

Joint Press Release

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New "planet" is larger than Pluto: Bonn astronomers measure size of recently discovered solar system object

Claims that the Solar System has a tenth planet are bolstered by the finding by a group lead by Bonn astrophysicists that this putative planet, announced last summer and tentatively named 2003 UB313, is bigger than Pluto. By measuring its thermal emission, the scientists were able to determine a diameter of about 3000 km, which makes it 700 km larger than Pluto and thereby marks it as the largest solar system object found since the discovery of Neptune in 1846.

Like Pluto, 2003 UB313 is one of the icy bodies in the so-called Kuiper belt that swarms beyond Neptune. It is the most distant object ever seen in the Solar System. Its very elongated orbit takes it up to 97 times farther from the Sun than is the Earth - almost twice as far as the most distant point of Pluto's orbit - so that it takes twice as long as Pluto to go around the Sun. When it was first seen, UB313 appeared to be at least as big as Pluto. But an accurate estimate of its size was not possible without knowing how reflective it is. A team lead by Prof. Frank Bertoldi from the University of Bonn and the Max-Planck-Institute for Radioastronomy (MPIfR) and the MPIfR's Dr. Wilhelm Altenhoff has now resolved this problem by using measurements of the amount of heat UB313 radiates to determine its size, which when combined with the optical observations also allows them to determine its reflectivity. "Since UB313 is decidedly larger than Pluto," Frank Bertoldi remarks, "it is now increasingly hard to justify calling Pluto a planet if UB313 is not also given this status."

UB313 was discovered in January 2005 by Prof. Mike Brown and his colleagues from the Californian Institute of Technology in a sky survey using a wide field digital camera that searches for distant minor planets at visible wavelengths. They discovered a slowly moving, spatially unresolved source, the apparent speed of which allowed them to determine its distance and orbital shape. However, they were not able to determine the size of the object, although from its optical brightness it was believed to be larger than Pluto.

Astronomers have found small planetary object beyond the orbits of Neptune and Pluto since 1992, confirming a then 40-year old prediction by astronomers Kenneth Edgeworth (1880-1972) and Gerard P. Kuiper (1905-1973) for the existence of a belt of smaller planetary objects beyond Neptune. The so-called Kuiper Belt contains objects left from the formation of our planetary system some 4.5 billion years ago. In their distant orbits they were able to survive the gravitational clean-up of similar objects by the large planets in the inner solar system. Some Kuiper Belt objects are still occasionally deflected to then enter the inner solar system and may appear as short period comets.

In optically visible light, the solar system objects are visible through the light they reflect from the Sun. Thereby the apparent brightness depends on their size as well as on the surface reflectivity. Latter is known to vary between 4% for most comets to over 50% for Pluto, which makes any accurate size determination from the optical light alone impossible.

The Bonn group therefore used the IRAM 30-meter telescope in Spain, equipped with the sensitive Max-Planck Millimeter Bolometer (MAMBO) detector developed and built at the MPIfR, to measure the heat radiation of UB313 at a wavelength of 1.2 mm, where reflected sunlight is negligible and the object brightness only depends on the surface temperature and the object size. The temperature can be well estimated from the distance to the sun, and thus the observed 1.2 mm brightness allows a good size measurement. One can further conclude that the UB313 surface is such that it reflects about 60% of the incident solar light, which is very similar to the reflectivity of Pluto.

