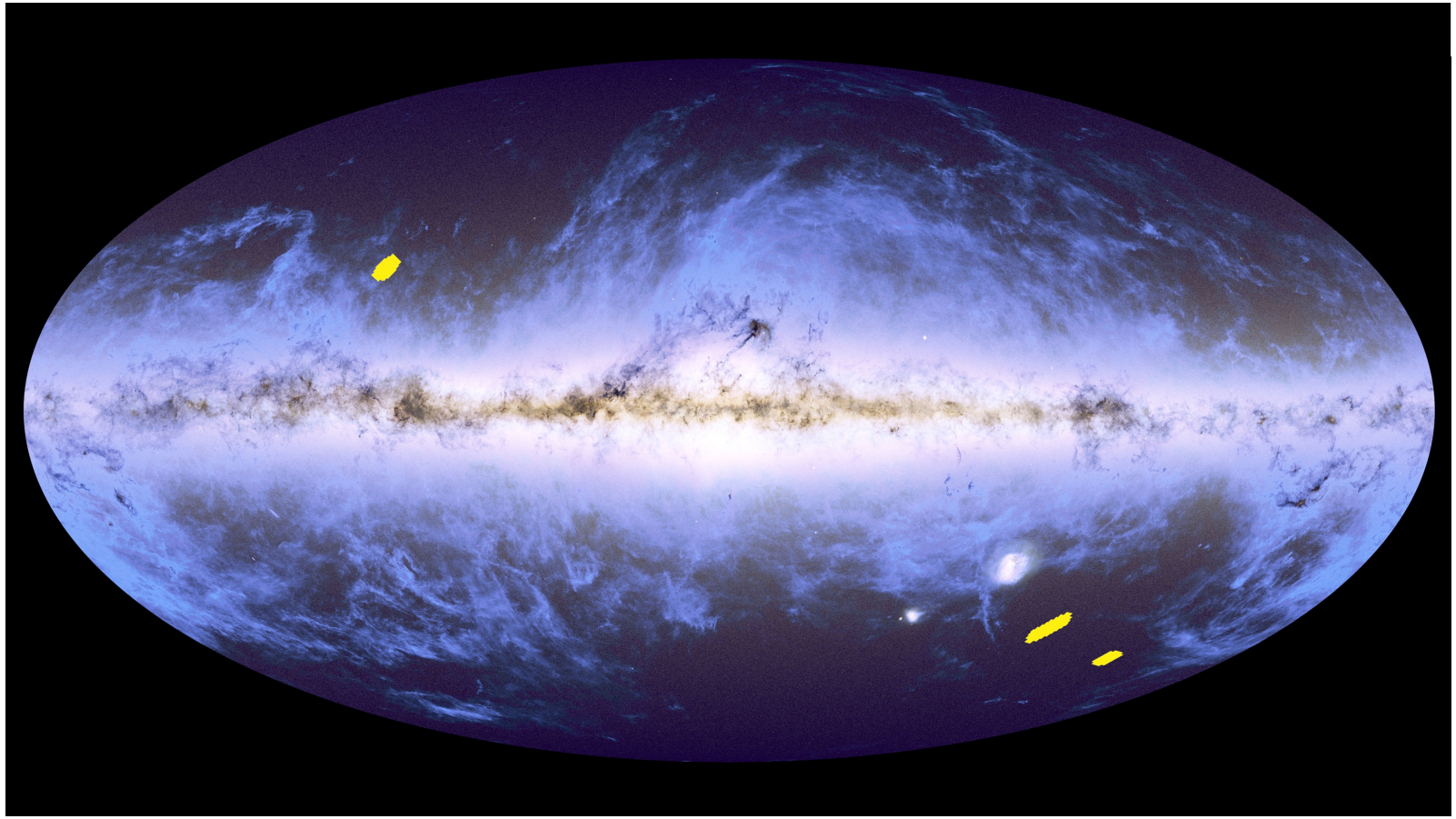
Session 3: Euclid Q1 Data release: processing and products, part I [Tuesday]

Session 5: Euclid Q1 Data release: processing and products, part II [Tuesday]

Session 8: hands-on session on how to access Euclid data [ESA archive, Datalabs, ESAsky]

… and many other talks related to Euclid Science, cosmology, highlights from other missions.

