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NOVEMBER 5th 2025 10:00 CET**

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## Euclid Consortium: New images and science results from the *Euclid* space telescope

In parallel to a new [Euclid image release by ESA](#) on the 'Dark Cloud' LDN 1641, the Euclid Consortium (EC) is today releasing (1) a new set of seven scientific publications based on the Euclid Quick Data Release (Q1) as well as (2) a new, *Euclid*-based collage of the 'Tuning Fork of galaxy morphologies'.

- (1) In March 2025 ESA and the EC released [the first 63 square degrees of calibrated Euclid science images and catalogues](#), a set of descriptive technical articles and first scientific papers to the public ([see Background Information at the end for an intro](#)). This Q1 data set demonstrated the unprecedented power of this telescope designed to provide the most precise map of our Universe over time. **A second set of publications is now ready.** These results are described in a series of seven scientific publications ([description, list and links below](#)).
- (2) The EC has taken this occasion to highlight *Euclid*'s imaging capabilities and wide area of *Euclid*'s ongoing sky survey, to re-create a version of the classical '**Morphological Classification of Galaxies**' diagram, displaying and sorting the wide range of galaxy structure observable in the sky – solely constructed from *Euclid* imaging data contained in Q1 ([image and high-res download options below](#)).

## Paper release: Scientific results released 5 November 2025

The series of seven articles using the *Euclid* Q1 dataset provides a panoramic view of galaxy formation and evolution across cosmic time.

At the earliest epochs, the paper led by **Natalie Allen** reveals the discovery of two ultra-bright galaxies at redshift  $z > 8$ , among the more than 100,000 Lyman Break Galaxies expected at  $z = 6\text{--}12$ , tracing the emergence of the first stellar systems in the infant Universe.

Building on these distant beacons, **Lorenzo Bazzanini et al.** introduce **ARTEMIDE**, an **open-source deep-learning algorithm** that automatically detects gravitational arcs, offering a powerful new tool to identify strong lensing systems and probe mass distributions in galaxies and clusters – key processes in their growth.

**Maximilian Fabricius et al.** explore the later stages of galactic evolution, focusing on mergers that produce **supermassive black hole binaries** and depleted stellar cores. Their identification of 666 candidate systems with secondary nuclei in early-type galaxies provides crucial insight into how galaxies coalesce and reshape their central structures.

Moving to population-scale evolution, the paper led by **Fabrizio Gentile** analyses nearly one million galaxies and find that **morphology and star formation** are tightly linked to environment: in low-density regions, galaxies evolve internally into star-forming bulge-dominated systems before quenching, while in dense environments, star formation ceases first, leading to quiescent disc galaxies that later transform into spheroids.

Complementing this, **Ryley Hill** and collaborators show from over two million star-forming galaxies that dust-to-stellar mass ratios have steadily declined since  $z \approx 1$ , marking a gradual depletion of the material needed for star formation.

**Manuela Magliocchetti et al.** investigate radio emission as a tracer of **galactic nuclear activity**, finding that radio-loud AGN preferentially reside in merging systems, whereas radio-emitting star-forming galaxies tend to be isolated – highlighting the dual pathways of galaxy growth through both mergers and secular processes.

Finally, the team led by **Daniela Vergani et al.** identifies a rare population of 65 galaxies exhibiting highly ionised emission lines, signatures of **extreme astrophysical phenomena** such as active galactic nuclei, shock fronts, or Wolf-Rayet stars, offering a new window into energetic feedback mechanisms shaping galaxy evolution.

*Together, these studies demonstrate Euclid's unique power to connect the earliest luminous sources with the complex physical processes – mergers, feedback, and environmental effects – that have sculpted the rich diversity of galaxies observed in today's Universe.*

List of the newly released seven papers and first authors. These will become publicly visible at <https://www.euclid-ec.org/science/publications> on 5 November 2025, 10:00 CET:

