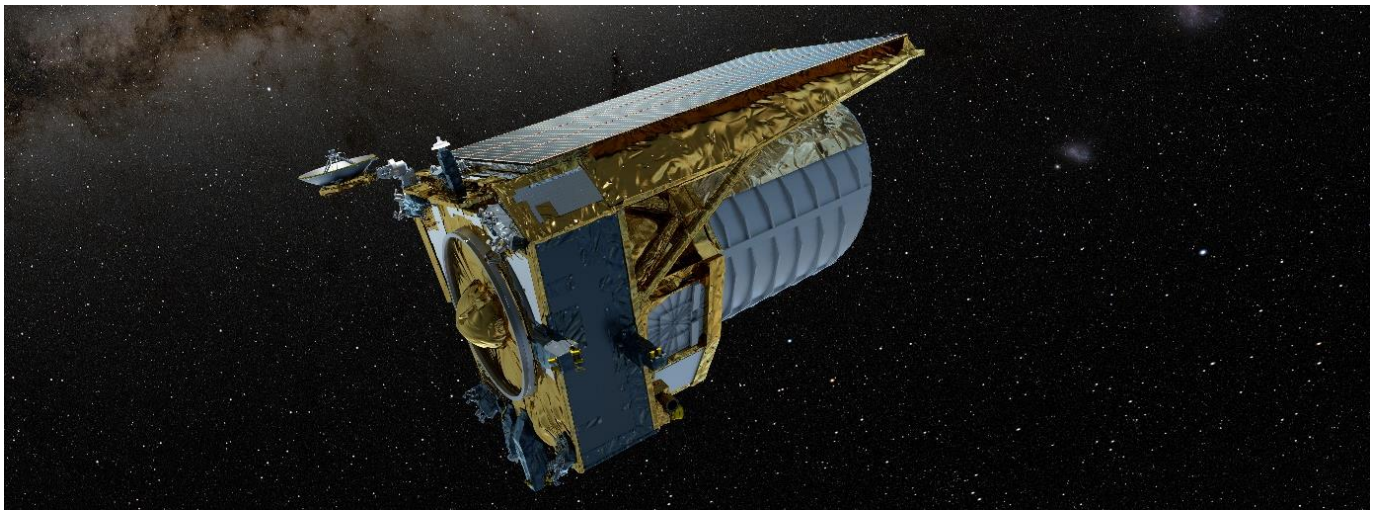
Euclid space telescope (main page)



(click for full photo)
Credit: ESA

Euclid is a **wide-angle space telescope** with a 600-megapixel camera to record visible light, a near-infrared spectrometer, and photometer, to determine the redshift of detected galaxies. It was developed by the European Space Agency (ESA) and the Euclid Consortium and was launched on 1 July 2023.

Overview

The objective of the Euclid mission is to better understand dark energy and dark matter by accurately measuring the accelerating expansion of the universe. To achieve this, the Korsch-type telescope will measure the shapes of galaxies at varying distances from Earth and investigate the relationship between distance and redshift. Dark energy is generally accepted as contributing to the increased acceleration of the expanding universe, so understanding this relationship will help to refine how physicists and astrophysicists understand it.

Euclid is designed to tackle some of the most important questions in cosmology:

- What is the structure and history of the cosmic web?
- What is the nature of dark matter?
- How has the expansion of the Universe changed over time?
- What is the nature of dark energy?
- Is our understanding of gravity complete?

Sources

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The mission

(click for full photo)
Credit: ESA

Objective

Euclid is designed to explore the evolution of the dark Universe. It will make a 3D-map of the Universe (with time as the third dimension) by observing billions of galaxies out to 10 billion light-years, across more than a third of the sky.

While dark energy accelerates the expansion of the Universe and dark matter governs the growth of cosmic structures, scientists remain unsure about what dark energy and dark matter actually are.

By observing the Universe evolving over the past 10 billion years, Euclid will reveal how it has expanded and how structure has formed over cosmic history – and from this, astronomers can infer the properties of dark energy, dark matter and gravity, to reveal more about their precise nature.

Name

Euclid is named after the Greek mathematician Euclid of Alexandria, who lived around 300 BC and founded the subject of geometry. As the density of matter and energy is linked to the geometry of the universe, the mission was named in his honour.

In numbers

Launch date	1 July 2023 15:12 UTC
Diameter	1.2 m (3 ft 11 in)
Focal length	24.5 m (80 ft)
Collecting area	1.006 m^2 (10.83 sq ft)
Wavelengths	From 550 nm (green) to 2 µm (near-infrared)

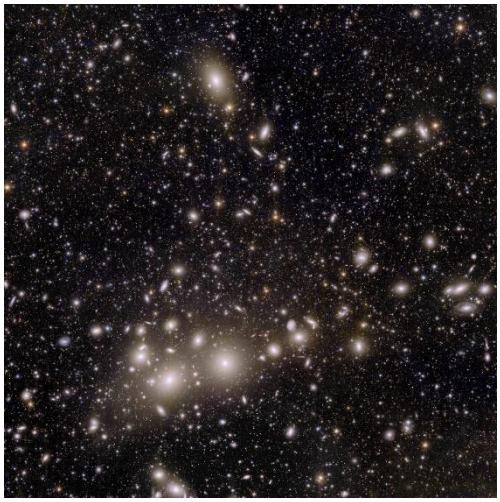
First images

[video]
https://www.youtube.com/watch?v=nn1WXAtoDdc

The Perseus Cluster of galaxies

The image shows 1000 galaxies belonging to the Perseus Cluster, and more than 100 000 additional galaxies further away in the background.

