Collisional implementation for an interplanetary dust model

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The Enhanced Interplanetary Meteoroid Population Model is an ESA funded project to develop a model of the interplanetary background dust for spacecraft impact hazard studies. This is envisaged as an improvement of the current ESA Interplanetary Meteoroid Environment Model (IMEM) [1]. This existing model is is constrained by various in-situ and infrared observations, but several simplifications in the implementation, including a step function for the long term behaviour of particles of different masses, mean that it is unable to provide a full interpretation of the background cloud [2].

The new model will include dynamical evolution over several 100 000 years of cometary and asteroidal dust populations of particles with sizes 10 μm – 1 cm in the inner solar system, including a collisional model as well as standard gravitational and radiation forces. Here we describe initial activities for the project, including description of initial populations, and the expected next steps for the model.

In particular, we describe the development of a collisional destruction model, based on the work of Grün et. al (1985) [3], in order to provide collisional lifetimes encompass the dynamical history of different types of particles. We use existing background model given by IMEM to provide the impactor population, and trace how the collisional lifetime varies each orbit, as the particles undergo orbital variations due to perturbations and Poynting-Robertson drag.

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References

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