The Case for an Enceladus Mission

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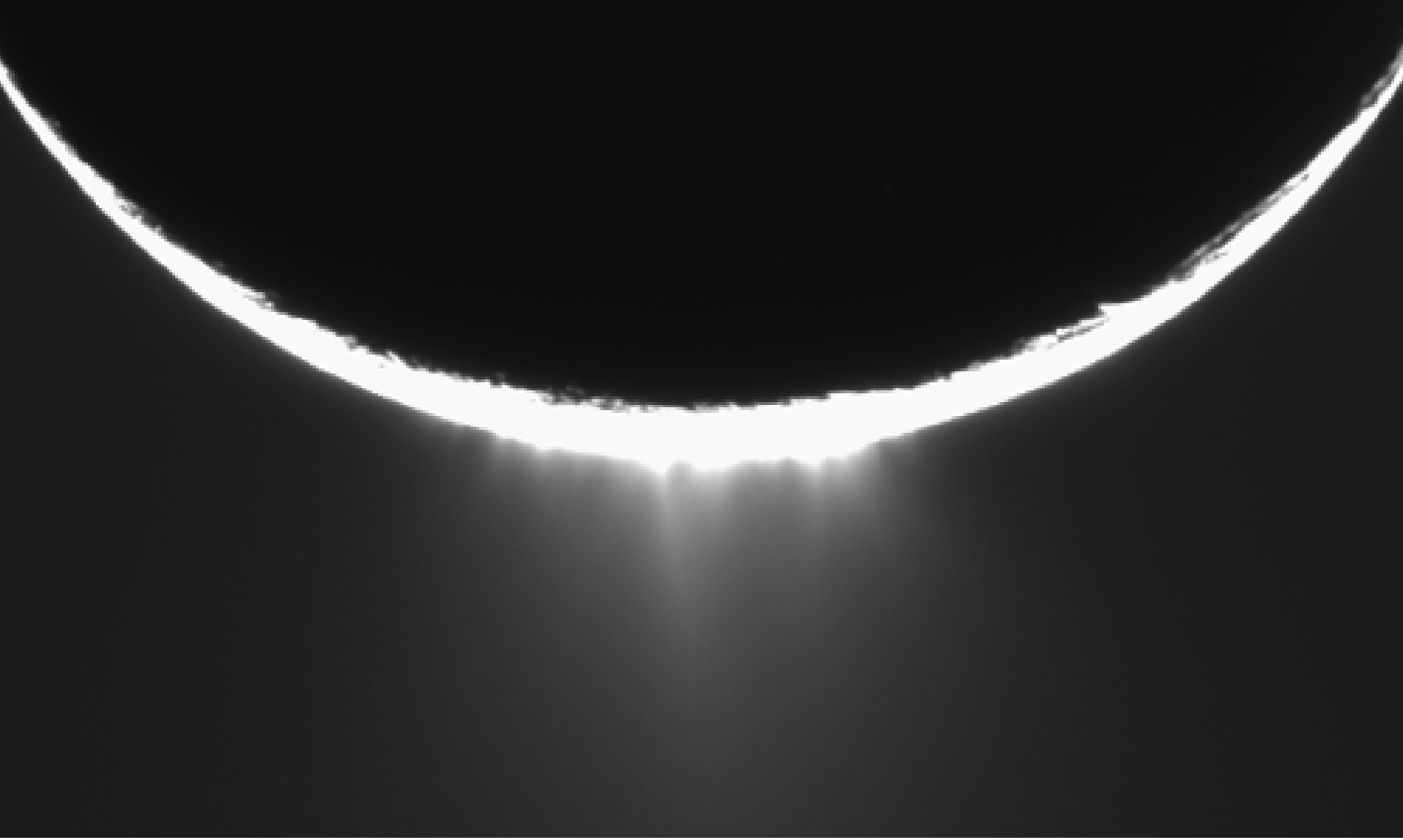
OPAG Meeting in Pasadena