#### SCIENTIFIC RESULTS USING EUCLID Q1 DATA

- Euclid Collaboration: **Natalie Allen** et al., Euclid Quick Data Release (Q1). “Hunting for luminous  $z > 6$  galaxies in the Euclid Deep Fields – forecasts and first bright detections”
- Euclid Collaboration: **Lorenzo Bazzanini** et al., “Euclid Quick Data Release (Q1). Searching for giant gravitational arcs in galaxy clusters with mask region-based CNNs”
- **Maximilian Fabricius** et al., “Euclid: Quick Data Release (Q1) – Secondary nuclei in early-type galaxies”
- Euclid Collaboration: **Fabrizio Gentile** et al., “Euclid Quick Data Release (Q1). Quenching precedes bulge formation in dense environments but follows it in the field”
- Euclid Collaboration: **Ryley Hill** et al., “Euclid Quick Data Release (Q1). The average far-infrared properties of Euclid-selected Galaxies”
- **Manuela Magliocchetti** et al., “Euclid: Quick Data Release (Q1) – The connection between galaxy close encounters and radio activity”
- Euclid Collaboration: **Daniela Vergani** et al., “Euclid Quick Data Release (Q1). Spectroscopic unveiling of highly ionised lines at  $z = 2.48 - 3.88$ ”

## Image release: Morphological Classification of Galaxies by *Euclid*

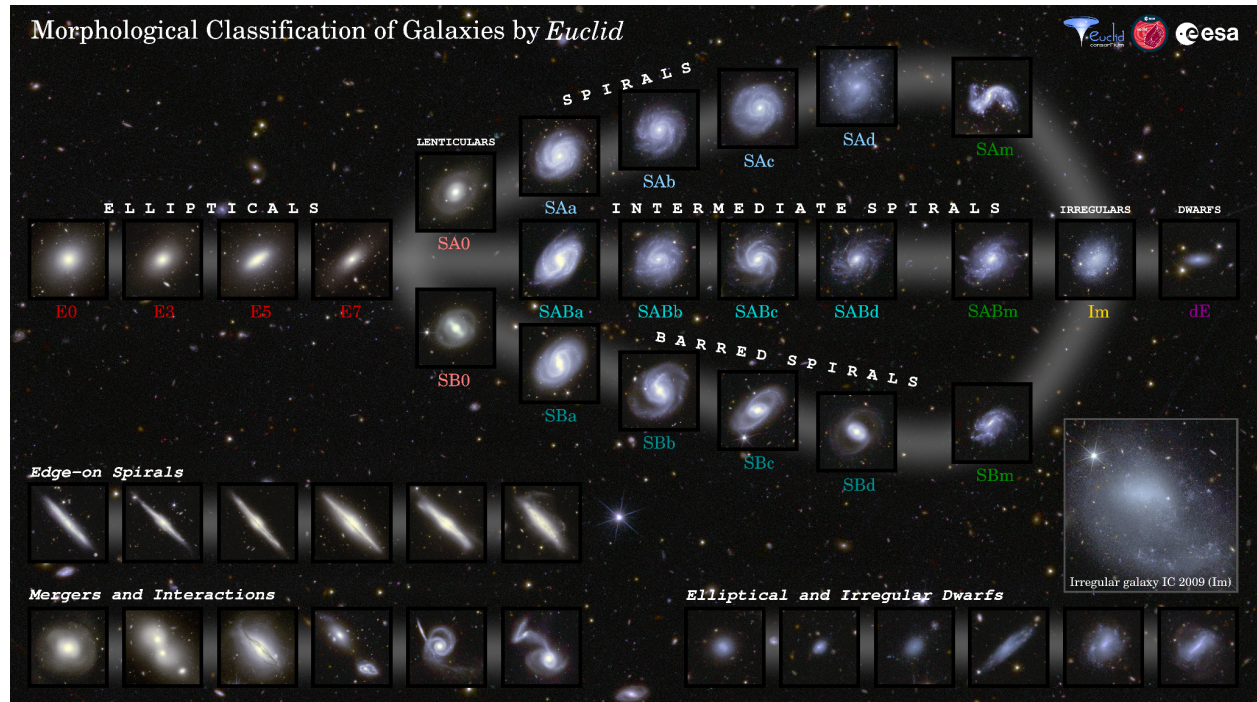


Image caption: The morphological classification scheme of galaxies as seen by *Euclid*

Image credits: ESA/Euclid/Euclid Consortium/NASA, Diagram by J.-C. Cuillandre, L. Quilley, F. Marleau.

