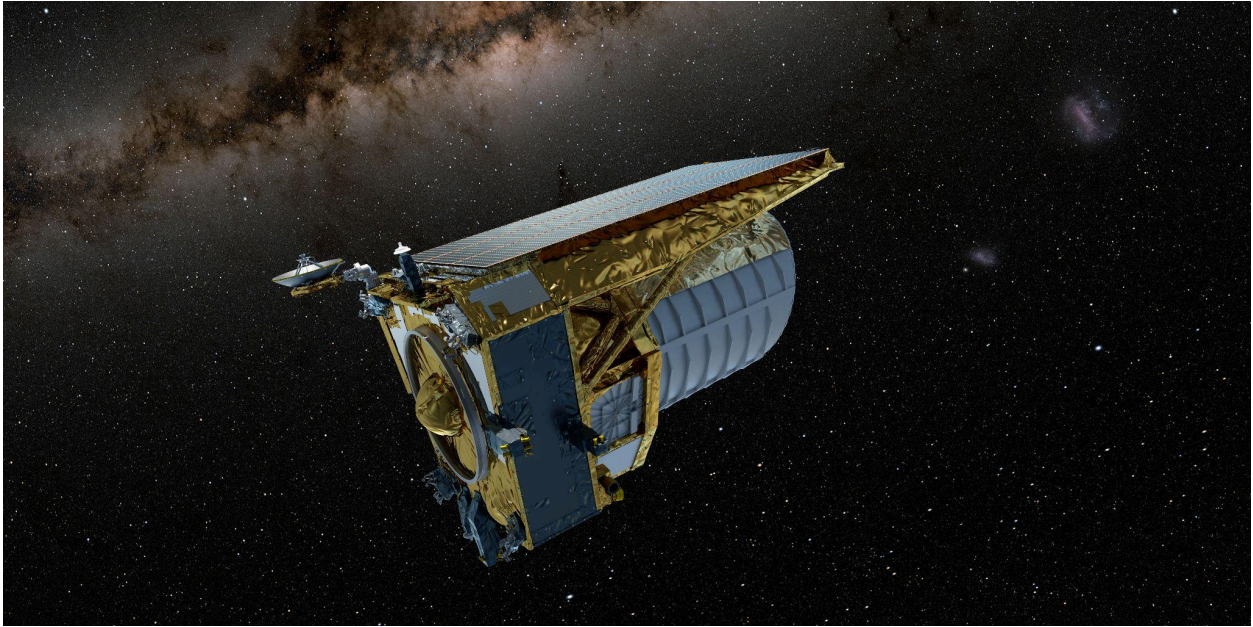


Euclid Consortium : First science results and exclusive *ERO* data from the *Euclid* space telescope



The *Euclid* Space Telescope. Credit : ESA

Today, the Euclid Consortium releases early scientific papers based on observations made by the *Euclid* telescope. A number of scientifically exciting targets have been observed and analysed by scientists of the Euclid Collaboration during an *Early Release Observations* phase, giving a glimpse of the unprecedented power of this telescope meant to provide the most precise map of our Universe over time. Exciting scientific results about the search for free-floating planets, the population of globular clusters around nearby galaxies, the discovery of new dwarf and low-surface brightness galaxies, the distribution of dark matter and intracluster light in clusters of galaxies, or high-redshift magnified lensed galaxies are described in a series of 10 scientific publications. In addition to these first and promising scientific results, the Consortium also publishes on this day the mission's *reference papers* that confirm the outstanding performance of *Euclid*.

The Euclid Consortium

In collaboration with the European Space Agency (ESA), the Euclid Consortium has been planning, building, and is currently operating the *Euclid* space telescope mission. This mission aims at mapping the extragalactic sky over a period of six years, providing unique data that can 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, including over 1000 researchers from more than 300 laboratories in 15 European countries, plus Canada, Japan and United States, covering various fields in astrophysics, cosmology, theoretical physics, and particle physics. Today, the efforts of the Collaboration can be shown through a first suite of *Euclid* publications. It is a pleasure to announce the release of its first papers describing the *Euclid* mission, its scientific instruments and its performance based on observations made by *Euclid*. Five of them will serve as key reference throughout the mission and beyond, while the other ten showcase the research conducted with the Early Release Observations (ERO) data.

Reference papers

The *Overview* paper provides a summary of the *Euclid* mission, covering its scientific goals, spacecraft details, survey planning, data products, planned analysis, and more. It will remain, during the whole mission, a reference for the broader scientific community interested in *Euclid* data and scientific results. “It summarises the outstanding achievement of more than 10 years of development to produce a scientific mission that will perform better than our expectations and put *Euclid* at the forefront of the exploration of the dark Universe, but also in almost all fields of astronomy”, Yannick Mellier, Euclid Consortium Lead, says.

