Euclid Consortium: New science results and exclusive data from the *Euclid* space telescope

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

Today, the Euclid Consortium (EC) releases scientific papers and exclusive data based on observations made by the *Euclid* space telescope. Three different fields, corresponding to 63 square degrees in total, have been observed and analyzed by scientists of the Euclid Collaboration, demonstrating the unprecedented power of this telescope designed to provide the most precise map of our Universe over time. With just 0.45% of Euclid's nominal survey, EC scientists have achieved a wealth of exciting scientific results. These include the discovery of strong gravitational lensing systems, the exploration of galaxy clusters and the cosmic web, the characterization of active galactic nuclei (AGN) and quasars, studies on galaxy evolution and morphology, and the identification of numerous dwarf galaxies and transients. Those results are described in a series of 27 scientific publications. In addition, the Consortium also publishes 7 technical papers that describe how this data has been processed by the Science ground segment experts, the team responsible for processing and analyzing the telescope's data.

The Euclid Consortium

The Euclid Consortium, in partnership with the European Space Agency[1] (ESA) and the National Aeronautics and Space Administration (NASA), has designed and built the instruments of the Euclid space telescope. It has also developed and currently operates the data pipeline, the system responsible for processing and organizing data from the telescope. This mission aims to map the extragalactic sky over a period of six years, providing unique data that offer new insights into dark energy and dark matter. Launched on July 1st, 2023, the telescope successfully began its cosmological survey on February 14th, 2024.

The Euclid Consortium comprises more than 2600 members, from more than 300 laboratories in 15 European countries, plus Canada, Japan, and the United States, covering various fields in astrophysics, cosmology, theoretical physics, and particle physics. After a first publication of early-release observations (ERO) results and data in May 2024, the Collaboration now presents a second set of Euclid observations and publications demonstrating further progress. This new data release, titled 'Q1', for 'Quick Release 1', is published today.

The Euclid Consortium gathered in Rome in June 2024. Credit : Marco Scodeggio

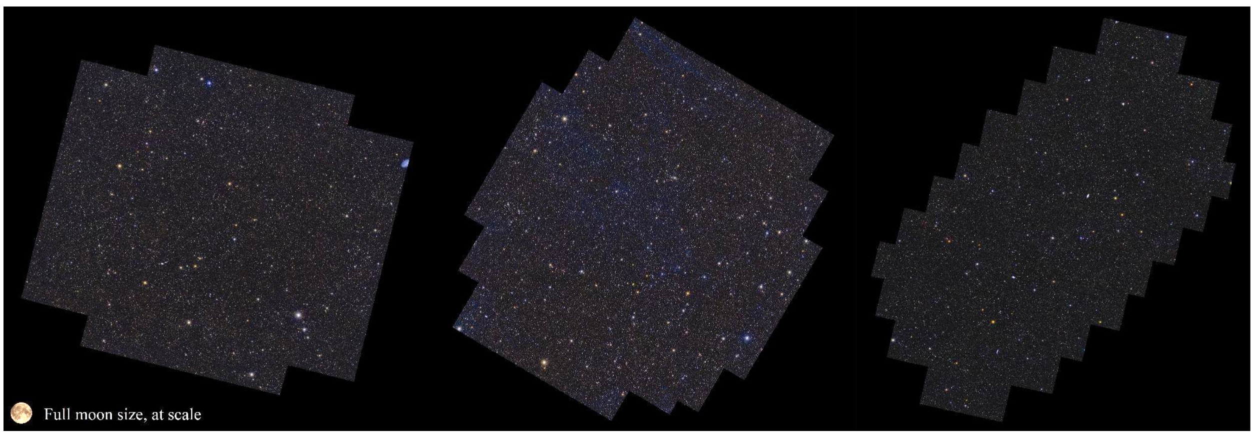
The 'Q1' data set

The data unveiled today provide a first glimpse of Euclid's cosmological survey. These fields are illustrative of what will be extensively analysed by scientists within the Euclid Collaboration to map the large-scale structure of the Universe across cosmic time, and investigate the nature of dark matter and dark energy in the years to come. With a sky area of about 63 square degrees, this release is seven times larger than the earlier ERO release, and represents the largest contiguous areas of sky ever observed with an

[1] Find ESA's story on this link

optical/near-infrared space telescope. The Q1 data are complemented by observations of a star-forming region in our own galaxy, taken early-on in the mission to test and improve Euclid's guiding performance.

