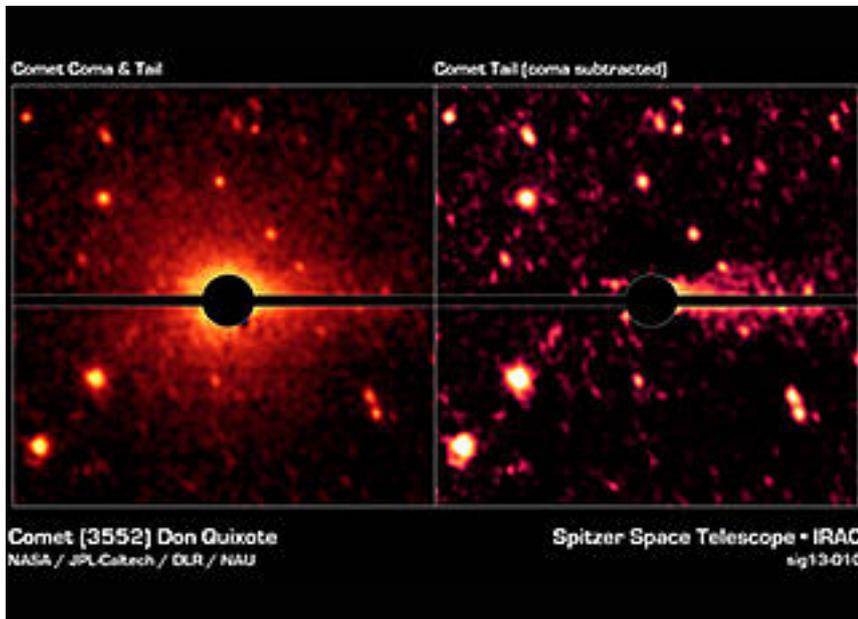


Don Quixote Revealed as Comet Hiding in Plain Sight

Europlanet



For 30 years, a large near-Earth asteroid wandered its lone, intrepid path, passing before the scrutinizing eyes of scientists while keeping something to itself: (3552) Don Quixote, whose journey stretches to the orbit of Jupiter, now appears to be a comet. The finding was presented by Dr Michael Mommert at the European Planetary Science Congress (EPSC) 2013 in London on September 10, 2013.

The discovery resulted from an ongoing project coordinated by researchers at Northern Arizona University using the Spitzer Space Telescope. Through a lot of focused attention and a little bit of luck, they found evidence of cometary activity that had evaded detection for three decades.

“Don Quixote's orbit resembles that of a comet, so people assumed it was a comet that had gotten rid of all its ice deposits thousands of years ago,” said Mommert, a PhD student of team member Prof. Alan Harris at the German Aerospace Center (DLR) in Berlin at the time this work was carried out. Near-Earth asteroids that are former comets make up roughly 5 percent of the whole near-Earth asteroid population, as found by Mommert and colleagues in a related study. These objects are mostly “dead comets” — comets that had shed the carbon dioxide and water that give them their spectacular comae and tails long time ago.

What Mommert, now a post-doctoral researcher at NAU, and an international team of researchers discovered, though, was that Don Quixote was not actually a dead comet. In fact, the third-biggest near-Earth asteroid out there, skirting Earth with an erratic, extended orbit, is “sopping wet,” said NAU associate professor David Trilling, with large deposits of carbon dioxide and presumably water ice.

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Finding evidence of carbon dioxide wasn't easy. During an observation of the object using Spitzer in August 2009, Mommert and colleagues found that it was far brighter than they expected. "The images were not as clean as we would like, so we set them aside," Trilling said.

Much later, though, Mommert prompted a closer look, and partners at the Harvard-Smithsonian Center for Astrophysics found something unusual when comparing the infrared images of the object: something, that is, where an asteroid would have shown nothing. The processed images indicated that Don Quixote had a coma and a faint tail.

"This discovery of carbon dioxide emission from Don Quixote required the sensitivity and infrared wavelengths of the Spitzer telescope and would not have been possible using optical telescopes on the ground," Mommert said. This discovery implies that carbon dioxide and water ice might be present on other near-Earth asteroids, as well.

The implications have less to do with a potential impact, which is extremely unlikely in this case, and more with "the origins of water on Earth," Trilling said. Comets may be the source of at least some of it, and the amount on Don Quixote represents about 100 billion tons of water — roughly the same amount that can be found in Lake Tahoe, CA.

This study has confirmed Don Quixote's size and the low, comet-like reflectivity of its surface. The results of this study have been submitted to the *Astrophysical Journal* for publication. Michael Mommert's work at the DLR's Institute of Planetary Research in Berlin was funded by Grant HA 2914/2-2 from the German Research Foundation (DFG).

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