

Researchers unveil Jupiter's smallest known moon

June 6 2012

(Phys.org) -- At a measly 2 kilometres in diameter, the smallest of two moons recently discovered orbiting Jupiter may be the giant planet's smallest known satellite.

In September of 2010, two previously unknown distant satellites of [Jupiter](#) were discovered during routine tracking observations of already known moons. These discoveries were then re-observed several times during the fall, in order to determine that they were indeed satellites of Jupiter, leading to them obtaining MPC designations S/2010 J 1 and S/2010 J 2 on the 1st of June 2011.

With Jupiter now having 67 known satellites, the discovery of two tiny satellites does not have a large bearing on our understanding of the system.

Information on the discoveries, the tracking effort, and new results are provided below. A paper by Alexandersen et al. detailing the discovery and tracking of the two moons has been accepted for publication in the *Astronomical Journal*, for publication in summer 2012.

Discoveries

S/2010 J 1 was discovered on images taken at the Palomar 200 inch Hale Telescope on the 7th and 8th of September 2010, by an international team (NASA Jet Propulsion Laboratory (JPL) astronomers Robert

Jacobson and Marina Brozovic, and University of British Columbia astronomy professor Brett Gladman and Ph.D. student Mike Alexandersen).

S/2010 J 2 was discovered on the 8th of September 2010 on images taken with the MegaCam mosaic CCD camera at the 3.6m Canada-France-Hawaii telescope (CFHT) by CFHT executive director and director Christian Veillet. Upon later inspection, S/2010 J 2 was also weakly visible in the September 7th images from Palomar.

Follow-up observations

Recoveries

Since discovery, the team has dedicated several hours of observing time to tracking these satellites. Observations from October and November 2010 and January 2011 allowed the orbits to be determined well enough to confirm that they were indeed satellites and not just nearby asteroids, allowing IAU designation in June 2011 (discovery announcement from Minor Planet center here). Further follow-up observations in July, August, September and October 2011 (here and here) have fine-tuned the [orbit](#) determination for these satellites sufficiently that their position can reliably be predicted several years into the future.

Precoveries

During 2003 two large project (one by Brett Gladman and UBC post-doctoral fellow Lynne Allen) observed the entire region around Jupiter in a search for moons, also using CFHT. In the 2003 observations, several faint objects were detected that were never classified as satellites because they were not recovered in follow-up observations in different months (needed to confirm that the orbit is indeed around Jupiter).

However, with well determined orbits of S/2010 J 1 and S/2010 J 2, it was possible to extrapolate backwards in time to 2003. Alexandersen searched the 2003 images and confirmed that S/2010 J 1 was indeed visible on several images. "We had actually already reported measurements of the first [moon](#) from Feb. 27 and 28, 2003 to the Minor Planet Center eight years ago", said Gladman, "but observations over several months are required to prove that the object is orbiting Jupiter, and this moon was too faint for the 2003 surveys to consistently track." Measurements of these images has increased the arc of measurements of S/2010 J 1 from one to over eight years, making its orbit very well determined.

Unfortunately, S/2010 J 2 could not be located or seen in any of the 2003 images. However, this is not surprising, as S/2010 J 2 is the faintest Jupiter satellite observed to date, so ideal conditions are required to see it, even with CFHT.

Characteristics and origin

Based on their brightness, the size of the moons can be estimated. S/2010 J 1 is estimated to be ~3 km in diameter, while S/2010 J 2 is estimated to be just ~2 km in diameter. It is believed that nearly all moons the size of S/2010 J 1 or larger are known, but because there are always a lot more small moons than large moons, there must be dozens of satellites in the 1-3 km class; our unplanned chance discovery of two such objects confirms this hypothesis. In addition to this, S/2010 J 2 is the faintest (and thus probably smallest) Jovian satellite discovered to date, confirming that the Jovian [satellite](#) population does continue down to those sizes.

"It was exciting to realise that this [S/2010 J 2] is the smallest moon in the Solar System that was discovered and tracked from Earth," says Alexandersen.

S/2010 J 1 is on an orbit with average distance (semi-major axis) from Jupiter of 23.45 million kilometres and orbital period of 2.02 years. S/2010 J 2 has a semi-major axis of 21.01 million kilometres and an orbital period of 1.69 years.

The irregular satellites of the giant planets are clustered in "families" with similar orbits and colours. These families are believed to have formed as a result of ancient collisions of passing-by comets or asteroids with former larger moons. S/2010 J 1 appears to belong to the Carme group, while S/2010 J 2 appears to belong to the Ananke group.

Provided by Canadian Astronomical Society

Citation: Researchers unveil Jupiter's smallest known moon (2012, June 6) retrieved 29 April 2024 from <https://phys.org/news/2012-06-unveil-jupiter-smallest-moon.html>

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