ORBITAL PERTURBATIONS OF CHARGED DUST AND SPACE DEBRIS DUE TO SPACE WEATHER EFFECTS.

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The construction of realistic particle distribution models in space is naturally of scientific interest, but also important to constrain the long-term evolution of natural and artificial space debris, and to predict impact rates of particles on spacecraft in orbit [I]. Since the distribution of particles is a direct consequence of individual particle orbits, we need good and accurate dynamical models that describe several effects, not included in the pure gravitational problem, i.e. variations in orbit due to solar radiation and interplanetary electromagnetic fields. It has been clearly demonstrated in [II]-[IV] that latitudinal perturbations of orbits of dust and space debris is strongly coupled to solar activity, i.e. space weathering effects in the solar system. For this reason, distribution models are only as good as models for space weathering effects. In a recent work we propose a mechanism causing strong latitudinal oscillations of the orbital planes of charged particles that are triggered by the heliospheric magnetic field. We have found that Lorentz force perturbations strongly affect the three-dimensional distribution of sub millimetre sized particles in space. As a consequence, we have large excursions of the orbital inclinations of debris, hence distributing the particles to high ecliptic latitudes. It is the purpose of the talk to review these recent findings and also to discuss the potential consequences of space weathering effects on the long-term evolution and distribution of space debris in the near Earth environment.

References:

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