The Euclid deep fields

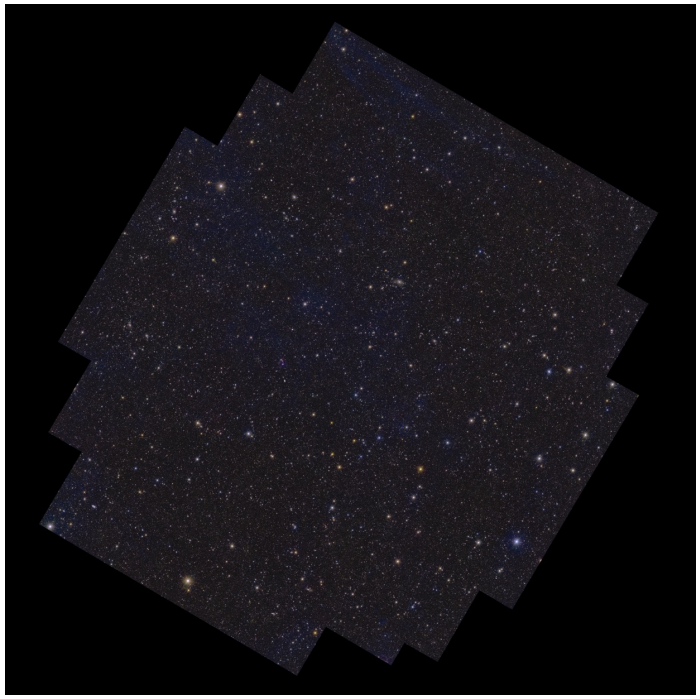


Credits: ESA/Euclid/Euclid Consortium/NASA; ESA/Gaia/DPAC; ESA/Planck Collaboration