Thanks to Euclid's very wide field of view and high resolution, these exquisite data are also highly valuable for various astrophysical studies on smaller scales, ranging from clusters of galaxies to planet-sized objects. All the papers published today are dedicated to this *non-cosmological* science, also called *legacy* science.



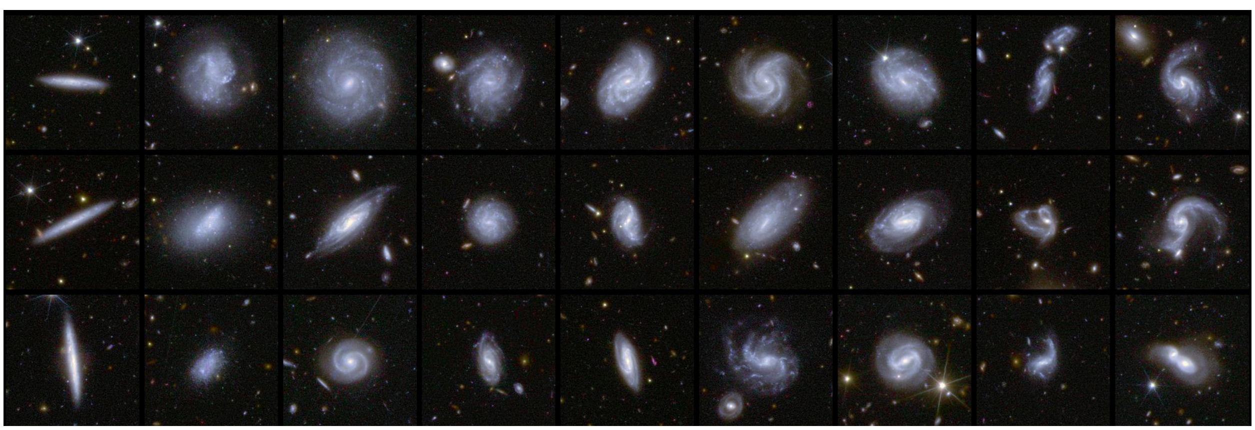
Credit: ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre, E. Bertin, G. Anselmi

Scientific results

Euclid maps the Universe across cosmic time and traces the evolution of large-scale structures that form the so-called cosmic web. Using the Q1 fields, researchers have successfully recovered galaxy filaments and explored their role in galaxy morphology and alignment far beyond previous limits, as well as which properties and environments make galaxy clusters connect to these filaments. "For the first time, we are studying the cosmic web in a statistical way on a very large area." says Simona Mei, Professor at Université Paris Cité (CNRS/IN2P3/APC). As key building blocks of the cosmic web, numerous previously unknown galaxy clusters have been discovered and characterized - some from the first ages of our Universe, many exhibiting strong gravitational lensing features.

The Euclid space mission has also ushered in a new era in the study of active galactic nuclei (AGN), which represent the bright phase of supermassive black holes at the center of nearly every galaxy. "These data help us better understand how black holes and their host galaxies grow together throughout cosmic history." says Berta Margalef-Bentabol, Postdoctoral researcher at the Netherlands Institute for Space Research. Using advanced AI algorithms, researchers have established vast catalogs of AGN and red quasars - extremely luminous AGN - featuring thousands of new candidates with unprecedented positional measurements across a large area of the sky, and are now able to statistically confirm how galaxy mergers drive AGN activity.

Galaxy morphology and evolution are central to Euclid's non-cosmological science. In August 2024, members of the Euclid Consortium launched a first citizen-science campaign on the *Zooniverse* platform, enlisting thousands of volunteers to train a deep-learning algorithm classifying galaxy morphologies. The resulting catalogue, based on the first 0.45% of the ~100 million lower-redshift galaxies that Euclid will ultimately capture in detail, has already proven valuable to researchers. Moreover, thanks to this large volume of high-quality data, scientists were able to observe differences with respect to simulated galaxy shapes and features. They also investigated how different environments, star-formation rates, and morphologies are linked and drive the evolution of galaxies in various epochs of our Universe.



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

A few months ago, the Euclid Collaboration launched another citizen-science campaign on the *Zooniverse* platform. With the help of over 1,000 participants and newly trained machine-learning algorithms, more than 500 strong gravitational lens candidates at galaxy scale were identified in the Q1 fields. "The resolution of the Euclid data allowed us to see these lensed systems in incredible detail, and these data are only a small fraction of the lenses we hope to find in the coming years as the survey continues," says Philip Holloway, PhD student at the University of Oxford. These rare phenomena, predicted by Einstein's general relativity, are invaluable tools for understanding the distribution of dark matter around galaxies, studying internal dynamics in galaxy clusters, and even uncovering previously hidden galaxies. So far, only about 150 of these lenses had been observed by space telescopes.