For an interactive version and high-res downloads of different variations of this image please visit the Euclid Consortium website at:

<https://www.euclid-ec.org/euclid-morphological-tuning-fork>

After only one year of observations, ESA's space telescope *Euclid* is shedding new light on a long-standing question about the remarkable diversity of galaxies in the Universe. Just like flowers, galaxies come in different colours, sizes, masses, and shapes – all of which are captured in a single word that defines a galaxy: its morphology.

Are these different morphologies linked to one another? For instance, does a blue spiral galaxy evolve into a giant orange elliptical galaxy? Is a galaxy's shape a consequence of its environment – does it depend on whether it lives near or far from other galaxies?

With millions of galaxies observed in the Q1 data release, *Euclid*'s astronomers are beginning to sketch the answers to these fundamental questions. Much like Charles Darwin, who once wondered why nature and evolution had produced flowers – the question he called 'an abominable mystery' – astronomers today face their own cosmic

puzzle: why has the Universe produced such a stunning variety of galaxies? Through *Euclid*'s unprecedented images, they are starting to trace the details of how galaxies grow, change shape, and interact over billions of years – revealing the hidden patterns of cosmic evolution.

Actually, the galaxies' different morphologies are linked to their internal physical properties: for instance, both spiral and irregular galaxies are still forming new stars in huge quantities whereas lenticular and elliptical galaxies tend to not form new stars. The *Euclid* telescope has a special asset, it produces images that are both long-exposed ('deep') and extremely fine-grained ('high angular resolution'). Since *Euclid* already photographed 1.2 million large galaxies in one year (over the six years in total of the mission), astronomers use machine-learning algorithms in order to measure galaxy shapes and internal features such as spiral arms.

An extract of those 1.2 million images were chosen to build a diagram that organizes galaxies along a path according to their shape, size, the presence of a bar of stars, of spiral arms, etc.. This proposition of a 'botanical' classification of galaxies dates from the 1950's. Using the information about physics that *Euclid* provides to astronomers, we now understand that in their lifetime (a universe lifetime), galaxy morphologies change from right to left in this diagram. This mainly happens through more or less violent encounters with other neighbour galaxies. This process is named 'merging' or 'galaxy collisions' in astronomy. The bottom-left corner of the diagram shows collisions of galaxies currently happening and captured by *Euclid*. Mergers can explain both the mass growth and morphological transformations leading to the stunning diversity of galaxies that we observe.

Surprisingly, the largest family of galaxies in the Universe is not that of the usual big blue spiral galaxies. On the contrary, the most frequent are very tiny ones, often called 'dwarfs'. Not only are they small in size but also they are very faint because they have few stars, a feature we call 'low surface-brightness'. For decades it has been a huge challenge to observe them. *Euclid* is changing the game in discovering thousands of dwarf galaxies, allowing astrophysicists to begin to understand the role they play in the cosmic evolution of galaxies in general.

Dwarf galaxies are thought to be the building blocks of more massive galaxies like our own big Milky Way. They are generally classified into two main types: dwarf irregulars, which contain gas and dust, actively forming new stars, and have clumpy, irregular shapes; and dwarf ellipticals, which are smoother, gas-poor systems made up mostly of older stars. Other morphological features can include the presence of a nucleus, a blue compact centre, or globular clusters. Their prominence in the auxiliary panel of the classification diagram highlights this morphological diversity and underscores their importance in both isolated environments and as companions to large massive galaxies, similar to how the tiny Magellanic Clouds orbit the Milky Way. A first analysis using Q1

data has identified 2674 dwarf galaxies, comprising 58% dwarf ellipticals and 42% dwarf irregulars. A small fraction hosts notable features, including a significant number of globular clusters (1.0%), a nucleus (4.0%), or a blue compact centre (6.9%). *Euclid* discovers that the dwarf ellipticals preferentially cluster around massive galaxies, whereas dwarf irregulars are more evenly distributed across the sky.

