On Numerically Reproducing the Enceladus Plume

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The Enceladus plume was one of the most exciting discoveries of the NASA Cassini mission. However, a number of fundamental features of the plume have yet to be agreed upon. Schmidt et al. (2008) estimated a mass production rate on the order of 5 kg/s based on data from the Cassini dust detector, while Ingersoll and Ewald (2005) estimated a production rate of 51 kg/s based on plume brightness. Porco et al. (2014) produced a set of jet locations and source strength based on imaging; however, simulations of these sources do not reproduce surface deposition patterns of plume particles across Enceladus. We simulate jet sources across the south polar terrain, particularly along the fractures, accounting for gravitational forces and the Lorentz force, to construct a detailed numerical profile of the Enceladus plume. Recent simulations have led to updated surface deposition maps, which are able to constrain jet source locations and strength, and the recent E21 flyby provides detailed, low-altitude data from the dust detector on spacecraft impact rates. Altogether, dust-detector data, surface heat maps of plume fractures, UV surface deposition maps, and photometry are used in conjunction to better resolve both the mass production rate - and thereby dust-to-gas ratio - and source strength and location for the Enceladus plume.