The *VIS*, *NISP* and *NISP Calibration* papers describe *Euclid*'s instruments' specifications, design, development, and roles within the mission. The *VIS* (for Visible) instrument, a 609 Megapixel optical-band imager ; and the *NISP* (for Near Infrared Spectrometer and Photometer) instrument, a multiband photometer also capable of slitless spectroscopy, are *Euclid*'s key features. They provide exquisite data to map the large-scale structure of our Universe over time to constrain the nature of dark energy and the validity of general relativity on cosmological scales. Performance verification tests indicate that both instruments are operating at fully in line with expectations.

Finally, the *SIM* paper introduces the *Euclid* Flagship simulation, a simulated catalogue of billions of galaxies based on the largest cosmological simulation ever conducted, designed to prepare the scientific exploitation for the *Euclid* mission. Developed to train

and validate the ground segment algorithms before the launch, simulations are now used to measure, calibrate and correct systematic biases.

Early Release Observations images, data and papers

An *Early Release Observations* program was conducted during *Euclid*'s first months in space as a first look at the depth and diversity of science *Euclid* will provide. A total of 24 hours was allocated towards specific targets chosen to produce stunning images, also relevant for scientific research. Five of these images were released in November, 2023. The remaining five are being published today, May 23rd, 2024, by ESA¹².



The five first *Euclid* ERO images. See footnote for details. Credits : ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre (CEA Paris-Saclay), G. Anselmi

The *Euclid* Collaboration has now concluded some of the early scientific analyses that were carried out with these *ERO* data, and publicly releases the associated papers and data today. Seventeen targets, from galaxy clusters, nearby galaxies, globular clusters, to star-forming regions, have been observed and analysed. “As scientists of the *Euclid* ERO programme, we were highly motivated and were working non-stop analysing the data to make great science out of the fantastic *Euclid* images,” claims Teymoor Saifollahi, postdoc fellow at the Observatory of Strasbourg.

Some of the science includes: new-born free-floating planet candidates, newly identified extragalactic star clusters, new low-mass dwarf galaxies in a nearby cluster of galaxies, and the discovery of very distant bright galaxies (seen during the first billion years of the Universe). “The broad spectral coverage, spanning from visible to near-infrared wavelengths, coupled with an exceptionally wide field of view, enables the discovery of the brightest and most massive galaxies in the early Universe.” says Hakim Atek, researcher at Paris Astrophysics Institute. “The ERO imaging of the Perseus cluster demonstrate the unique capability of *Euclid* to concurrently detect and characterize large samples of dwarf galaxies, their nuclei, and their globular cluster systems, allowing us to

¹ See [ESA's press release](#) of November 7, 2023.

² See [ESA's press release](#) of May 23rd, 2024.

construct a detailed picture of the formation and evolution of galaxies over a wide range of mass scales and environments.” adds Francine Marleau, scientist at the Institute of Astro and Particle Physics in Innsbruck.

These science outputs demonstrate *Euclid*'s excellent performance and ability to deliver the expected precision for various targets, as well as the smooth and effective analysis of the data within the *Euclid* Collaboration, auguring well for the mission's future. “The *Euclid* Early Release Observations are only the tip of the iceberg of discoveries to come from the *Euclid* surveys already underway.” affirms Leslie Hunt, scientist at INAF - Arcetri Astrophysical Observatory in Florence. In fact, all these spectacular results were obtained in less than 0.1% of *Euclid*'s allocated survey observing time.

These papers, which have all been subject to the internal peer review process, are available at [Euclid Consortium Publications](#), and will appear as pre-publications on the ArXiv later today. The images and science-ready catalogue are available for download from ESA.

Contributions from the LUTH/Paris Observatory-PSL

The Paris Observatory-PSL was involved in the production of the final forecasts for the performance of the mission in terms of cosmological parameter constraints using the Cosmology Likelihood for Observables in Euclid (CLOE) code. Two high-performance computing clusters partly funded by the Paris Observatory-PSL were used in this endeavour, namely Infinity and mesoPSL. “The forecasted performances exceed our expectations. I cannot wait to analyse the first data and produce the first cosmological results.”, says Amandine Le Brun, a researcher at LUTH/Paris Observatory-PSL, who was involved in their generation and in writing the CLOE code over the past four years.

Future milestones for the Euclid mission

The next data release from the Euclid Consortium will concern *Euclid*'s nominal survey. A first worldwide *quick release* is currently planned for March 2025, while a wider *data release* is scheduled for June 2026. At least three other *quick releases* and two other *data releases* are expected before 2031, which corresponds to a few months after the end of *Euclid*'s initial survey.

For more information, please contact the [Paris Observatory-PSL Press Office](#) or [Amandine Le Brun](#).

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