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THE LIFETIME OF DUST PARTICLES IN THE PLUTO SYSTEM

Abstract

It has been made much effort in order to find out dust in the Pluto–Charon binary system. Pluto and its largest satellite Charon form a binary system, which implies that the Pluto–Charon centre of mass is outside Pluto. While the New Horizons spacecraft was travelling to approach Pluto, four small satellites were discovered in orbit around the baricentre of the system: Styx, Nix, Kerberos and Hydra. All of these small moons lie outside Charon's orbit (the innermost moon). In 2015, the New Horizons spacecraft, the first mission to explore Pluto, made its closest approach to the system. The main goal of this work is to locate stable regions where dust particles can be located despite of the perturbative effects of the five satellites. The orbital evolution of these small particles (1, 5, and 10 μm in size) is analysed by adding the effects of the solar radiation force. This force enhances the perturbation of the satellites leading them to collisions or ejection of the system. About 52000 particles of each size were numerically integrated for 10^5 orbital periods of Charon in different inclinations, 0, 30° , 60° , 90° , 120° , 150° , and 180° related to the orbital plane of the satellites. The lifetime of the smallest dust grain is less than 10yr for all the adopted values of inclinations, except for $I = 180°$ where the particles can last up to 180 yr. It takes about 1800yr for 90 per cent of the initial set of 1, 5, and 10-μm-sized particles leave the system. These clusters of dust particles encompass the orbits of the four small satellites. Given this short lifetime, if these dust particles are present in the Pluto system, they have to be generated by collisions of interplanetary debris onto the surface of the small satellites.