

2005 YU55 resembles a collection of rocks hurtling through space

November 18 2011



This image of the minor planet 2005 YU55 at a wavelength of 70 micron was reconstructed from more than 3500 individual exposures with the Herschel space observatory. The shape of the image shows the point spread function of the telescope, the asteroid itself is too small to be resolved with Herschel. Credit: MPI for Extraterrestrial Physics/ESAC

(PhysOrg.com) -- It is the closest, fastest and smallest object so far seen by Herschel. In fact, such observations were not even foreseen due to technical constraints. The asteroid 2005 YU55 is moving on the sky with a speed exceeding by far Herschel's possibilities to track it. But with the help of a little trick scientists at the Max Planck Institute for



Extraterrestrial Physics and at the European Space Astronomy Center in Spain were able to use Herschel to catch a glimpse of this asteroid shortly after it had crossed the Moon's orbit. As it turned out, 2005 YU55 is somewhat smaller than had been assumed and probably might be a loose assembly of boulders, pebbles and dust.

The <u>minor planet</u> (or asteroid) 2005 YU55 was first detected in December 2005, hence its name, and on 9 November 2011 passed the Earth at 00:28 CET in 0.85 lunar distances (324,600 km). The Herschel observations took place one day later from a safe distance of 805,000 km.

As Herschel could not track the object on the sky, the scientists observed an elongated fixed sky field on the asteroid's track at a pre-calculated time in a standard way. 2005 YU55 dashed - exactly as predicted - right through this field. Data reduction was done in a special way, centering the more than 3500 individual images from the two four-minute observing runs on the true object position. The final images show 2005 YU55 perfectly focused and centred in all three frequency channels.





Here the reconstructed temperature distribution of the asteroid is shown, where the model was based on a round object. Size and thermal performance were determined from the PACS observations. © Max Planck Institute für Extraterrestrial Physics

This was only possible because the PACS instrument used for these infrared observations was designed and built at the Max Planck Institute for Extraterrestrial Physics, and the scientists therefore have precise knowledge of the instrument and its capabilities. A careful analysis of the data in each of the three infrared filters (at 70, 100 and 160 microns) resulted in an estimate for several asteroid parameters.

Although 2005 YU55 is the smallest object seen by Herschel so far, it is one of the largest bodies with very close Earth-encounters. Surprisingly, however, the new measurements indicate that is has to be smaller than previously thought. Depending on its orientation the scientists estimate about 310 m for the object's diameter (retrograde) or about 340 m (prograde). In any case the minor planet has to be smaller than the 400 m



diameter derived from Nasa radar observations in 2010.

From the <u>infrared observations</u> the scientists also determined the albedo (6%) - 2005 YU55 is very dark and reflects only 6% of the sunlight. The rest is absorbed and converted to infrared radiation. This indicates a dark, carbonaceous surface consistent with a previous classification as C-type object. About 75% of all minor planets belong to this class.

The thermal properties seem to be very similar to the ones found for Itokawa, a small body visited by the Japanese mission Hayabusa, which turned out to be a rubble pile. Our findings indicate that 2005 YU55 might also be a loose assembly of boulders, pebbles and dust and not a single monolithic rock in space.

The <u>Herschel</u> observations also help to improve the orbit calculations of 2005 YU5. The minor planet does not pose a danger for Earth, at least within the next few decades, for which we can predict its orbit with high accuracy. In 2029 this little asteroid will have a close encounter with Venus (at 340 000 km), afterwards the orbit is not perfectly predictable and it is unlikely that 2005 YU55 will cross the Moon's orbit again in 2041.

In case of 2005 YU55 we can rest assured that we are safe for the next few decades. And, instead of working out deflection concepts, we can concentrate on the more scientific aspects of characterizing this exotic and very interesting minor body.

Provided by Max-Planck-Gesellschaft

Citation: 2005 YU55 resembles a collection of rocks hurtling through space (2011, November 18) retrieved 27 April 2024 from <u>https://phys.org/news/2011-11-yu55-resembles-hurtling-space.html</u>



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