This first year of observations demonstrates *Euclid*'s remarkable capability to provide a comprehensive view of galaxy formation and evolution across diverse mass scales, distances, and environments. Bringing a logical link to the variety of colours and shape of the galaxies, those cosmic flowers.

### **Related articles from the March 2025 paper release:**

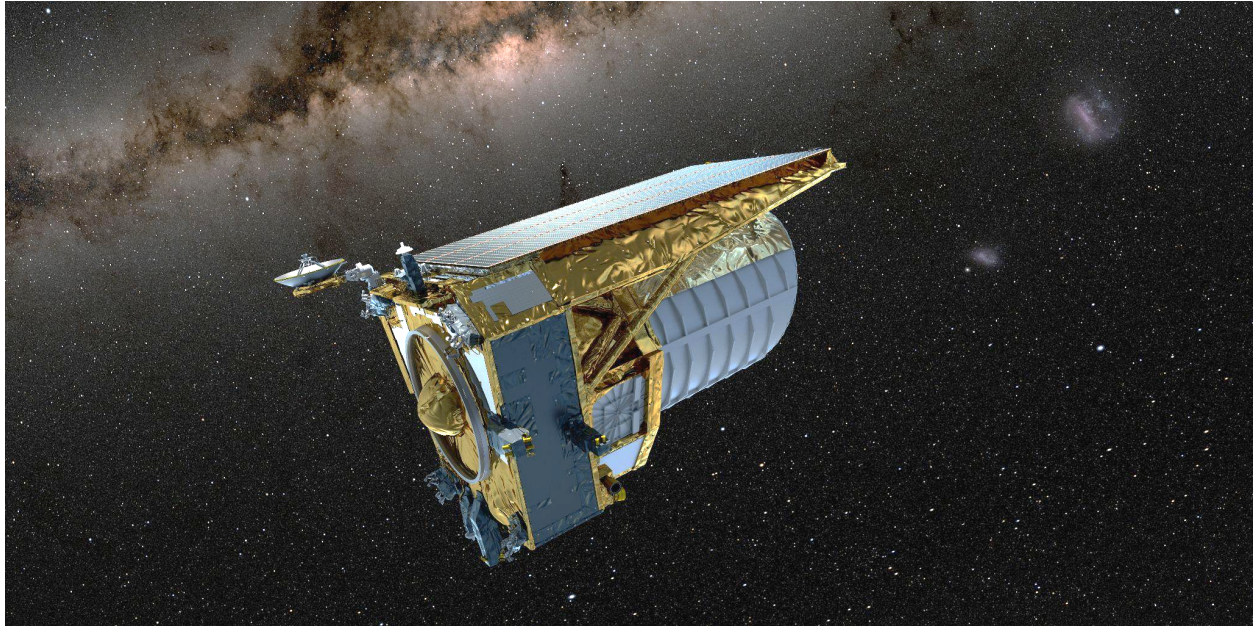
Euclid Consortium: Louis Quilley et al., 2025, “Euclid Quick Data Release (Q1). Exploring galaxy morphology across cosmic time through Sersic fits”, accepted for publication in *Astronomy & Astrophysics*, <https://arxiv.org/abs/2503.15309>

Euclid Consortium: Francine Marleau et al., 2025, “Euclid Quick Data Release (Q1). A census of dwarf galaxies across a range of distances and environments”, accepted for publication in *Astronomy & Astrophysics*, <https://arxiv.org/abs/2503.15335>

For more information, or press inquiries, please contact [press@euclid-ec.org](mailto:press@euclid-ec.org)



## Background information



The *Euclid* Space Telescope. Credit: ESA

### The Euclid Consortium

The Euclid Consortium, in partnership with the European Space Agency (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. The data release, titled ‘Q1’, for ‘Quick Release 1’, that the current publications are based on, was released 19 March 2025 (find ESA’s story about Q1 [at this link](#), the EC’s press release [at this link](#)).



The Euclid Consortium gathered in Leiden, Netherlands, in March 2025. Photo credit: Naor Scheinowitz

## The ‘Q1’ data set released 19 March 2025

The Q1 data unveiled on 19 March 2025 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, the Q1 release is seven times larger than the earlier ERO release, and represents the largest contiguous areas of sky ever observed with an 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.

## 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.