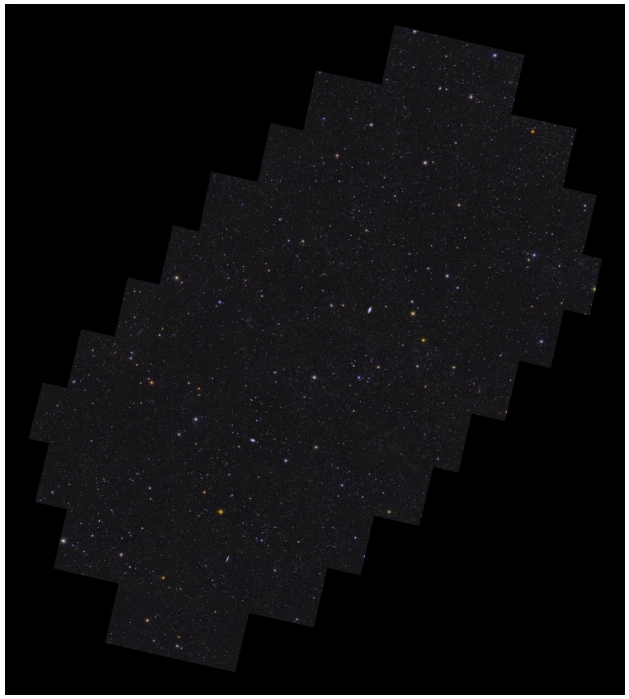
The Euclid deep fields

https://sky.esa.int/

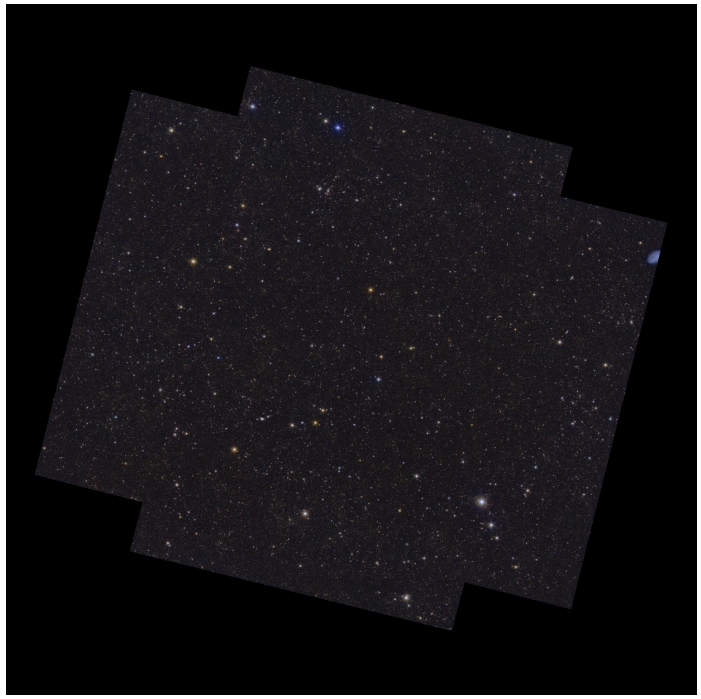
A single visit over the Euclid Deep Fields



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 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 deg2.

Star-forming area with young stellar objects

Credits: Aussel et al 2025, Data Release Overview

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 all, Busillo et al*

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

Transients: *Duffy et al*

Nearby galaxies: *Marleau et al*

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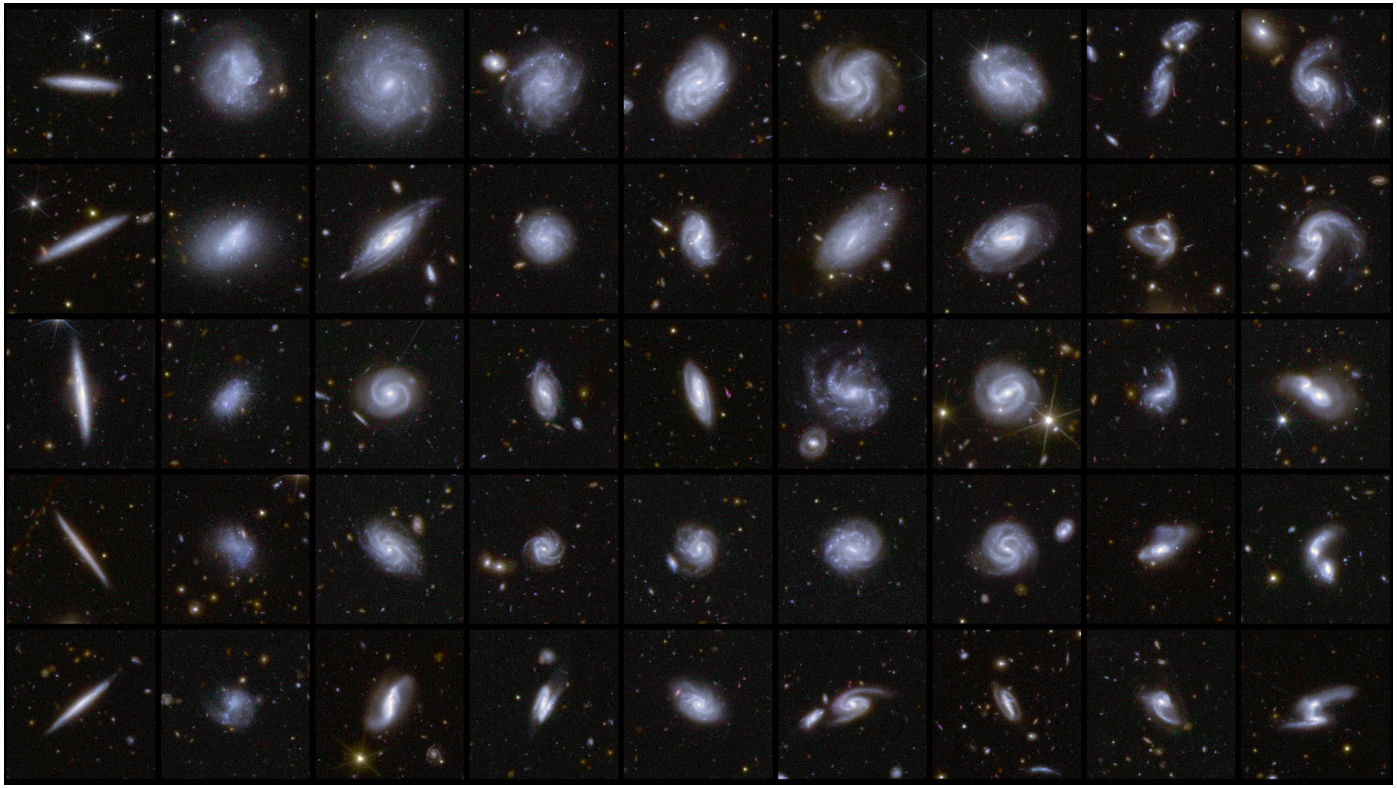
Galaxy morphology