May 5, 2006



C. C. Porco et al., Science 311, 1303 - 1401 (2006)

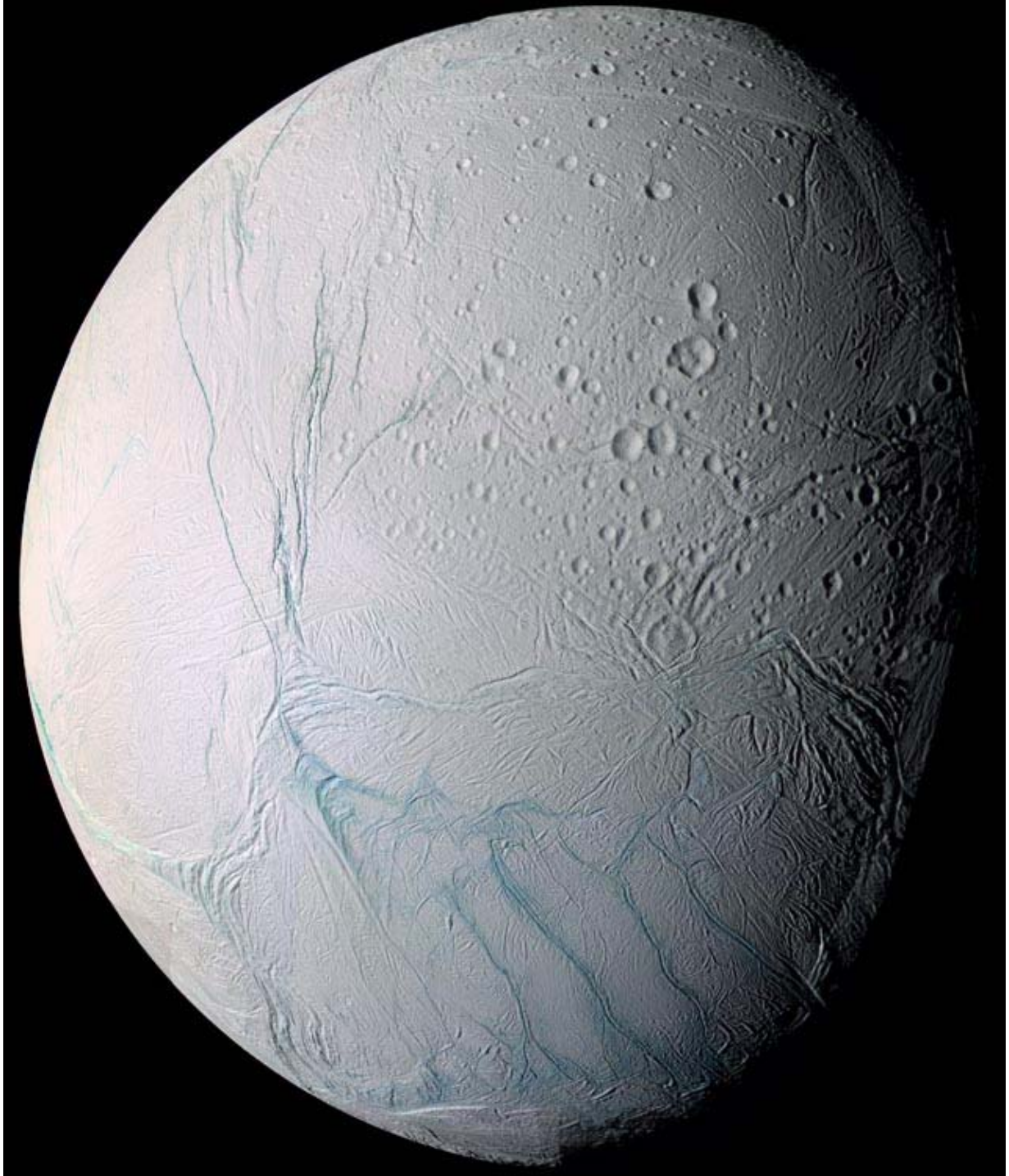
