The Interplanetary Meteoroid Environment for eXploration

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The Interplanetary Meteoroid Environment for eXploration (IMEX) project, funded by the European Space Agency (ESA), aims to characterize dust trails and streams produced by comets in the inner solar system. The goal is to predict meteor showers at any position or time in the solar system, such as at specific spacecraft or planets. This model will allow for the assessment of the dust impact hazard to spacecraft, which is important because hypervelocity impacts of micrometeoroids can damage or destroy spacecraft or their subsystems through physical damage or electromagnetic effects. Such considerations are particularly important in the context of human exploration of the solar system. Additionally, such a model will allow for scientific study of specific trails and their connections to observed dust phenomena, such as cometary trails and new meteor showers at Earth.

We have recently expanded the model to include explicit integrations of large numbers of particles from each comet, utilizing the Constellation platform to perform the calculations. This is a distributed computing system, where currently 10,000 users are donating their idle computing time at home and thus generating a virtual supercomputer of 40,000 host PCs connected via the Internet (aerospaceresearch.net). This form of citizen science provides the required computing performance for simulating millions of particles ejected by each of the ∼400 comets, while developing the relationship between scientists and the general public.

The result will be a unique set of saved orbital information for a large number of cometary streams, allowing efficient computation of their locations at any point in space and time. Here we will present the results from several test streams and discuss the progress towards obtaining the full set of integrated particles for each of the selected ∼400 short-period comets.

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