Grain Orbits in the Pluto-Charon System: Modeling Non-Gravitational Forces

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Porter & Grundy (2014), a paper submitted to arXiv earlier this year but has yet to pass peer review for *Icarus*, attempts to model grain orbits in the Pluto-Charon system, both for interplanetary dust particles (IDPs) and those that ejected from the surfaces of both Nix and Hydra through collisions. This was done using an n-body code in an inertial reference frame centered on the Sun, examining one grain at a time and following it until the grain impacted the surface of a member of the system, escaped, or orbited for 10^6 days. The gravity from the Sun and Pluto, was included, which was perturbed by both solar radiation and Pluto's atmospheric drag, where the planetary atmosphere was approximated as isothermal. Using these results, the authors then go on to make estimations of the effect that these grains have on the surface of Pluto, including a mock albedo map, which they then compare to the previous work of Buie et al. (2014). This is of potential interest to the New Horizons mission, which will be passing Pluto in 2015.

Although this is an intriguing article, D. Hamilton has claimed that the authors made a few critical errors in modeling the forces acting on these dust grains. I will explain the assumptions they have made in modeling the different forces involved in this problem (e.g. the solar radiation pressure) and determine if and where Porter & Grundy (2014) went wrong. I will also show how one would better approximate these forces, and give the resulting affect on the dust grain orbits. If time permits, I will also use my own force models in a suite of n-body simulations to compare how improved analytical models can affect predictions.