Suspected Asteroid Collision Leaves Odd X-Pattern of Trailing Debris

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This is a NASA Hubble Space Telescope picture of a comet-like object called P/2010 A2, which was first discovered by the LINEAR (Lincoln Near-Earth Asteroid Research program) sky survey on January 6. The object appears so unusual in ground-based telescopic images that discretionary time on Hubble was used to take a close-up look. This picture, from the January 29 observation, shows a bizarre X-pattern of filamentary structures near the point-like nucleus of the object and trailing streamers of dust. The inset picture shows a complex structure that suggests the object is not a comet but instead the product of a head-on collision between two asteroids traveling five times faster than a rifle bullet (5 kilometers per second). Credit: NASA, ESA, and D. Jewitt (UCLA)

(PhysOrg.com) -- NASA's Hubble Space Telescope has imaged a mysterious X-shaped debris pattern and trailing streamers of dust that suggest a head-on collision between two asteroids. Astronomers have long thought that the asteroid belt is being ground down through

collisions, but such a smashup has never before been seen.

The comet-like object imaged by Hubble, called P/2010 A2, was first discovered by the LINEAR (Lincoln Near-Earth Asteroid Research program) sky survey on January 6. New Hubble images taken on January 25 and 29 show a complex X-pattern of filamentary structures near the nucleus.

"This is quite different from the smooth dust envelopes of normal comets," says principal investigator David Jewitt of the University of California at Los Angeles. "The filaments are made of dust and gravel, presumably recently thrown out of the nucleus. Some are swept back by radiation pressure from sunlight to create straight dust streaks. Embedded in the filaments are co-moving blobs of dust that likely originate from tiny unseen parent bodies."

Hubble also shows that the main nucleus of P/2010 A2 lies outside its own halo of dust. This has never before been seen in a comet-like object. The nucleus is estimated to be 460 feet (140 meters) in diameter.

Normal comets fall into the inner regions of the solar system from icy reservoirs in the Kuiper Belt and Oort Cloud. As comets near the Sun and warm, ices near the surface vaporize and eject material from the solid comet nucleus via jets. But P/2010 A2 may have a different origin. It orbits in the warm, inner regions of the asteroid belt where its nearest neighbors are dry rocky bodies lacking volatile materials.

This leaves open the possibility that the complex debris tail is the result of an impact between two bodies rather than ices from a parent body simply turning into vapor. Asteroid collisions are energetic, with an average impact speed over 11,000 miles per hour (5 km/s, or five times faster than a rifle bullet).

"If this interpretation is correct, two small and previously unknown asteroids recently collided, creating a shower of debris that is being swept back into a tail from the collision site by the pressure of sunlight," says Jewitt.

The main nucleus of P/2010 A2 would be the surviving remnant of this so-called hypervelocity collision. "The filamentary appearance of P/2010 A2 is different from anything seen in Hubble images of normal comets, consistent with the action of a different process," says Jewitt. An impact origin would also be consistent with the absence of gas in spectra recorded using ground-based telescopes.

The asteroid belt itself contains abundant evidence for ancient collisions that have shattered precursor bodies into fragments. The orbit of P/2010 A2 is itself consistent with membership in the Flora asteroid family, produced by collisional shattering a few hundred million years ago. (One fragment of that ancient smashup may have struck Earth 65 million years ago, triggering a mass extinction that wiped out the dinosaurs.) But, until now, no such asteroid-asteroid collision has been caught "in the act."

Continued observations with Hubble and an armada of ground-based telescopes may reveal the mechanisms by which natural impacts generate dust to supply the zodiacal cloud, a plane of dust in our solar system.

At the time of the Hubble observations, the object was approximately 180 million miles (300 million km) from the Sun and 90 million miles (140 million km) from Earth. The Hubble images were recorded with the new Wide Field Camera 3 (WFC3).

Provided by JPL/NASA