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



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

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***)

Strong lenses

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

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

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.

Galaxy clusters

Related papers: Bergamini et al, Mai et al

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

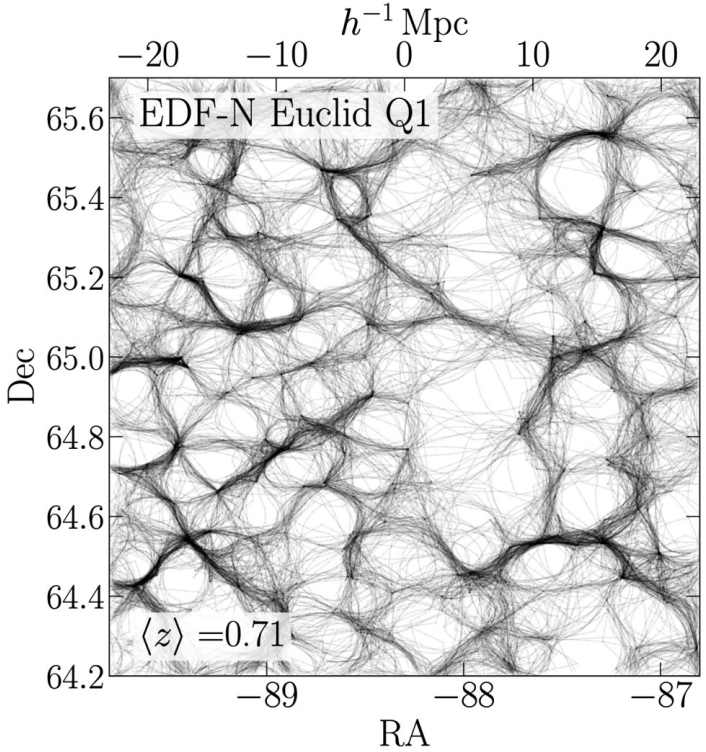
Credits: ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre, E. Bertin, G. Anselmi

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.

The Q1 data release is large enough to detect tens of clusters and hundreds of protoclusters at z > 1.3. *(**Mai et al**)*

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.*

The Q1 Euclid data release

Many many people involved from ESA and Euclid Consortium

mission operation center,

science operation center,

science ground segment,

survey team,

Archive, Datalabs and ESASky team,

instrument scientists,

Euclid Science Team,

all those involved in the processing and software development,

all scientists involved in the writing and reviewing of scientific papers,

all people supporting a number of communication activities,

all members of the Euclid Project team who contributed to make this happen.

Thank you

from me and from the ESA Mission Manager Pierre Ferruit

What's next

Cosmology DR1 data release in October 2026

Time: 1 week	⇨	1 year of observations
Area: 62.1 deg2	⇨	~1900 deg2
Data: 35 TB	⇨	~2.5 PT data
Papers: 34	⇨	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