

How much dust does Enceladus eject?

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There is an ongoing argument how much dust per second the ice volcanoes on Saturn's ice moon eject. By adjusting their plume model to the dust flux measured by the Cassini dust detector during the close Enceladus flyby in 2005, Schmidt et al. (2008) obtained a total dust production rate in the plumes of about 5 kg/s . On the other hand, Ingersoll and Ewald (2005) derived a dust production rate of 51 kg/s from the total plume brightness. Knowledge of the production rate is essential for estimating the dust to gas mass ratio, which in turn is an important constraint for finding the plume source mechanism.

Here we report on measurements of the plume dust density during the last close Cassini flyby at Enceladus in October 2015. The data match our numerical model for the Enceladus plume. The model is based on a large number of dynamical simulations including gravity and Lorentz force to investigate the earliest phase of the ring particle life span. The evolution of the electrostatic charge carried by the initially uncharged grains is treated self-consistently. Our numerical simulations reproduce all Enceladus data sets obtained by Cassini's Cosmic Dust Analyzer (CDA). Our model calculations together with the new density data constrain the Enceladus dust source rate to $< 5 \text{ kg/s}$. Based on our simulation results we are able to draw conclusions about the emission of plume particles along the fractures in the south polar terrain.