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Statistical analysis of micrometeoroids flux at the heliocentric distance of Mercury

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This work shows preliminary results of a study of the orbital evolution of dust particles originating from the Main Belt in order to obtain a statistical analysis, then to provide an estimate of the flux of particles hitting the Mercury's surface.

Meteoritic flux on Mercury really depends on the particle size, because meteoroids of different size follow different dynamical evolution. In this work we consider meteoritic sizes smaller than 1 cm that are particles with a dynamical evolution dominated by the Poynting-Robertson effect.

The meteoroid impact mechanism seems to be an important source of neutral atoms contributing to the exosphere and, according to recent papers, mostly due to particles smaller than 1 cm. Unfortunately the dynamical studies and statistics of meteoroids smaller than 1 cm are based on quite old papers and always extrapolated from calculations made for the Earth.

This is the reason why we are working on a dynamical model following small dust particles that may hit the surface of Mercury. Up to now we have taken into account only particles coming from the Main Belt.

The main effects that determine the distribution of dust in the Solar System are the gravitational attractions of the Sun and planets, Poynting-Robertson drag, solar radiation pressure, solar wind pressure and the effects of different magnetic fields.

In order to determine the meteoritic flux at the heliocentric distance of Mercury we utilize the dynamical evolution model of dust particles of Marzari and Vanzani (1994) that numerically solves a (N+1)+M body problem (Sun + N planets + M body with zero mass) with the high-precision integrator RA15 (Everhart 1985). The solar radiation pressure and Poynting-Robertson drag, together with the gravitational interactions of the planets, are taken as major perturbing forces affecting the orbital evolution of the dust particles. We have performed numerical simulations with different initial conditions for the dust particles, depending on the sources, with the aim of estimating to flux of dust on the surface of Mercury.

In this work we will report the first interesting estimate of the flux of small particles, and their velocity distribution, hitting the surface of Mercury.

We intend also to evaluate a possible asymmetry between the leading and trailing surface of Mercury in terms of impact frequency.