Dynamics of interplanetary dust and comets

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The orbital evolution of 30,000 Jupiter-family comets (JFCs) and 12,000 dust particles was integrated [1-3]. For asteroidal and cometary particles, the values of the ratio β between the radiation pressure force and the gravitational force varied from $<$0.0004 to 0.4 (for silicates, such values correspond to particle diameters between $>$1000 and 1 microns). The probability P_E of a collision of an asteroidal or cometary dust particle with the Earth during a lifetime of the particle was maximum at diameter d $\sim$100 microns. For particles started from asteroids and comet 10P, this maximum probability was $\sim$0.01. For Comet 10P itself, P_E $\approx$1.4*10^{-4}, but 80% of this mean probability was due only to 1 object among 2600 considered objects with orbits close to that of Comet 10P. For runs for Comet 2P, P_E $\approx$(1-5)*10^{-4} and P_E was not smaller than that for dust particles started from this comet. For other considered JFCs, $10^{-6} < P_E < 10^{-5}$. P_E $\sim$10^{-6} for particles started at perihelion from long-period comets with e=0.995 and q=0.9 AU at β $\leq$0.002. Lifetimes of such particles can exceed several Myr; greater particles were quickly ejected from the solar system. Different studies of migration of dust particles and small bodies testify that the fraction of cometary dust particles of the overall dust population inside Saturn's orbit is considerable and can be dominant: (1) Some (less than 0.1%) JFCs can reach typical near-Earth object (NEO) orbits and remain there for millions of years. Most former JFCs that have typical NEO orbits moved in such orbits for 10^6-10^9 yr, so during most of this time they were extinct comets. Such former comets could produce a lot of mini-comets and dust. (2) Cometary dust particles produced both inside and outside Jupiter's orbit are needed to explain the observed constant spatial density of dust particles at 3-18 AU. The spatial density of migrating trans-Neptunian particles near Jupiter's orbit is smaller by a factor of several than that beyond Saturn's orbit. Only a small fraction of asteroidal particles can get outside Jupiter's orbit. (3) Comparison of the velocities of zodiacal dust particles obtained in our runs [3-4] with the velocities obtained at observations [5] shows that only asteroidal dust particles cannot explain these observations, and particles produced by high-eccentricity comets (such as Comet 2P/Encke) are needed for such explanation. [1] Ipatov S.I. and Mather J.C. (2004) *Annals of the New York Acad. of Sciences*, 1017, 46-65. [2] Ipatov S.I., Mather J.C., and Taylor P. (2004) *Annals of the New York Acad. of Sciences*, 1017, 66-80. [3] Ipatov S.I. and Mather J.C. (2006) *Advances in Space Research*, in press. [4] Ipatov S.I. et al. (2006) 37th *LPSC*, #1471. [5] Reynolds R.J. et al. (2004) *Ap.J.*, v. 612, 1206-1213.