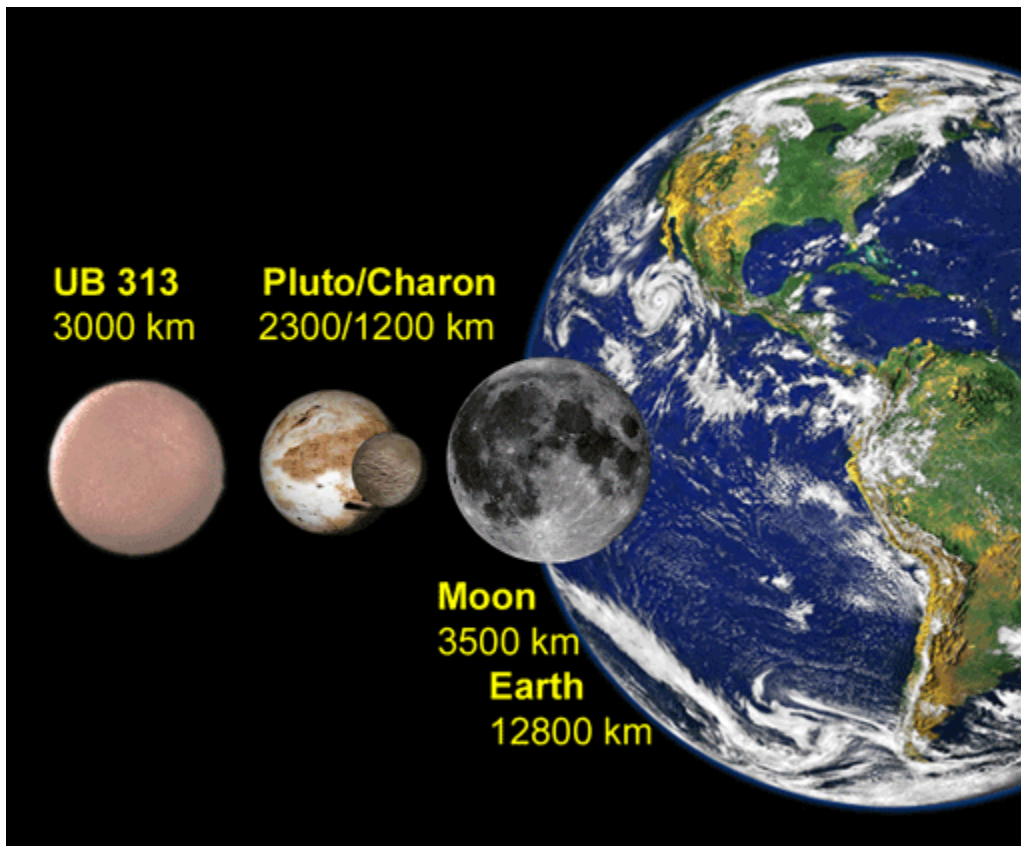


Figure 1: The diameter of 2003 UB313 compared with that of the Pluto, Charon, Earth, and Moon.

"The discovery of a solar system object larger than Pluto is very exciting," Dr. Altenhoff exclaims, who has researched minor planets and comets for decades. "It tells us that Pluto, who should properly also be counted to the Kuiper Belt, is not such an unusual object. Maybe we can find even other small planets out there, which could teach us more about how the solar system formed and evolved. The Kuiper Belt objects are the debris from its formation, an archeological site containing pristine remnants of the solar nebula, from which the sun and the planets formed." Dr. Altenhoff made the pioneering discovery of heat radiation from Pluto in 1988 with a predecessor of the current detector at the IRAM 30-meter telescope.

The size measurement of 2003 UB313 is published in the 2 February 2006 issue of Nature. The research team includes Prof. Dr. Frank Bertoldi (Bonn University and MPIfR), Dr. Wilhelm Altenhoff (MPIfR), Dr. Axel Weiss (MPIfR), Prof. Dr. Karl M. Menten (MPIfR), and Dr. Clemens Thum (IRAM).