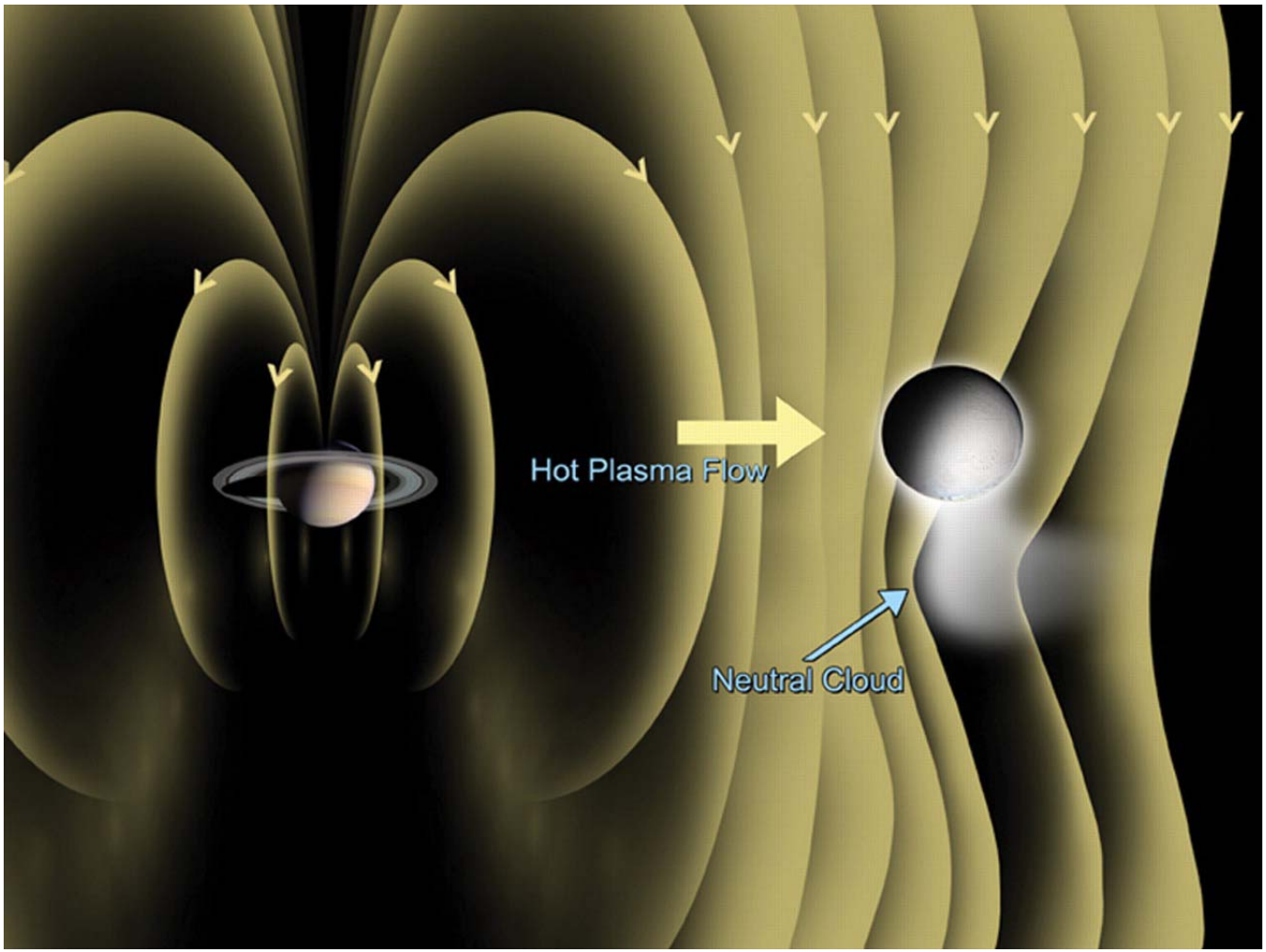
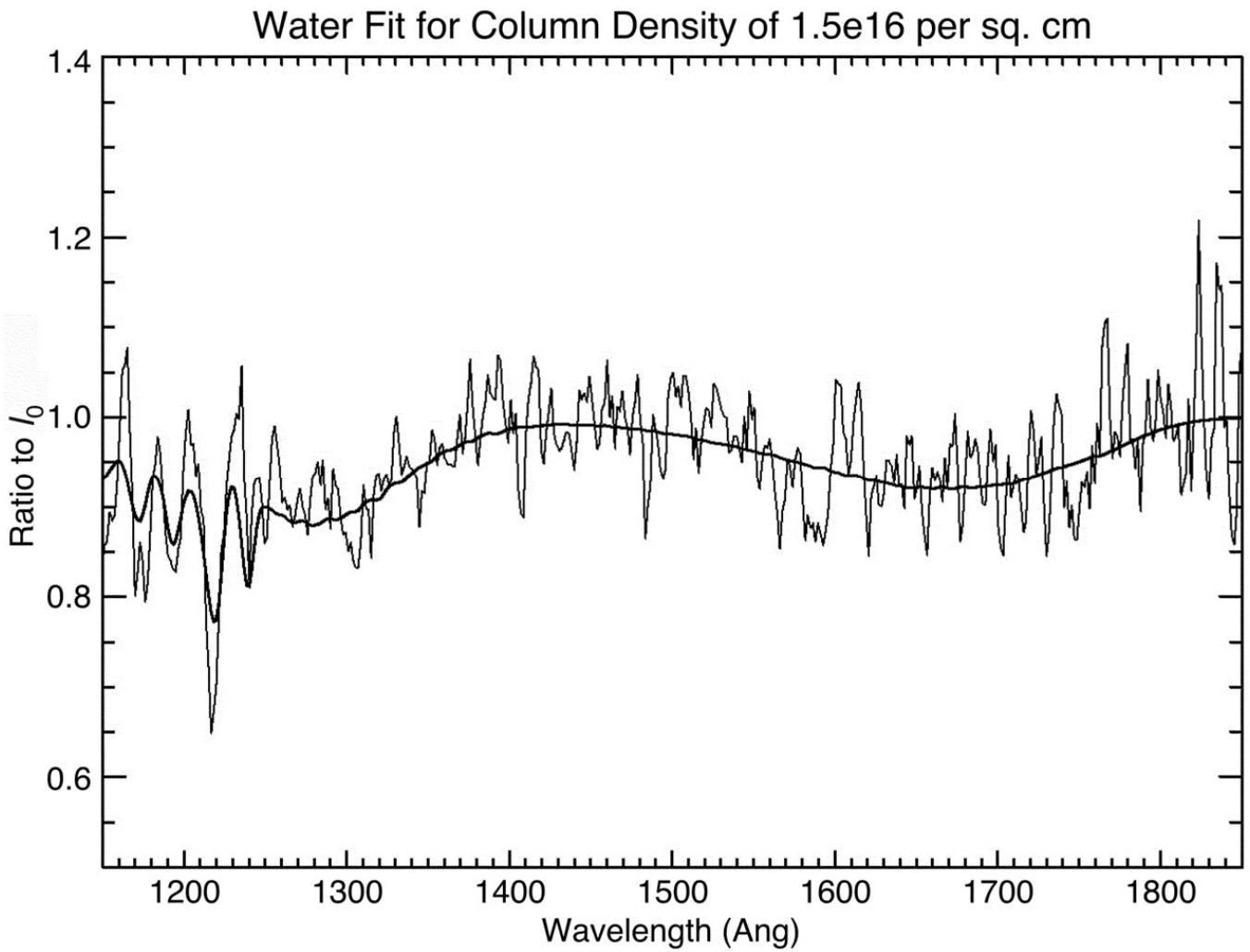


