Scientist finds medium sized Kuiper belt object less dense than water

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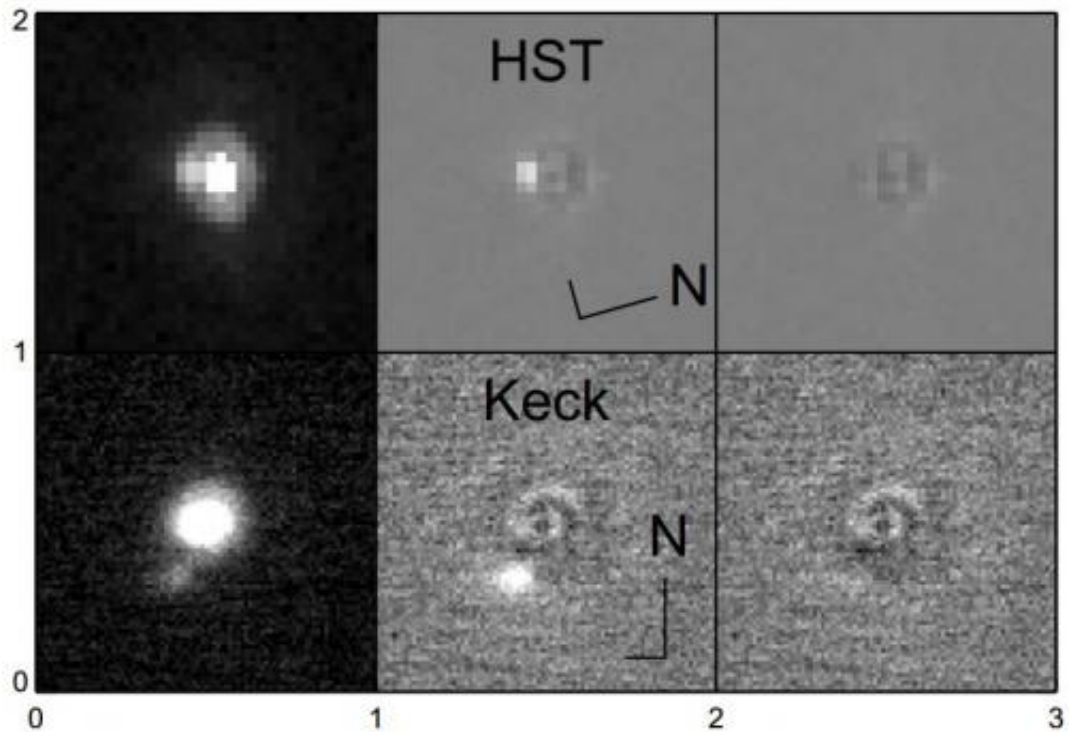

Observations of the 2002 UX25 system with HST/HRC and Keck LGS-AO/NIRC2. The northward orientation arrow is 0.25 arcseconds long, for scale. In the first column, we show the image of both 2002 UX25 and its satellite. Credit: arXiv:1311.0553 [astro-ph.EP]

(Phys.org) —Michael Brown, a planetary scientist with California Institute of Technology, has found a medium sized object in the Kuiper belt (dubbed 2002 UX25) that doesn't appear to conform to theories of

how such objects came to exist. In his paper to be published in *Astrophysical Journal Letters*, Brown notes that the mid-sized object appears to be less dense than it should be if it followed conventional thinking that suggests the larger the objects are in the belt, the more dense they should get.

The Kuiper belt, is of course, a group of rock-like objects (comets, dwarf planets, etc.) orbiting the sun that lie farther out than Neptune. Such Kuiper belt objects (KBOs) are believed to have formed in ways similar to the way planets did, i.e. due to accretion of material over time. Conventional theory suggests that small KBOs are less dense than water because of their porous nature—large KBOs grew more dense as they grew larger due to gravity causing them to compact. If the theory is correct medium size KBOs should have medium density. But this new KBO that Brown has found doesn't conform to the theory at all, instead, its density is roughly the same as smaller KBOs, suggesting that it's not size that determines KBO density, but something else. And right now, Brown notes, nobody knows what that something else might be.
2002 UX25 has a diameter of roughly 650 kilometers, putting it squarely in the mid-size KBO category, and it, like other KBOs, is believed to exist in very nearly the same state it's held since the formation of the solar system. It's in studying such objects that scientists learn more about how everything in our solar system came to be the way it is. Until now, most scientists agreed that KBOs of a size smaller than 350 kilometers across had a density less than that of water, whereas bigger ones had a greater density. That theory might have to be changed however as 2002 UX25 is the first medium sized KBO to have its density measured and it clearly doesn't conform.

The discovery of 2002 UX25's density properties has already led to new theories, Brown notes, with some suggesting that scientists have been wrong to assume that KBOs and the planets formed at the same time. Instead, they suggest, that it's possible that KBOs came first and

afterwards as the planets were forming, eddies formed causing KBOs to knock into one another breaking them into different sized pieces.

More information: The density of mid-sized Kuiper belt object 2002 UX25 and the formation of the dwarf planets, arXiv:1311.0553 [astro-ph.EP] arxiv.org/abs/1311.0553

Abstract
The formation of the largest objects in the Kuiper belt, with measured densities of ~1.5 g cm-3 and higher, from the coagulation of small bodies, with measured densities below 1 g cm-3 is difficult to explain without invoking significant porosity in the smallest objects. If such porosity does occur, measured densities should begin to increase at the size at which significant porosity is no longer supported. Among the asteroids, this transition occurs for diameters larger than ~350 km. In the Kuiper belt, no density measurements have been made between ~350 km and ~850 km, the diameter range where porosities might first begin to drop. Objects in this range could provide key tests of the rock fraction of small Kuiper belt objects. Here we report the orbital characterization, mass, and density determination of the 2002 UX25 system in the Kuiper belt. For this object, with a diameter of ~650 km, we find a density of 0.82+/-0.11 g cm-3, making it the largest solid known object in the solar system with a measured density below that of pure water ice. We argue that the porosity of this object is unlikely to be above ~20%, suggesting a low rock fraction. If the currently measured densities of Kuiper belt objects are a fair representation of the sample as a whole, creating ~1000 km and larger Kuiper belt objects with rock mass fractions of 70% and higher from coagulation of small objects with rock fractions as low as those inferred from 2002 UX25 is difficult.