

Stuart Clark

Is this planet 10?

It's larger than Pluto. In fact, it's the largest object found in the Solar System for more than 150 years. 'Planet 10', or 2003 UB313, sits three times further away from the Sun than Pluto and could herald a bonanza of new planets to be discovered. But, will the International Astronomical Union (IAU) call it a planet? Stuart Clark investigates.

Be careful what you wish for, you might just get it. Michael E Brown, a professor of planetary astronomy at the Californian Institute of Technology finds himself in exactly that situation. "I have argued in the past that Pluto is not a planet. I have come full circle on that," he says. And no wonder.

Late in the Californian afternoon on 29 July, as clocks struck midnight in the UK, Brown announced the discovery of 2003 UB313. By the most conservative of estimates it is the largest object discovered in the Solar System since Neptune in 1846. It is larger than Pluto and, according to Brown, that can only mean one thing: "Get out your pens and start re-writing the text books today," he said at the press conference, "We are calling this planet 10,"

Such amendments may be premature, however, as the IAU have been locked in a debate for the last 12 months over what constitutes a planet. Until those deliberations are over, 2003 UB313 will remain in classification limbo with no one, apart from Michael Brown, willing to say for certain whether this is a planet or not.

First glimpse

2003 UB313 was first seen on 8 January 2005, on images taken using the 1.2-metre Samuel Oschin Telescope on Mt. Palomar, California. Michael Brown and his colleagues David Rabinowitz, Yale University and Chadwick A Trujillo, Gemini Observatory, Hawaii, rapidly began searching back through the archives looking for previous, but overlooked, images of the object.

Soon they had images stretching back to 2003 and that's when the suspicion about what they had discovered began to sink in. "It's actually quite a bright object,"

says Brown, “In fact, high-end amateur observers could see this.” (See Track down the new object.)

When Brown says bright, however, it’s important to remember that he’s a professional astronomer talking. It’s still some 80 times fainter than Pluto. But the point he is making is that 2003 UB313 is bright compared to the objects he was expecting to find.

When a celestial object is bright, it means: big, close or reflective, or some combination of these three. So the team set about unscrambling what they had discovered.

Using the images, they figured out the orbit and deduced that it was not close. In fact, it’s 97 times the Earth’s distance from the Sun, or three times further away than Pluto.

“If you were standing on the surface of this world, you could cover the Sun with the head of a pin, held at arm’s length,” says Brown.

So either it was big or reflective. To decide which, they made a crazy assumption: that its surface reflected every ray of sunlight that hit it. This allowed them to calculate just how big such a ‘mirrored’ object would be.

The answer was extraordinary: just bigger than Pluto for a perfectly reflecting surface. In reality, it would have to be less than perfect and so, to reflect the same amount of light, it would need to be bigger. In other words, this object had to be larger than Pluto.

“I telephoned my wife straight away but I didn’t know how to describe how excited I was,” says Brown. The team began to think in terms of having found a planet, rather than the usual icy asteroids of the outer Solar System they had become used to finding. But how could they verify their find?

### Icy surface

On 25 January 2005, the giant Gemini North telescope on Mauna Kea, Hawaii turned towards the new world and collected infrared light with its Near-Infrared Spectrograph (NIRS) instrument. They saw a strong signature of methane ice on the surface of this world. That single fact puts it into the same class of object as Pluto, which also has a covering of methane on its surface. The only other world in the

Solar System to share this characteristic is Neptune's moon Triton, which is itself larger than Pluto.

With this piece of knowledge in place, the team estimated that 2003 UB313 surface would reflect the same amount of light as Pluto, namely 60 percent. That led to a size estimate of around 3000km diameter, or roughly one and a half times bigger than Pluto.

Next, they decided to use the Spitzer Space Telescope to see if its infrared detectors could capture an image of the world that they were now starting to confidently think of as planet 10. The reason was that the forty percent of starlight that the planet absorbed would heat the planet. The planet would then radiate this heat into space at longer wavelengths of infrared radiation than Gemini could observe from the ground.

The infrared images from Spitzer would allow them to measure the temperature of the world, giving them a valuable way to double check the size of the planet and their assumptions about its surface conditions. However, this was where the team's luck ran out. Spitzer failed to see the planet.

All they could tell from the lack of the detection was that the new world was smaller than twice the size of Pluto (otherwise they could not help but have seen it). The surface temperature was likely to be around  $-243$  degrees centigrade.

They are now working on other ways of verifying the diameter.

Planet 10?

"We hope this discovery is non-controversial," said Brown at the time of 2003 UB313's announcement. Boy was he wrong. Not one astronomer that Astronomy Now talked to during the preparation of this article said that it was unequivocally a planet. Instead most saw it as a chance to re-open the debate about whether Pluto is a planet.

As an example of a typical response, Richard Nelson, a planetary formation theorist at Queen Mary, University of London said, "If Pluto is a planet, then this is too. But is Pluto really a planet?"

Brown's reason for optimism stems from the late 1990s, when the IAU became embroiled in a heated debate concerning whether Pluto should continue to be classified as a planet. It decided that it was and stated on the IAU website

([www.iau.org](http://www.iau.org)) that “The IAU considers the discussion closed with this statement and does not intend to reopen it in the foreseeable future.”

It’s open again, now.

Deciding whether 2003 UB313 is a planet is harder than it might seem at first, because no one actually knows just what constitutes a planet. Professor Iwan Williams, Queen Mary, University of London, is President of IAU Division III, which deals with ‘Planetary Systems Sciences’. “We have been debating what defines a planet for about 12 months. This new discovery puts some urgency into the matter,” he says.

The discussion was opened by Michael Brown’s previous discovery Sedna, an object twice as far from the Sun as Pluto and in a highly elliptical orbit. Announced early in 2004, Sedna is about three quarters the size of Pluto, making it easy to dismiss the half-hearted claims that Sedna was planet 10.

However: “As soon as Sedna was discovered, we realised that it was likely to become important to have a definition of a planet so that we could deal with new discoveries,” says Williams.

That time is now.

At present, 2003 UB313 has a minor planet designation, placing it in the same league as the other icy asteroids in the outer Solar System, and will remain this way until the IAU arrives at a firm decision as to what constitutes a planet.

“My personal view is that defining a planet is a problem not just of science but of historical, cultural, social and to some extent semantic context,” says Williams. He goes on to say that if we were to start with a blank sheet of paper today, there would be no way astronomers would classify the gas giants as the same kind of object as Earth.

“It all stems from an earlier time when people saw bright points moving through the sky and assumed that each was the same as the other. Now, we know that is not true,” he says.

The earliest Williams believes that the IAU is likely to make a decision concerning 2003 UB313 is early September, when most members, of the IAU’s fifteen-person committee charged with defining a planet, meet in Cambridge, UK for the American Astronomical Society’s Division of Planetary Science meeting.

UPDATE: At a subsequent meeting of the IAU, they voted to disallow UB313 as planet 10. The decision forced the demotion of Pluto from full planetary status, also.

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#### Planet 10 at a glance

Name: 2003 UB313

Orbital Period: 560 years

Orbit: 36–97 AU (highly elliptical)

Diameter: approximately 3000 km

Inclination: 44 degrees

Discoverers: Michael Brown, Caltech

David Rabinowitz, Yale University

Chadwick A Trujillo,

Gemini Observatory, Hawaii.

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