

Hubble Space Telescope Investigation of Active Asteroid P/2018 P3 (PANSTARRS)

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Abstract

Active asteroids are objects that orbit in the main asteroid belt but show transient dust emission. Newly discovered active asteroid P/2018 P3 (PANSTARRS) has a semimajor axis 3.006 au, eccentricity 0.415, inclination 8.9° , placing it within the dynamical boundary region between asteroids and comets (the Tisserand parameter 3.096) [1]. This object has been recurrently active near two successive perihelia (at 1.75 au), indicative of the sublimation of volatile ices. We obtained Hubble Space Telescope (HST) observations of P/2018 P3 from 2018 September to 2018 December, in order to study the spatial distribution of the ejected dust at superb spatial resolutions (20–40 km). Numerical modeling of P/2018 P3’s dust emission showed that the properties of the ejected dust are remarkably consistent with those found in other sublimating active asteroids (e.g., the continuous emission of $>10 \mu\text{m}$ particles at $0.2\text{--}3 \text{ m s}^{-1}$ speeds) [2,3]. Unlike low-eccentricity active asteroids which are assumed to be native to the main belt, our dynamical analysis suggests that P/2018 P3 appears unstable on timescales $>10 \text{ Myr}$ and is likely to be a recently implanted interloper. We also find that several synthetic Jupiter-family comets in the literature [4] briefly take on P/2018 P3-like orbital elements during their evolution. As such, we speculate that P/2018 P3 is a captured Jupiter-family comet that has been residing in the main belt for $>10 \text{ Myr}$, finally becoming indistinguishable from weakly sublimating active asteroids in terms of the dust properties.

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References

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