Fig. 4. A schematic (where Saturn and Enceladus are not to scale) showing the corotating Saturn magnetic field and plasma being perturbed by the neutral cloud that is produced by a polar plume generated close to the south pole of Enceladus



M. K. Dougherty et al., Science 311, 1406 -1409 (2006)

Fig. 4. An average unocculted star spectrum (I0) was computed from 25 time records



C. J. Hansen et al., Science 311, 1422 -1425 (2006)

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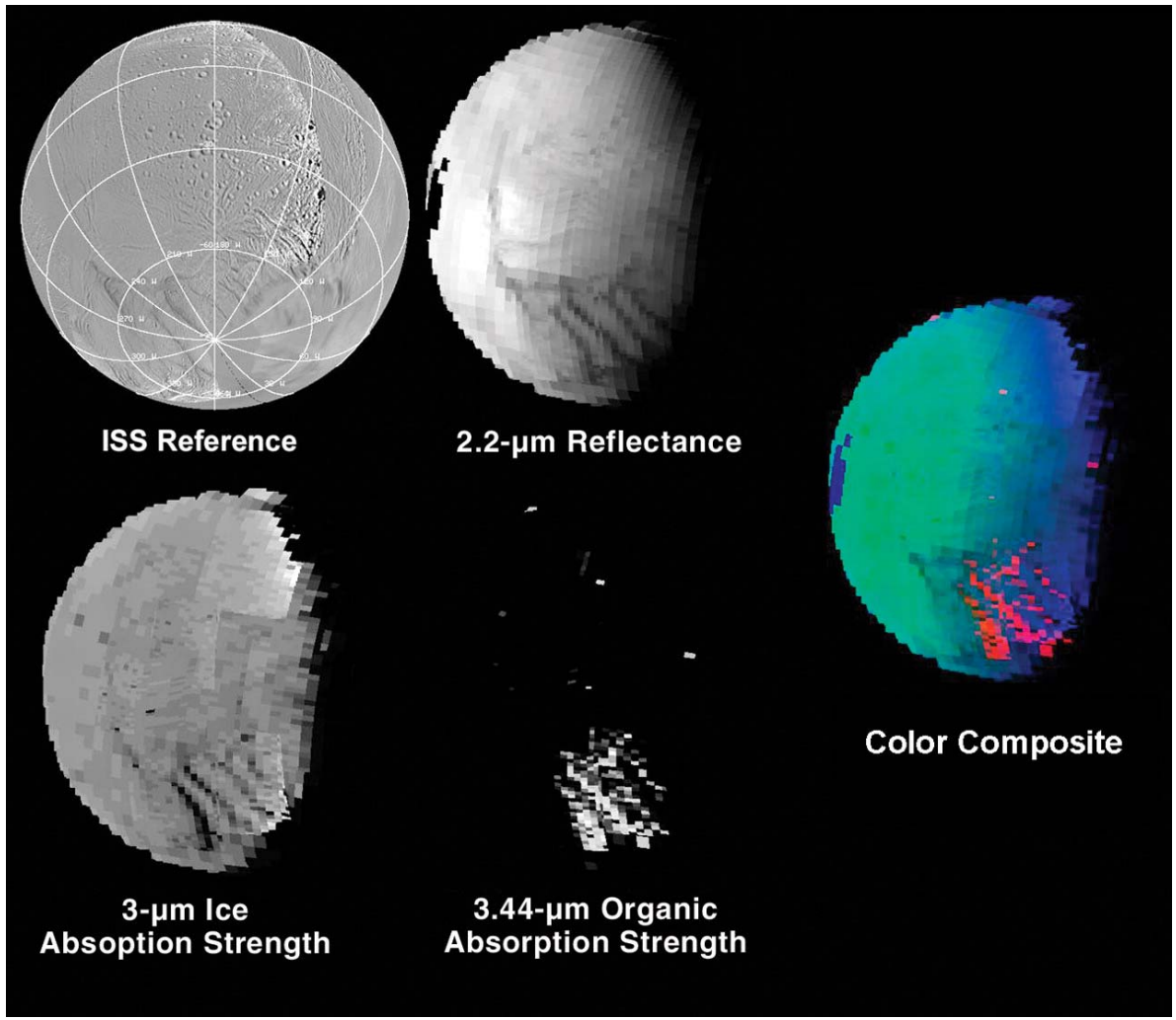
Fig. 2. A compositional map of Enceladus



