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The mass flux of micrometeoroids into the Saturn

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The origin of Saturn's ring is still not known. There is an ongoing argument whether Saturn's ring are rather young or have been formed shortly after Saturn together with its satellites. The water-ice rings contain about 5% rocky material resulting from continuous meteoroid bombardment of the ring material with interplanetary micrometeoroids. Knowledge of the incoming mass flux would allow to estimate the ring's exposure time. Model calculations suggest exposure times of 10^8 years implying a late ring formation. This scenario is problematic because the tidal disruption of a Mimas-sized moon or of a comet within the planet's Roche zone would lead to a much larger rock content as observed today.

Here we report on the first direct measurements of the meteoroid flux into the Saturnian system by Cassini's Cosmic Dust Analyzer (CDA). We measured the impact speed vectors of about 100 extrinsic micrometeoroids $\geq 2\mu$m and determined their orbital elements. On the basis of these measurements we determined the mass flux into the Saturnian system. Our findings suggest a ring exposure time of 4.5 billion years and is in support of an early ring generation from a proto-Titan during the formation of the Saturnian system.