UNIVERSITÉ DE GENÈVE

PRESS RELEASE

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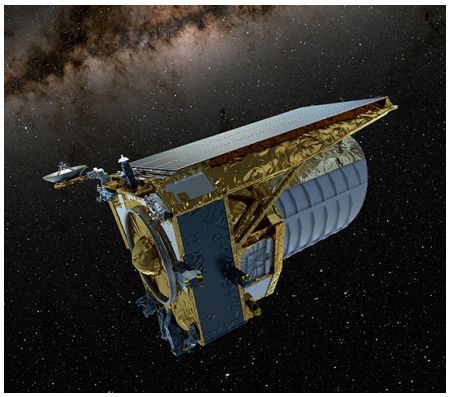
Euclid reveals cosmic wonders

The Euclid mission, in which UNIGE is actively involved, delivers its first batch of data—valuable information to help unravel, among other things, the mystery of dark matter.

The European Space Agency's (ESA) Euclid mission has unveiled its first public data, offering unprecedented insights into the structure and evolution of the Universe. Among the millions of galaxies observed, Euclid has provided a detailed insight into the structures of the cosmic web, gravitational lenses and the classification of galaxies. The University of Geneva (UNIGE), along with other Swiss research institutions, is playing a key role in the development and scientific exploitation of the mission. The contribution of its researchers has been decisive in the development of the main scientific objectives, aimed at deepening the understanding of dark matter and dark energy.

On 19 March 2025, the European Space Agency's (ESA) Euclid mission unveiled its first public data. Swiss research institutes are playing a central role in the Euclid mission, contributing essential technologies, advanced algorithms and computing infrastructures that will significantly improve our understanding of dark matter and dark energy.

The Euclid mission opens a new cosmic chapter: ESA's Euclid mission, launched in July 2023, aims to map more than a third of the sky to study the mysterious dark Universe. This data release includes observations of 26 million galaxies and identifies hundreds of strong gravitational lens candidates, highlighting the mission's power in astrophysical and cosmological research. Among these, a remarkable discovery: a complete Einstein ring, an extraordinary example of gravitational lensing, which vividly demonstrates Euclid's scientific potential (source ESA). Artificial intelligence and citizen science are an integral part of the classification of galaxy morphologies, paving the way for profound cosmological discoveries.



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Artist's impression of the Euclid space telescope. The mission will catalogue billions of distant galaxies by scanning the sky with its sensitive telescope.

High resolution pictures

The UNIGE's contribution

Thanks to the large team of staff involved in the Euclid mission, UNIGE is playing a leading role, both in the development of the mission and in the scientific exploitation of the data. UNIGE astrophysicists and cosmologists have played a decisive role in the development of Euclid's key scientific objectives. In collaboration with the Swiss company APCO Technologies, UNIGE led the construction of part of the VIS high-resolution imager, an extremely precise and reliable shutter that drives the instrument's scientific exposures.

Under the leadership of Professor Stéphane Paltani of the Faculty of Science's Astronomy Department, UNIGE is also responsible for developing and implementing key algorithms for the precise determination of galaxy distance, both for mainstream cosmological science and for the study of galaxy evolution. It developed the

software used to detect the billions of sources in the Euclid survey and to characterise their shapes.

The UNIGE is also one of the nine centres where Euclid data is processed, thanks to its high-performance computing (HPC) infrastructure. Teams from the theoretical physics and astrophysics departments are heavily involved in the scientific exploitation of the mission, particularly in understanding the history of the Universe and its mysteries. The groups led by Professors Camille Bonvin and Martin Kunz are actively involved in using Euclid data to characterise dark matter and dark energy, and to test Einstein's general relativity.

UNIGE scientists are the authors of two of the 34 papers published on this occasion. In his paper, Dr. Marco Tucci presents the system for measuring the properties of galaxies detected by Euclid, such as their distances and masses. Dr Federica Tarsitano has conducted a study of the detection of red quasars, considered to be a key phase in the coevolution of galaxies and their central black holes, which hide behind thick clouds of dust that make them appear red. Her work shows that Euclid's superior depth and resolution improve the identification of some of the reddest and darkest sources in the Universe.

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Swiss contributions at the heart of the project

The FHNW School of Computer Science is leading the development of the Euclid HPC framework, a sophisticated software stack running on nine supercomputers located in Europe and the United States. All Euclid data is orchestrated and processed using this software stack, making it the backbone of Euclid's ground processing. This software, developed by the team led by Simon Marcin, a computer scientist at the FHNW, ensures efficient processing of the data by the many algorithms used by Euclid's scientists, enabling rapid analysis of the mission's vast data sets.

The Institute of Astrophysics at the University of Zurich (UZH) is one of the main centres for large-scale numerical simulations as part of the Euclid mission. Members of the institute, including Professor Joachim Stadel and Dr Doug Potter, have developed and optimised the simulation software that has made it possible to break through the limit of a thousand billion simulated particles for the first time. This record-breaking Euclid flagship simulation, carried out on the Swiss high-performance computer 'Piz Daint' at the Swiss National Supercomputing Centre (CSCS), represents the distribution of matter in the Universe with unequalled precision.

In preparation for future data releases, the University of Zurich is currently developing new state-of-the-art simulations that consider different scenarios for dark energy and dark matter. In addition, it is developing innovative methods based on artificial intelligence that will be used in the future to evaluate Euclid data. In this way, it is making an essential contribution to the main objective of the Euclid mission: to decipher the true nature of the dark Universe.

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