R. H. Brown et al., Science 311, 1425 -1428 (2006)

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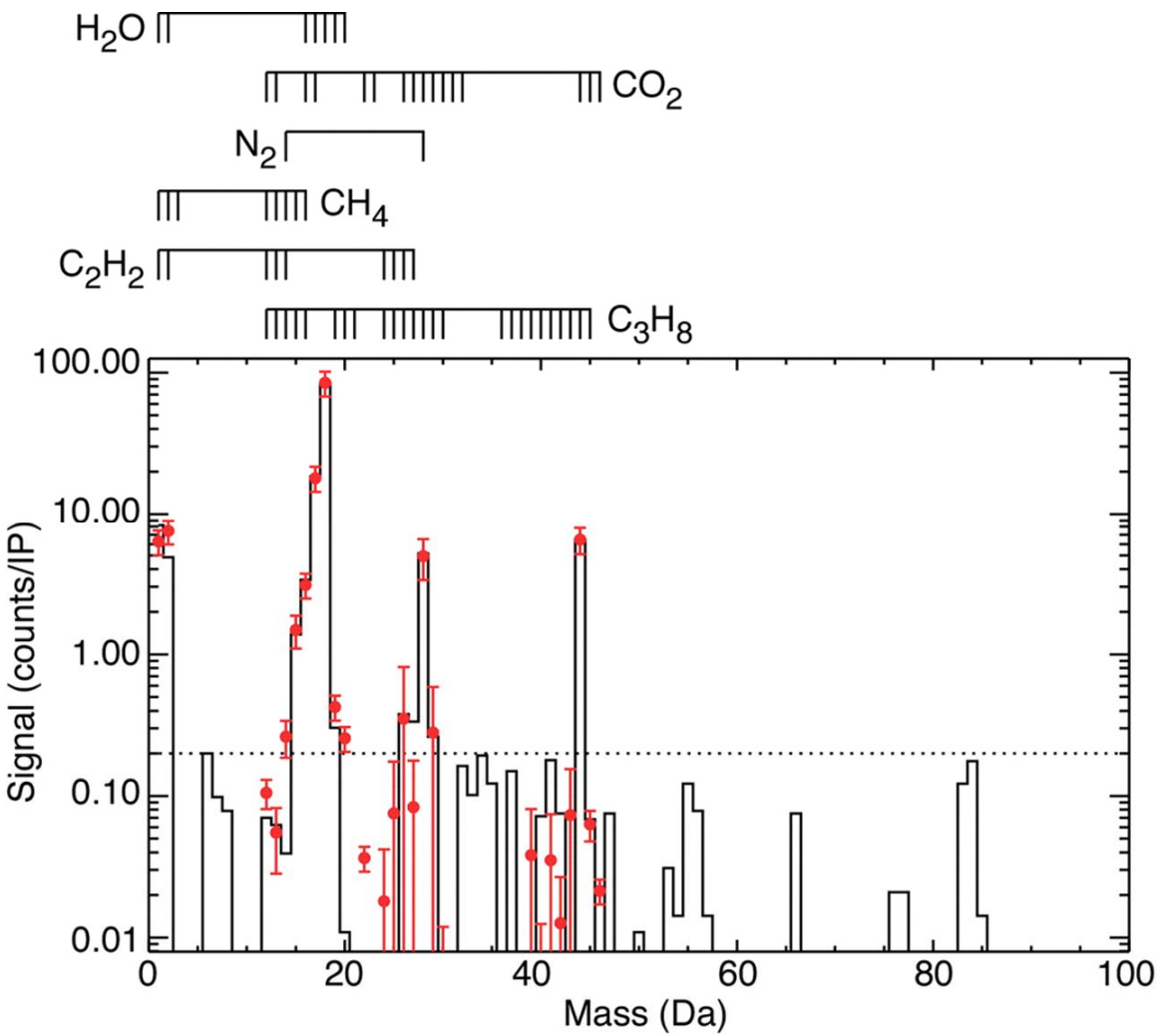
Fig. 2. Average mass spectrum for altitudes below 500 km



