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Observations of object “Peggy” during the final stages of the Cassini mission

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An unusual object at the outer edge of Saturn’s A ring was discovered by Cassini’s Imaging Science Subsystem (ISS) cameras in April 2013. The gravitational effect of the object (nicknamed “Peggy”) on nearby ring material produced a highly localised, radial discontinuity (typically of ∼10 km) in the azimuthal profile of the A ring edge, and the longitude of this feature was monitored continually until the end of mission in September 2017. The observations showed that the object underwent an apparent stochastic evolution of +/- 5 km in semi-major axis, possibly due to the gravitational effect of other objects in the region. The most recent observations show a net decrease in semi-major axis with respect to the discovery value. Although most detections with the ISS instrument between 2013 and 2016 were typically at a resolution of ∼10 km/pixel, the final stages of the Cassini mission afforded numerous opportunities to observe the “Peggy” region at resolutions of better than ∼3 km/pixel. Furthermore, several sets of observations designed to track the region over one orbital period showed how the morphology changed with inertial longitude. Numerical simulations of the effect of a single embedded object on surrounding ring material have also been carried out and confirmed that the size of the discontinuity is proportional to the assumed radius of “Peggy” for a fixed density. Therefore, the lower semi-major axis detected in 2017 is consistent with a less pronounced discontinuity. Analysis of high-resolution ISS images has revealed that the object is at the centre of an extended region of non-uniform, azimuthal structure covering +/- 5 degrees in longitude; the region is reminiscent of a debris field, and the structure tracks at the local Keplerian rate. One possibility is that this is the aftermath of a collision perhaps immediately prior to the discovery of “Peggy,” when the large amounts of dust would have facilitated the original detection. Another possibility is that “Peggy” formed out of material in this region, perhaps due to the bunching of streamlines associated with the nearby 7:6 Inner Lindblad Resonance with Janus. The talk will review our current knowledge about this intriguing object and highlight the remaining puzzles.