

## VIS Press Release

### Euclid space telescope's camera a step closer to imaging galaxies

ESA's Euclid mission to study more than a billion galaxies is a step closer to launch as its two instruments are now built and fully tested, including a massive optical digital camera delivered by an international consortium led by UCL Mullard Space Science Laboratory.

Once Euclid is launched from French Guiana in 2022, the VIS instrument will be one of the largest such cameras put into space and will capture light from distant galaxies, providing a more detailed look at the visible universe over a larger part of the sky than ever before.

Euclid has a 1.2-metre mirror telescope that is designed to work at both visible and near-infrared wavelengths. It will collect light from distant cosmic objects and feed it into VIS and another instrument, the Near Infrared Spectrometer and Photometer (NISF).

Euclid will survey the shapes of galaxies and map the geometry of the Universe with the aim of making accurate measurements of mysterious Dark Matter and Dark Energy, which make up most of the cosmos. No-one yet knows what Dark Energy is, but Euclid will be a powerful tool for astronomers looking to find out.

Dr Yannick Mellier (Institut d'astrophysique de Paris, CNRS/Sorbonne Université and CEA/Irfu, Saclay), lead of the Euclid 1500-strong Consortium of which VIS is a part, said "Euclid will revolutionize our knowledge of the Universe by making the most accurate measurements of Dark Matter and Dark Energy, testing whether Einstein's theory of General Relativity requires modification, weighing neutrinos and exploring the details of how galaxies evolve."

The VIS instrument was delivered by a team of astronomers and engineers from UCL and The Open University in the UK, with teams at CEA-Irfu, Institute for Research on the Fundamental Laws of the Universe of the CEA (The French Alternative Energies and Atomic Energy Commission) and Institut d'astrophysique spatiale (IAS, CNRS/Université Paris-Saclay) in France, Istituto di Astrofisica e Planetologia Spaziali (IAPS) in Italy and the University of Geneva in Switzerland.

VIS and the Euclid telescope are built to be incredibly stable and to take very sharp high-resolution images in order to measure the shapes of galaxies with sufficient accuracy. To do this, the instrument has a mosaic of 36 CCDs, to give a total of just over 600 megapixels.

Professor Mark Cropper (UCL MSSL), leader of the VIS instrument team, said: "The VIS camera will take pictures of entire sky that is accessible for large scale cosmology and reach out to the most distant parts of the universe over the course of six years. Each of these images will be more than 70 times larger than those captured using the Hubble Space Telescope and will contain information useful for all fields of astronomical research. They will be available for astronomers and the public alike, allowing everyone to enjoy the beauty of the Cosmos."

VIS has been funded by the UK Space Agency, and those of France, Italy and Switzerland, and has benefitted from support from the Euclid Consortium and from close cooperation with ESA.

The UCL team provided the system-level role, and produced, tested and calibrated the electronics for the detector array to ensure they survive the cold environment of space.

The structure for the camera was produced by CEA, the shutter by the University of Geneva, a calibration unit by IAS, a unit to operate these two by CEA, and a powerful data processing

unit to capture all of the 144 individual channels from the camera and to control the instrument by IAPS.

Professor Andrew Holland (Centre for Electronic Imaging at The Open University and co-investigator for Euclid VIS), added: "The VIS instrument contains one of the largest detector arrays to be used in space and its demanding science goals have required the development of new operating modes and experimental techniques to enhance the quality of science data returned and to extend the Euclid mission lifetime. This research will inform and enhance future space missions going forward."

The NISP instrument, which is being built by a consortium of nationally funded institutes led by the Laboratoire d'astrophysique de Marseille (LAM, CNRS/AMU/CNES) in France, is dedicated to making distance measurements of galaxies. With VIS, it will allow Euclid's data to be turned into the largest, most accurate 3D survey of the Universe ever conducted.

The UK Space Agency's Head of Space Science, Caroline Harper said: "We know very little about Dark Energy and Dark Matter, and yet many astronomers believe that together they make up an incredible 95% of the Universe. Euclid will help us unlock some of their secrets by imaging more than a billion galaxies in more detail than ever before.

"The UK is a leading member of the ESA and, in addition to funding the lead role on the VIS camera, the UK Space Agency is supporting the development new data processing capability with universities across the country. This will allow researchers to analyse the data that will be returned from space."

Now that the instruments have been delivered to Airbus, they will be integrated first with the telescope, and next with the rest of the payload module, which will take several months to ensure everything is precisely aligned and electronically communicating.

It has been a long journey getting this far. Euclid was selected for implementation in 2011, having already undergone almost five years of studies. While there is still a lot of hard work and testing ahead, the delivery of the instruments and telescope means that the spacecraft is now really beginning to come together.