J. H. Waite et al., Science 311, 1419 -1422 (2006)

CDA

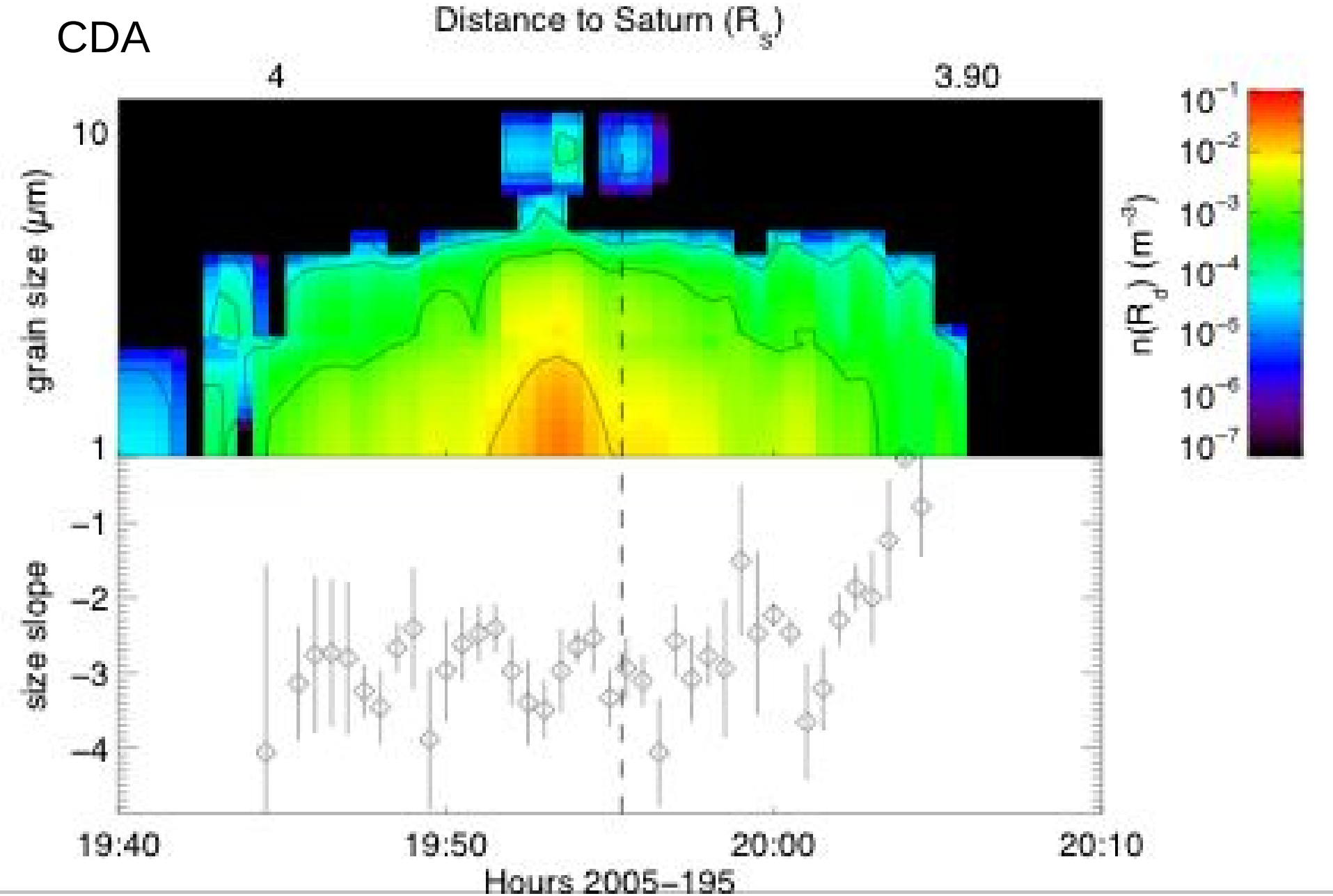
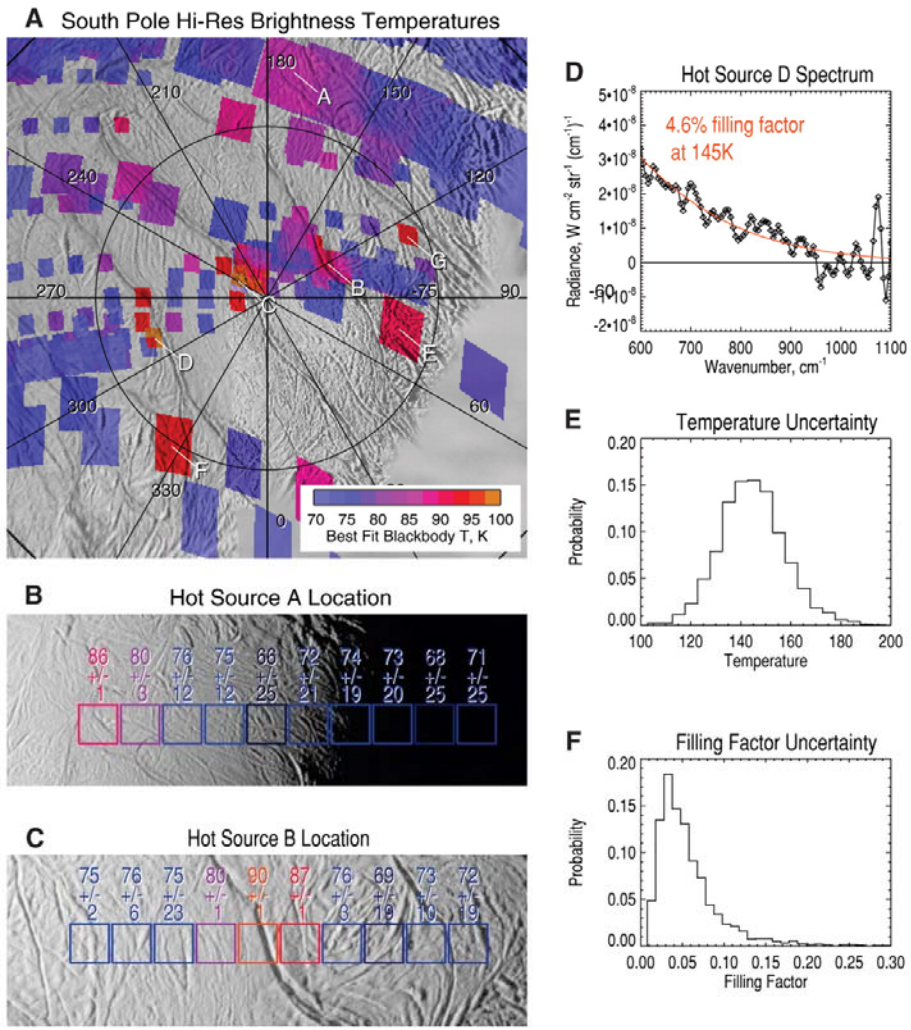