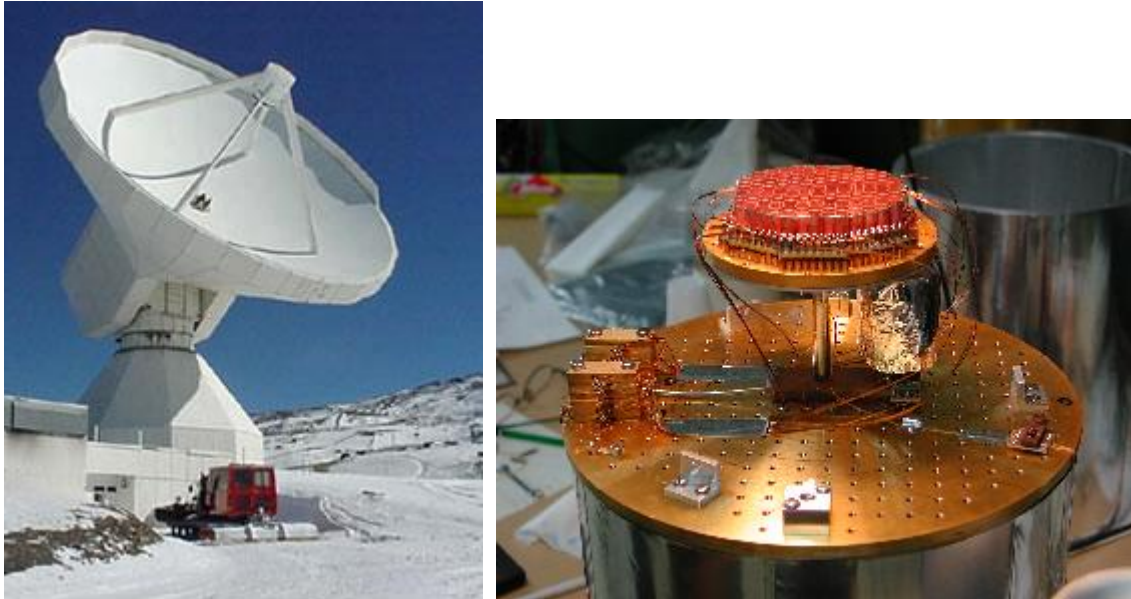


Figure 2: To detect the very faint millimeter wavelength emission from UB313, the Bonn group used the IRAM 30-m telescope on Pico Veleta in the south of Spain, and the very sensitive heat sensor MAMBO-2, which was developed and built at the MPIfR in Bonn by the group of Dr. Ernst Kreysa. The Institute for Radio Astronomy at Millimeter wavelengths (IRAM) is supported jointly by the German Max-Planck-Society, the French Centre National de Recherche Scientifique (CNRS) and the Spanish Instituto Geografico Nacional.

The Kuiper Belt

UB313 is a member of a ring of some 100,000 objects in the outskirts of the solar system, beyond Neptune at distances over 4 billion km from the sun, over 30 times the distance between Earth and Sun. The objects in this "Kuiper belt" circle the sun in stable orbits with periods of about 300 years. In the mid of last century, the existence of a ring of small planetary objects was first suggested by the astronomers Kenneth Edgeworth (1880-1972) and Gerard P. Kuiper (1905-1973), but the first discovery of a "Kuiper belt object" was not until 1992. By now, over 700 such objects are known. UB313 is somewhat different from the normal Kuiper belt in that its orbit is highly eccentric and 45 degrees inclined to the ecliptic plane of the planets and Kuiper Belt. It is likely that it originated in the Kuiper Belt and was deflected to its inclined orbit by Neptune.

For more detailed information on the Kuiper belt, browse the web page by David Jewitt (see link below).

Abstract of the February 2 Nature paper:

The trans-neptunian object UB313 is larger than Pluto

F. Bertoldi, W. Altenhoff, A. Weiss, K.M. Menten, C. Thum

The most distant known object in the Solar System, 2003 UB313 (97 au from the Sun), was recently discovered near its aphelion. Its high eccentricity and inclination to the ecliptic plane, along with its perihelion near the orbit of Neptune, identify it as a member of the 'scattered disk'. This disk of bodies probably originates in the Kuiper belt objects, which orbit near the ecliptic plane in circular orbits between 30 and 50 au, and may include Pluto as a member. The optical brightness of 2003 UB313, if adjusted to Pluto's distance, is greater than that of Pluto, which suggested that it might be larger than Pluto. The actual size, however, could not be determined from the optical measurements because the surface reflectivity (albedo) was unknown. Here we report observations of the thermal emission of 2003 UB313 at a wavelength of 1.2 mm, which in combination with the measured optical brightness leads to a diameter of $3,000 \pm 300 \pm 100$ km; here the first error reflects measurement uncertainties, while the second derives from the unknown object orientation. This makes 2003 UB313 the largest known trans-neptunian object, even larger than Pluto (2,300 km). The albedo is $0.60 \pm 0.10 \pm 0.05$, which is strikingly similar to that of Pluto, suggesting that the methane seen in the optical spectrum causes a highly reflective icy surface.

Further information on the internet:

High-resolution images and additional information provided by the authors:

<http://www.astro.uni-bonn.de/~bertoldi/ub313>

Information on 2003 UB313 by the discoverer Mike Brown:

<http://www.gps.caltech.edu/~mbrown/planetlila/>

Visit this page for a note on the object name, and why it's final name will be neither Xena nor Lila.

David Jewitt's Kuiper Belt Page: <http://www.ifa.hawaii.edu/faculty/jewitt/kb.html>

MPIfR Bonn: <http://www.mpifr-bonn.mpg.de/>

MAMBO detector: <http://www.mpifr-bonn.mpg.de/staff/bertoldi/mambo/>

IRAM 30-meter telescope: <http://www.iram.es/>

Do contact the authors for additional information:

Prof. Dr. Frank Bertoldi

Tel.: +49 – 228-73 6789 or +49 – 176-20114268

e-mail: Bertoldi@astro.uni-bonn.de

Dr. Wilhelm Altenhoff

Tel.: +49 - 228 – 525-293

e-mail: waltenhoff@mpifr-bonn.mpg.de

Prof. Dr. Karl M. Menten

Tel.: +49 - 228 – 525-297

e-mail: kmenten@mpifr-bonn.mpg.de

Dr. Norbert Junkes (MPIfR public outreach)

Tel: +49 - 2257 - 301-105

e-mail: njunkes@mpifr-bonn.mpg.de