



Ulysses spacecraft data revisited: Detection of cometary meteoroid streams by following in situ dust impacts

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Cometary meteoroid streams (also referred to as trails) exist along the orbits of comets, forming fine structures of the interplanetary dust cloud. The streams consist predominantly of the largest cometary particles (with sizes of approximately (100 micrometer to 1 cm) which are ejected at low speeds and remain very close to the comet orbit for several revolutions around the Sun.

The Interplanetary Meteoroid Environment for eXploration (IMEX) dust streams in space model (Soja et al., *Astronomy & Astrophysics*, 2015) is a universal model that simulates recently created cometary dust streams in the inner solar system, developed under ESA contract. IMEX is a physical model for dust dynamics and follows the orbital evolution of the streams of 420 comets. Particles are emitted when the comet is in the inner solar system, taking into account comet apparitions between the years 1700 and 2080. The dust ejection is described by an emission model, dust production rate and mass distribution covering the mass range from 10^{-8} kg to 10^{-2} kg (approximately corresponding to 100 micrometer to 1 cm particles). The dust production is calculated from the comet's absolute magnitude, the observed water production rate and dust-to-gas ratio. For each emitted particle, the trajectory is integrated individually including solar gravity, planetary perturbations as well as solar radiation pressure and Poynting-Robertson drag. The model calculates dust number density, flux and velocity.

We apply the IMEX model to study comet stream traverses by the Ulysses spacecraft. Ulysses was launched in 1990 and, after a Jupiter swing-by in 1992, became the first interplanetary spacecraft orbiting the Sun on a highly inclined trajectory with an inclination of 80 degrees. The spacecraft was equipped with an impact ionization dust detector which provided the longest data set of continuous in situ dust measurements in interplanetary space existing to date, covering 17 years from 1990 to 2007. In addition to the interplanetary dust complex, several dust populations were investigated with the Ulysses dust instrument in the past: interstellar dust sweeping through our solar system, streams of approximately 10 nanometer-sized dust particles emanating from Jupiter's volcanically active moon Io, as well as sub-micrometer-sized particles driven away from the Sun by solar radiation pressure (so-called beta particles). Here we study the detection conditions for cometary meteoroid streams with the dust detector on board the Ulysses spacecraft and present first results from our attempt to identify cometary stream particles in the measured dust data set.

Acknowledgements: The IMEX Dust Streams in Space model was developed under ESA funding

(contract 4000106316/12/NL/AF - IMEX).