

The multiple tails of the active asteroid P/2013 P5

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The active asteroid P/2013 P5 is an inner main-belt asteroid with a diameter of < 480 m. It was discovered in August 2013 by the Pan-STARRS sky survey, following a brightening episode that produced a comet-like appearance.

We obtained high-resolution images of P5 with the Hubble Space Telescope that revealed an intricate system of six dust tails emerging from the nucleus (see figure). We have modeled the dynamics of the ejected dust under the influence of solar gravity and radiation pressure, and found that each tail contained dust ejected at a specific date in the spring or summer of 2013. The activity of P5 continued over many months and took place in bursts of short duration, with no apparent pattern of periodicity.

In view of the episodic nature of the activity, we exclude an impact or collision as its cause. Also, sublimation of subsurface ices is unlikely in this object, because temperatures in the inner part of the main asteroid belt are too high for asteroids to harbour ices over the age of the solar system. We therefore think that the most likely cause of activity is rotation-driven break-up, where YORP or other torques have increased the spin rate of the asteroid to the point where surface material breaks loose and escapes the gravity field of the nucleus.

We present the details of our modeling, and discuss the implications of our results for the cause of activity.

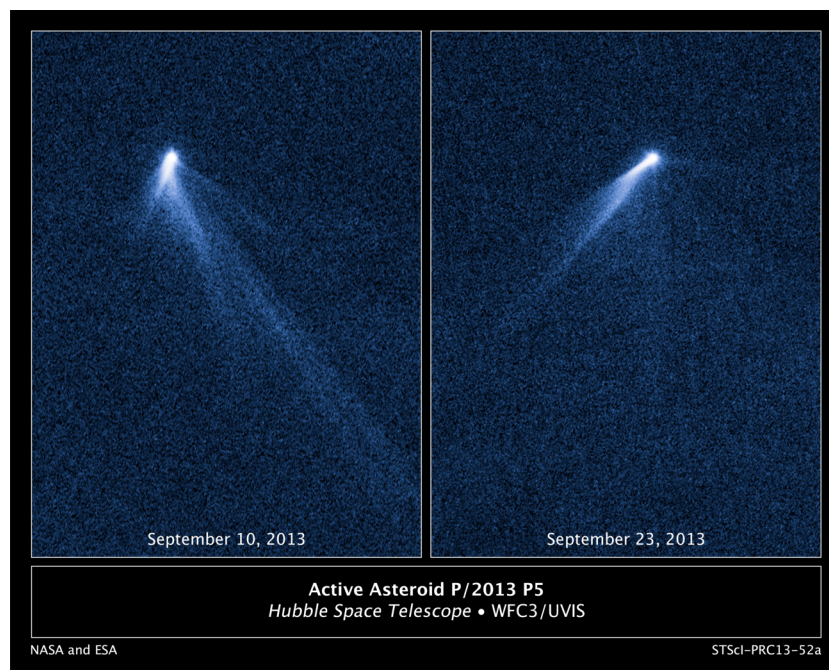


Figure: The tail system of the active asteroid P/2013 P5 on September 10 and 23, 2013 in the Hubble Space Telescope images.

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References: Jewitt, D., et al. (2013), ApJL 778, L21, "The extraordinary multi-tailed Main-Belt Comet P/2013 P5".