## **Notes to Editors**

For more information or to speak to the researchers involved, please contact Dr Rebecca Caygill, UCL Media Relations. T: +44 (0)20 3108 3846 / +44 (0)7733 307 596, E: [r.caygill@ucl.ac.uk](mailto:r.caygill@ucl.ac.uk)

## **Additional material**

### **Images**

Images are downloadable using this link and corresponding captions/credits are below: <https://we.tl/t-AYojCw4Jwj>

1. The VIS Focal Plane. The 36 dark blue CCDs are held in the grey Silicon Carbide structure seen here under a protective cover (to be removed before launch) at the top of the unit, while the electronics to measure and digitize the images are in the gold structure below with their power supplies on the outside. The silver sections are the thermal shrouds which isolate the cold CCDs from the warm electronics. Image credit: CEA

2. A single Flight Model "slice" with six CCDs and two sets of electronics each of 12 detector channels. Six of these slices make up the full focal plane. Image credit: CEA
3. The VIS shutter with the shutter door on the right, which opens and closes at the start and end of exposures. This mechanism is finely balanced and momentum-compensated to minimize any disturbance to the stability of the satellite. Image credit: ESA
4. The VIS Calibration Unit with projection optics and baffle. Image credit: IAS
5. The VIS Power and Management Control Unit (front) and Control and Data Processing Unit (back) already integrated on one of the spacecraft panels. Image credit: UCL MSSL

European Space Agency Euclid site: <http://sci.esa.int/science-e/www/area/index.cfm?fareaid=102>

Euclid consortium website: <https://www.euclid-ec.org/>

UK Space Agency: <https://www.gov.uk/government/organisations/uk-space-agency>

European Space Agency main site: <http://www.esa.int/esaCP/index.html>

### **About Euclid**

Euclid is an ESA medium class astronomy and astrophysics space mission. By making use of both weak gravitational lensing, which measures the distortion of distant galaxies caused by intervening matter, and baryonic acoustic oscillations, based on measurements of the clustering of galaxies, the mission will capture a 3D picture of the evolving distribution of both dark and ordinary (or baryonic) matter in the cosmos. This will enable scientists to reconstruct the past few billion years of the Universe's expansion history, estimating the acceleration caused by the mysterious dark energy its possible time.

ESA selected Thales Alenia Space as prime contractor for the construction of the satellite and its Service Module, with Airbus Defence and Space chosen to develop the Payload Module, including the telescope. Euclid comprises two instruments: the visible imager (VIS), and the near-infrared spectro-photometer (NISP). The Euclid Consortium is a collaboration of nationally funded scientists, engineers and managers responsible for the definition of the scientific mission and the provision of the scientific instruments and data processing. The VIS instrument is being built by a consortium of nationally funded institutes led by UCL Mullard Space Science Laboratory (MSSL), UK. The NISP instrument is being built by by a consortium of nationally funded institutes led by the Laboratoire d'astrophysique de Marseille (LAM) in France; its detectors are provided by NASA.

### **About UCL – London's Global University**

UCL is a diverse community with the freedom to challenge and think differently.

Our community of more than 41,500 students from 150 countries and over 12,500 staff pursues academic excellence, breaks boundaries and makes a positive impact on real world problems.

We are consistently ranked among the top 10 universities in the world and are one of only a handful of institutions rated as having the strongest academic reputation and the broadest research impact.

We have a progressive and integrated approach to our teaching and research – championing innovation, creativity and cross-disciplinary working. We teach our students how to think, not what to think, and see them as partners, collaborators and contributors.

For almost 200 years, we are proud to have opened higher education to students from a wide range of backgrounds and to change the way we create and share knowledge.

We were the first in England to welcome women to university education and that courageous attitude and disruptive spirit is still alive today. We are UCL.

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### **About UCL Mullard Space Science Laboratory (UCL MSSL)**

The UCL Mullard Space Science Laboratory is UCL's Department of Space and Climate Physics, which brings together scientists and engineers to address key questions in modern space science.

UCL was one of the first universities in the world to become involved in making scientific observations in space. Since it was established in 1966, UCL MSSL has participated in over 60 satellite launches, over 100 suborbital experiments and more than 200 rocket experiments, and is now a world-leader in space research and engineering.

We cover all aspects of space research, from understanding the Sun and its interaction with the planets, to understanding galaxies and the matter that makes up the universe. We build and operate cutting edge space hardware for multinational space missions and offer state-of-the-art test facilities for ground and space-based technology.

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### **About the UK Space Agency**

The UK Space Agency leads the UK's efforts to explore and benefit from space, with responsibility for all strategic decisions on the UK civil space programme. It ensures Government investments in space science and technology deliver significant value to the UK economy and people's lives. As set out in the Industrial Strategy, the UK Space Agency works with industry to develop new technologies, infrastructure and services, and to ensure the UK thrives in the commercial space age.

The UK Space Agency:

- supports the work of the UK space sector at home and abroad, maximising its benefit to the UK's growing economy
- Invests in science and exploration to increase our understanding of the universe and deliver practical benefits such as new technologies to life on Earth
- inspires the next generation of UK scientists and engineers

- provides a safe and supportive regulatory environment for the launch and operation of UK spacecraft, launch operators and UK spaceports
- promotes global co-operation in space, through the UK's membership of the European Space Agency and international partnerships

The UK Space Agency is an executive agency, sponsored by the Department for Business, Energy & Industrial Strategy

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