SATURN'S DIFFUSE E RING AND ITS CONNECTION WITH ENCELADUS. S. Kempf[1], T. Hill[2], N. Krupp[3], M. Horanyi[1], J. Schmidt[4], T. Smith[5], and R. Srama[6], [1]Physics Dep. & LASP, Univ. of Colorado Boulder, USA, [2]Physics & Astronomy Dep., Rice University, USA, [3]MPI for Solar System Research, Göttingen, Germany, [4]Astronomy & Space Physics, Univ. of Oulu, Oulu, Finland [5]APL, Johns Hopkins Univ., USA, [6]IRS, Univ. Stuttgart, Germany.

Introduction: Saturn's E ring is the second largest planetary ring in the solar system, encompassing the icy satellites of Mimas (r_M = 3.07R$_S$), Enceladus (r_E = 3.95R$_S$), Tethys (r_T = 4.88R$_S$), Dione (r_D = 6.25R$_S$), Rhea (r_R = 8.73R^S), and Titan (r_R = 20.25R$_S$). Enceladus was proposed early on as the dominant source of ring particles [1], since the edge-on brightness profile peaks near the moon's mean orbital distance. We now know that the cryo-volcanoes at the moon's south-polar terrain are the main sources for the E ring particles [2]. Many features such as the ring's blue color and the local ring structure can be explained by the dynamics of the plume particle ejection [3][4].

Before the discovery of the Enceladus plumes in 2005, the mechanism for replenishing the E ring with ring particles was attributed to the ejecta particles produced by collisions of interplanetary particles [5] or by impact of the ring particles [6] with the moon's surface. In principle all ring moons contribute via the so-called impactor ejecta mechanism to the ring particle population, the extent of which is a focus of ongoing research [7][8]. However, there is now consensus that the primary source of ring particles are ice particles ejected by the Enceladus plume into an orbit around Saturn [8]. The fact that the particles emerge from localized sources at the Enceladus southpole terrain [9] has interesting consequences for the ring's fine structure. Spikes in the ring's vertical density profile observed by Cassini CDA as well as the long sinuous brightness structures dubbed tendrils observed by Cassini ISS can be associated with the strongest dust jets on Enceladus [4][3].

A surprising finding by the Cassini was that the E ring extends out to Titan's orbit [10]. Numerical simulations of ring particle evolution show that particles < 500 nm released at Enceladus can migrate far beyond Rhea's orbit [7]. However, measurements by Cassini CDA indicate the presence of larger particles at the outer parts of the E ring, which suggests that those particles cannot originate from Enceladus [7].

The ring particle composition is water ice with traces of sodium salts [11] and nano-silica inclusions, which act as nucleation seeds for the plume particles formed in the water vapor ascending through the fractures within the Enceladus surface [12]. After the ice mantels get removed by plasma sputtering, the silica inclusions form hypervelocity dust streams that are observed by Cassini CDA [13].

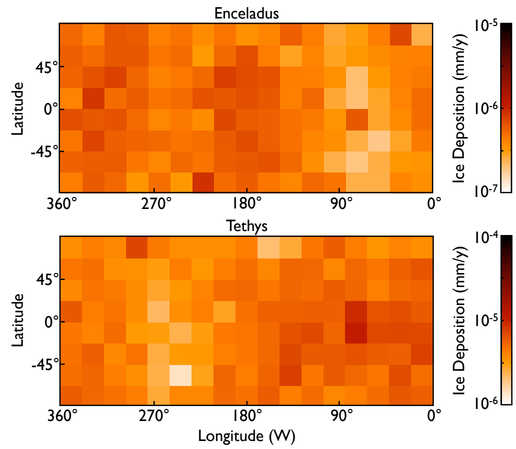

Fig. 1 Mass deposition rate of E ring particles on Enceladus (top) and Tethys (bottom) [14]. Saturn is at 0° longitude (W) and the moons' orbital motion is at 90° longitude (W).

A fraction of ring particles are deposited on the surfaces of the moons embedded in the ring. Numerical simulations of the ring particle dynamics allow us to estimate where, and to what extent, E ring material is deposited (Fig. 1) [14].

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