New views of an ancient asteroid

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The Herschel Telescope is poised to obtain the first-ever views of target asteroid 1999 RQ36 at far infrared wavelengths before... Credit: ESA/AOES MedialabNASA/ ESA/STScI

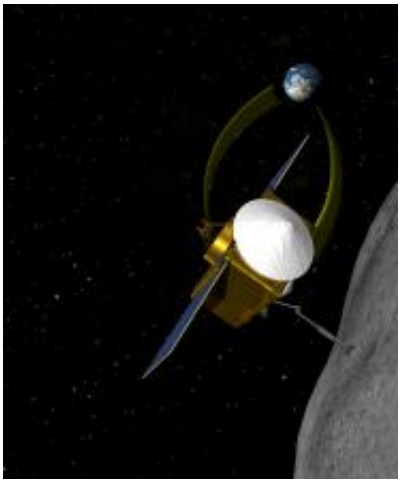
Using the Herschel Space Telescope, astronomers are set to obtain the first-ever images of asteroid 1999 RQ36 in far infrared light, a wavelength that the OSIRIS-REx spacecraft will not be able to see once it approaches the charcoal-black chunk of rock floating in space.

Peering through forest-fire smoke with the 61-inch telescope on Mt. Bigelow north of Tucson, Carl Hergenrother observed the asteroid known as 1999 RQ36 on its 2011 Earth-approaching orbit early last June.

The 1,900-foot (580 meter) diameter, blacker-than-coal asteroid is the destination asteroid for the U.S.' first asteroid-sample return mission, NASA's OSIRIS-REx.

Hergenrother, of the Lunar and Planetary Laboratory at the University of Arizona, heads the OSIRIS-REx asteroid astronomy working group of more than three dozen scientists from the U.S., Canada and Europe.

Astronomers want to get as many observations of 1999 RQ36 as possible through spring 2012, before the asteroid heads away from Earth and beyond view for ground-based and space telescopes for the next six years. By which time, the OSIRIS-REx spacecraft will have launched.



...the OSIRIS-REx spacecraft will visit the object and scoop up a sample of pristine material in 2020. Credit: NASA/GSFC/The University of Arizona

They plan observations with a network of telescopes in Arizona, the Canary Islands, Chile, Puerto Rico and space.

Observations will be challenging because the asteroid will pass no closer

to Earth than 10.9 million miles (17.5 million kilometers) in early September, when it will be difficult to view against the angle of the sun.

The asteroid appears 30 times dimmer in 2011 than it did in 2005, when it passed 3.1 million miles (5 million kilometers) from Earth and astronomers got a bonanza of data.

New observations will influence mission planning and development and also directly address some OSIRIS-REx mission key goals, said Dante Lauretta of the UA Lunar and Planetary Laboratory, OSIRIS-REx deputy principal investigator.

One goal is to compare results from ground-based and Earth-orbiting telescopes to results from cameras and other science instruments aboard the OSIRIS-REx spacecraft as it circles the asteroid, flying as close as four-tenths of a mile (0.7 kilometers), for about 500 days beginning October 2019.

This "ground truthing" of Earth-based telescopes empowers astronomers to interpret observations made from Earth more accurately and expand their science to other Earth-approaching asteroids and to the main belt between Mars and Jupiter, Lauretta said.

This year's first near-infrared observation of 1999 RQ36 was made about a month ago.

Massachusetts Institute of Technology professor Richard Binzel and post-doctoral fellow Francesca DeMeo used one of the twin 6.5-meter Magellan telescopes at Las Campanas Observatory in Chile to view the asteroid at near-infrared wavelengths on July 26.

"The asteroid was extremely faint, an exceedingly difficult target, even with the Magellan telescope," Binzel said.

The new Magellan results are consistent with excellent data taken in 2005, which show the asteroid is composed of primitive material, he said.

This consistent result is gratifying because a core OSIRIS-REx mission goal is to bring back to Earth a good-sized, pristine sample of carbon-rich, primitive asteroid, a time capsule left over from solar system formation 4.5 billion years ago that could contain the building blocks of life.

"Even though these new data don't affect what we already know," Binzel said, "what is most important is that we are doggedly pursuing all opportunities to learn a little bit more about this object."

One highlight anticipated for September observations will be using the European Space Agency's Herschel space telescope to get first-ever views of the asteroid at far infrared wavelengths, Lauretta said. OSIRIS-REx will not see the asteroid at far infrared wavelengths.

Asteroid 1999 RQ36 will appear brighter in April and May 2012 than it does in September. Although it will be farther from Earth by next spring, it will have moved out of the glare of the sun and be positioned to reflect more light back to Earth, Lauretta and Hergenrother said.

This will give astronomers a better chance to do photometry, which measures how light brightens and dims over time. Prominent surface features cause dimming and brightening as the asteroid rotates, and astronomers can get a more precise rotation rate by watching the light changes.

To talk about 1999 RQ36 "brightness" is somewhat of a misnomer, Hergenrother noted, for the asteroid reflects only about 3 percent of the sunlight that hits it. Fresh asphalt is brighter.

Hergenrother in Arizona and colleagues in other parts of the world study how reflectivity changes during different asteroid phases.

Using the moon as an analogy, a full moon reflects far more light back to Earth than a crescent moon or a quarter moon does.

"Problem is, we never observe the asteroid at full phase from the ground," he said. "It's really difficult to do because the asteroid never lines up completely with the Earth and the sun."

By observing the asteroid at its different phases, astronomers can derive a function that tells them how bright it would be at full-phase. That gives them important information on albedo, which is how much total light the asteroid surface reflects.

Measuring albedo is important for mission planning and for helping astronomers constrain the size of asteroids they view with telescopes, Hergenrother said.

And it's important for learning more about how sunlight heats an asteroid surface, possibly sending the asteroid into an orbit that eventually heads toward Earth.

Provided by University of Arizona