

# Hawai'i observatories add color, depth to European Euclid mission

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The three observatories in Hawai'i collaborating with the Euclid mission. (left to right) the Canada-France-Hawai'i Telescope (CFHT), the Subaru Telescope, and the University of Hawai'i Institute for Astronomy Pan-STARRS (PS1). Credit: CFHT, NAOJ, IfA

[Launched on July 1, 2023](#), the European Euclid mission will observe billions of galaxies over one-third of the sky to create a map of the Universe. But Euclid's map will be in black and white; telescopes in Hawai'i, including the Subaru Telescope, are needed to determine the colors of the galaxies. The color data will be used to deduce the distance, thus creating a 3D map, uncovering the mysteries of dark matter and dark energy.

The European Space Agency (ESA) Euclid space telescope mission will explore the mysteries of dark matter, dark energy, and cosmic evolution.

Without atmospheric interference, Euclid can clearly capture the shape of galaxies and detect the gravitational lensing effect, in which the gravitational field of a foreground object distorts the image of a distant galaxy. But Euclid is equipped with only one filter in [optical wavelengths](#), meaning that Euclid takes black and white images. To precisely determine the distance to galaxies, images taken with multiple filters are necessary. That is why collaboration with [ground-based telescopes](#) is essential.

Three observatories in Hawai'i—the Canada-France-Hawai'i Telescope (CFHT), the Subaru Telescope on Maunakea, and the University of Hawai'i Institute for Astronomy Pan-STARRS telescopes on Haleakala, Maui—started the UNIONS project prior to the launch, to survey the northern sky in optical and near-infrared wavelengths.

This project will cover almost one-third of Euclid's observation area. "UNIONS is a consortium of telescopes in Hawai'i. CFHT equipped with MegaCam observes in shorter wavelength bands, the Subaru Telescope equipped Hyper Suprime-Cam (HSC) observes mainly in longer wavelength bands, and two Pan-STARRS telescopes equipped with a Gigapixel Camera observe in an intermediate wavelength band. Not only with Euclid, UNIONS scientists are also sharing data to conduct research collaboration," explains Satoshi Miyazaki, Director of Subaru Telescope, the significance of UNIONS.

The Subaru Telescope's most significant contribution to the collaboration, WISHES (Wide Imaging with Subaru HSC of the Euclid Sky), is in the near infrared, beyond the reach of Euclid's optical filter. "We established the WISHES project when we received an enthusiastic invitation that the contribution of the Subaru Telescope is crucial for the

success of the Euclid mission," says Masamune Oguri at Chiba University, a member of the Euclid Consortium Board.

"I am excited about the launch because the time has come for many scientists' dreams to come true," says Miyazaki, who has been aware of the mission from since the 2000s. He believes that collaboration with cutting-edge international missions will be increasingly important for the Subaru Telescope. "Our collaboration with Euclid will be a role model."

Provided by Subaru Telescope

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