Many of these faint galaxies were previously unseen. Some of them are so distant that their light has taken 10 billion years to reach us. By mapping the distribution and shapes of these galaxies, cosmologists will be able to find out more about how dark matter shaped the Universe that we see today.



Credit: ESA

The Horsehead Nebula

Credit: ESA

At approximately 1375 light-years away, the Horsehead – visible as a dark cloud shaped like a horse's head – is the closest giant star-forming region to Earth. It sits just to the south of star Alnitak, the easternmost of Orion's famous three-star belt, and is part of the vast Orion molecular cloud.

Many other telescopes have taken images of the Horsehead Nebula, but none of them are able to create such a sharp and wide view as Euclid can with just one observation. In Euclid's new observation of this stellar nursery, scientists hope to find many dim and previously unseen Jupiter-mass planets in their celestial infancy, as well as young brown dwarfs and baby stars.

Dark matter & dark energy

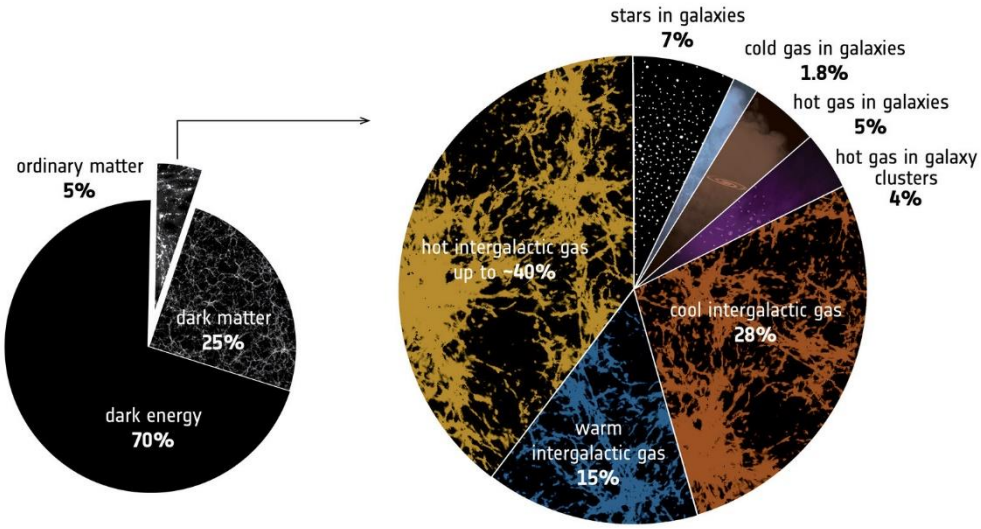
(click for full photo)
Credit: ESA

Normal matter

Normal matter consists of the elemental particles described in the famous Standard Model of particle physics. This includes quarks and electrons, which together form atoms.

We know that normal matter attracts other normal matter, depending on how much mass it has, via gravity. This force explains why apples fall towards the Earth. It also explains why the Earth revolves around the Sun, and the Sun orbits the centre of the Milky Way galaxy.

Surprisingly, normal matter turns out to be only a small fraction of what the Universe contains. 95% of the Universe is made up of dark matter and dark energy. These are words astronomers have come up with to give a name to the mysterious, invisible side of the Universe.



Credit: ESA

Dark matter

Dark matter is a hypothetical form of matter that appears not to interact with light or the electromagnetic field. Dark matter is implied by gravitational effects which cannot be explained by general relativity unless more matter is present than can be seen. Such effects occur in the context of formation and evolution of galaxies, gravitational lensing, the observable universe's current structure, mass position in galactic collisions, the motion of galaxies within galaxy clusters, and cosmic microwave background anisotropies.

When cosmologists incorporated dark matter into their computer models of the Universe, they found that not only could they more easily explain the way galaxies moved but they could also match the puzzling speed with which galaxies seemed to form in cosmic history. The same was true of other large scale structures such as clusters of galaxies.

Dark energy

Measurements in the 1990s showed that the rate at which the Universe expands is accelerating. This was completely unexpected because nothing in known physics could produce this effect. The Universe has continuously expanded since the Big Bang, but it was assumed that this expansion rate would slow down over time because it is resisted by the gravity of all matter in the Universe.

In keeping with the naming of the mysterious dark matter, astronomers began referring to whatever was causing the acceleration as ‘dark energy’. This unidentified component of the Universe is thought to be present in such a large quantity that it overwhelms all other components of matter and energy put together. According to the most recent estimates from ESA's Planck mission, dark energy contributes 68 percent of the matter-energy density of the Universe.

Have questions?

(click for full photo)
Credit: ESA

Want to know more about Euclid and its mission or about dark matter and dark energy? Send us your messages and questions below.

Name

E-mail address

Which topic are you asking about?

- ◯ Euclid mission
- ◯ Dark matter and dark energy

Message

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