Thanks to Euclid's vast field of view and its ability to detect faint and distant objects, researchers have further identified thousands of new dwarf galaxy candidates, as well as thousands of mysterious 'little red dot' candidates—objects from the early Universe first observed a few years ago with JWST. Euclid has also allowed for the determination of host galaxies for several previously hostless transient bright sources, and the physical properties of dusty, massive red galaxies from the early Universe, demonstrating again Euclid's capability to deliver highly valuable data across a wide range of objects and cosmic ages.

All these results are described in a series of papers, which have all been subject to the internal peer review process. They are available at Euclid Consortium Publications, and will appear as pre-publications on the ArXiv later today. The images and science-ready catalogues are available for download from ESA.

Processing papers

While the scientific analyses presented above are unprecedented and highly promising for the future of the mission, they represent only a small fraction of the extensive work carried out by the Euclid Consortium. Producing high-quality data - first for Euclid Consortium researchers and later for the international scientific community - requires an extensive processing effort. Once captured by the telescope, raw images undergo rigorous treatment by the engineers and researchers of the Euclid science ground segment (SGS), who work daily to transform them into usable data, paving the way to more advanced scientific analyses and discoveries. "The quality of Euclid data is incredibly high. The SGS is already preparing the next release, using increasingly complex algorithms." explains Andrea Zacchei, Senior Astronomer at the Trieste Astronomical Observatory (INAF/OATs) and Project Manager of the SGS.

These multi-faceted data-processing algorithms correct the VIS (optical) and NISP (infrared) camera data for numerous instrumental and systematic effects. They extract tens of millions of sources from their images, determine their precise brightness and position on the sky, and in combination with ground-based observations at other wavelengths estimate their redshift, which gives their distances. For some sources, this redshift is precisely determined from their spectra given by the NISP instrument. All these procedures require numerous and complex algorithms to meet Euclid’s rigorous quality control standards. The entirety of this processing is described in the seven technical papers published today.

Future milestones for the Euclid mission

The next data release from the Euclid Consortium will concern *Euclid*’s nominal survey and core-science, including results about the nature of dark energy. A first worldwide data release is currently planned for October 2026. At least two other *quick releases* and two other *data releases* are expected before 2031, the currently foreseen end date of *Euclid*’s main survey.

For more information, or press inquiries, please contact menard@iap.fr.

Find ESA’s story here :
https://www.esa.int/Science_Exploration/Space_Science/Euclid/Euclid_opens_data_treasure_trove_offers_glimpse_of_deep_fields

@journalists : to obtain the embargoed images and ESA’s press material before the 19th, follow this link
https://blogs.esa.int/forms/subscription-for-under-embargo-press-releases/

List of these 34 papers and first authors :

OVERVIEW, DATA PRODUCTS AND PROCESSING:

Euclid Quick Data Release (Q1): Data Release Overview, Euclid Collaboration: Aussel et al. (2025); [Q1-TP001]

Euclid Quick Data Release (Q1): VIS processing and data products, Euclid Collaboration: McCracken et al. (2025); [Q1-TP002]

Euclid Quick Data Release (Q1): NIR processing and data products, Euclid Collaboration: Polenta et al. (2025); [Q1-TP003]

Euclid Quick Data Release (Q1): From Images to Multiwavelength Catalogues: the Euclid MERge Processing Function; [Q1-TP004]

Euclid Quick Data Release (Q1): Photometric redshifts and physical properties of galaxies through the PHZ processing function, Euclid Collaboration: Tucci et al. (2025); [Q1-TP005]

Euclid Quick Data Release (Q1): From spectrograms to spectra: the SIR spectroscopic processing function, Euclid Collaboration: Copin et al. (2025); [Q1-TP006]

Euclid Q1: SPE Processing and Data Products, Euclid Collaboration: Le Brun et al. (2025); [Q1-TP007]

SCIENTIFIC RESULTS USING EUCLID Q1 DATA

Euclid. Q1. Exploring galaxy morphology across cosmic time through Sérsic fits, Euclid Collaboration: Quilley et al. (2025); [Q1-SP040]

Euclid Quick Data Release (Q1): First Visual Morphology Catalogue, Euclid Collaboration: Walmsley et al. (2025b); [Q1-SP047]

Euclid Quick Data Release (Q1): A first look at the fraction of bars in massive galaxies at $z < 1$, Euclid Collaboration: Huertas-Company et al. (2025); [Q1-SP043]

