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Retrograde particles in Galileo Dust Detector Data

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Knowledge of the infalling exogenic flux onto the Jovian and Saturnian systems is valuable as it may contaminate the environment and satellite surfaces and rings and contribute to the impact hazard for spacecraft. Colwell et. al. (1998) and Mitchell et. al. (2005) show numerically that Jupiter's and Saturn's magnetospheres can capture interplanetary and interstellar particles into circumplanetary orbits.

A population of large (micron-sized), bound retrograde particles detected in Galileo Dust Detector data in the Jovian satellite region has been cited as evidence of such a capture mechanism (Thiessenhusen et. al. 2000). We are conducting a re-analysis of these observed impacts now that the complete Galileo dataset is available, to evaluate the confidence with which retrograde particles have been detected. Due to the larger uncertainties in the impact velocity magnitudes and directions for observed particles, the orbits of detected grains cannot be well constrained. Instead, we must determine the range of detectable orbits from the spacecraft location and detector pointing, and use the velocity and sensitive area of the spacecraft to determine the likelihood of each orbit.

Furthermore, if positive detection of retrograde particles is confirmed, we plan to investigate whether such particles must exclusively have an origin outside of the Jovian system, and whether magnetospheric capture is the sole mechanism responsible.

References:
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