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Stream particles observation during the Cassini-Huygens flyby of Jupiter

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Abstract

On December 30, 2000, the Cassini-Huygens spacecraft flew by Jupiter at a distance of 137 R_J (Jupiter radius, 71 400 km). Six months before the closest approach, when the spacecraft was about 1 AU (astronomical unit) away from Jupiter, the Cassini dust detector started to register impacts of fast ($\sim$ 100 km/s) and tiny ($\sim$ 10 nm) grains, so-called stream particles. Jovian stream particles originate from Io's volcanic plumes. Due to the small scale of the nanometer size, they are more sensitive to the electromagnetic force than to gravity. The charged nanoparticles aquire energy from the co–rotational electric field and are able to escape the Jovian magnetosphere with velocity greater than 100km/s. Different from the dust detection of the Galileo and Ulysses spacecrafts in the interplanetary space, the Cassini instrument observed not only a few dust bursts but also a continuous flux coming from the Cassini-Jupiter line-of-sight. Based on the CDA data and the structure of the interplanetary magnetic field, we provide quantitative constrains on the physical properties of Jovian stream particles and explain the differences between the stream particle observations by the Ulysses, Galileo, and Cassini instruments.