Euclid Quick Data Release (Q1): A first look at a multimodal autoregressive foundation model for exploring galaxy properties, Euclid Collaboration: Siudek et al. (2025); [Q1-SP049]

Euclid Quick Data Release (Q1): The evolution of the passive-density and morphology-density relations up to $z \sim 1$ in Q1, Euclid Collaboration: Cleland et al. (2025); [Q1-SP017]

Euclid Quick Data Release (Q1): A first view of the star-forming main sequence in the Euclid Deep Fields, Euclid Collaboration: Enia et al. (2025); [Q1-SP031]

Euclid Quick Data Release (Q1): A probabilistic classification of quenched galaxies, Euclid Collaboration: Corcho-Caballero et al. (2025); [Q1-SP044]

Euclid Quick Data Release (Q1): Optical and near-infrared identification and classification of point-like X-ray selected sources in Q1, Euclid Collaboration: Roster et al. (2025); [Q1-SP003]

Euclid Quick Data Release (Q1): First Euclid statistical study of galaxy mergers and their connection to Active Galactic Nuclei, Euclid Collaboration: La Marca et al. (2025); [Q1-SP013]

Euclid Quick Data Release (Q1): First Euclid statistical study of AGN power fraction, Euclid Collaboration: Margalef-Bentabol et al. (2025); [Q1-SP015]

Euclid Quick Data Release (Q1): First study of red quasars selection, Euclid Collaboration: Tarsitano et al. (2025); [Q1-SP023]

Euclid Quick Data Release (Q1): The active galaxies of Euclid, Euclid Collaboration: Matamoro Zatarain et al. (2025); [Q1-SP027]

Euclid Quick Data Release (Q1). TBD. AGN identification using diffusion-based inpainting of Euclid VIS images, Euclid Collaboration: Stevens et al. (2025); [Q1-SP009]

Euclid Quick Data Release (Q1): An investigation of optically faint, red objects in the Euclid Deep Fields, Euclid Collaboration: Girardi et al. (2025); [Q1-SP016]

Euclid Quick Data Release (Q1): Extending the quest for little red dots to $z < 4$, Euclid Collaboration: Bisigello et al. (2025); [Q1-SP011]

Euclid Quick Data Release (Q1): The Strong Lensing Discovery Engine A – System Overview and First Lens Sample, Euclid Collaboration: Walmsley et al. (2025a); [Q1-SP048]

Euclid Quick Data Release (Q1): The Strong Lensing Discovery Engine B – Early strong lens candidates from visual inspection of high velocity dispersion galaxies, Euclid Collaboration: Rojas et al. (2025); [Q1-SP052]

Euclid Quick Data Release (Q1): The Strong Lensing Discovery Engine C – Finding Lenses with Machine Learning, Euclid Collaboration: Lines et al. (2025); [Q1-SP053]

Euclid Quick Data Release (Q1) The strong lensing discovery engine D – double source plane lens candidates and cosmological forecast, Euclid Collaboration: Li et al. (2025); [Q1-SP054]

Euclid Quick Data Release (Q1): The strong lensing discovery engine E – ensemble classification of strong gravitational lenses: lessons for Data Release 1, Euclid Collaboration: Holloway et al. (2025); [Q1-SP059]

Euclid Quick Data Release (Q1): LEMON -- Lens Modelling with Neural networks. Automated and fast modelling of Euclid gravitational lenses with singular isothermal ellipsoid mass profile, Euclid Collaboration: Busillo et al. (2025); [Q1-SP063]

Euclid Quick Data Release (Q1): The first catalogue of strong-lensing galaxy clusters, Euclid Collaboration: Bergamini et al. (2025); [Q1-SP057]

Euclid Quick Data Release (Q1). A catalogue of Spitzer galaxy overdensities at $z>1.3$ in the Q1 data release, Euclid Collaboration: Mai et al. (2025); [Q1-SP022]

Euclid Quick Data Release (Q1): The role of cosmic web connectivity in shaping galaxy clusters, Euclid Collaboration: Gouin et al. (2025); [Q1-SP005]

Euclid Quick Data Release (Q1): Galaxy shapes and alignments in the cosmic web, Euclid Collaboration: Laigle et al. (2025); [Q1-SP028]

Euclid: Quick Data Release (Q1) – Photometric studies of known transients, Duffy et al. (2025); [Q1-SP002]

Euclid: Quick Data Release (Q1) – A census of dwarf galaxies across a range of distances and environments, Marleau et al. (2025); [Q1-SP001]