Distance to Saturn (R_s)
4
3.90
10
1
grain size (μm)
$n(R_p)$ (m^{-3})
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
−1
−2
−3
−4
size slope
19:40
19:50
20:00
20:10
Hours 2005–195

Fig. 3. (A) Color-coded south polar brightness temperatures at high spatial resolution, derived from the ISS ride-along CIRS observations, superposed on an ISS base map (19)



J. R. Spencer et al., Science 311, 1401 -1405 (2006)

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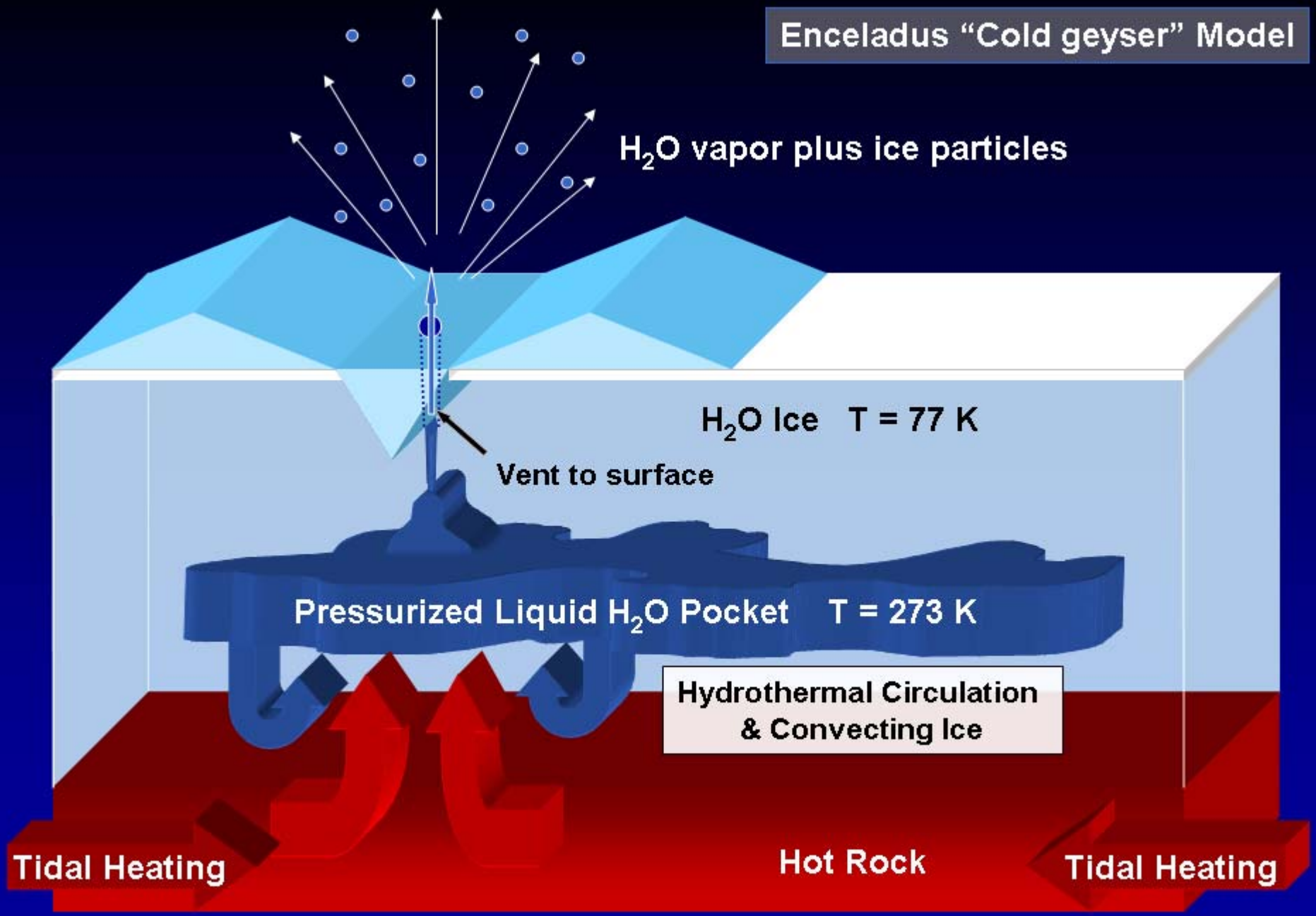
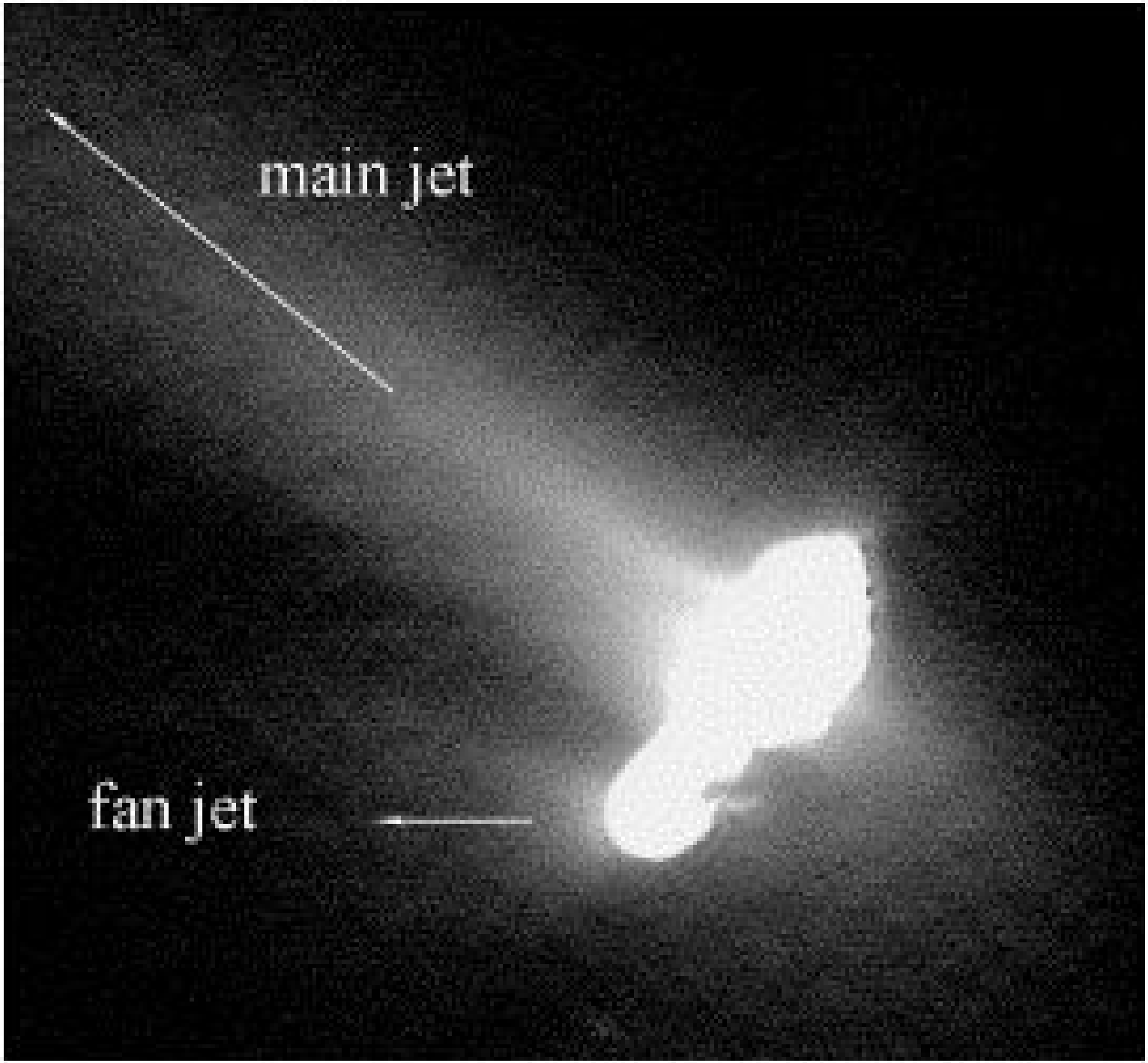

Enceladus "Cold geyser" Model
H_2O vapor plus ice particles
H_2O Ice T = 77 K
Vent to surface
Pressurized Liquid H_2O Pocket T = 273 K
Hydrothermal Circulation & Convecting Ice
Tidal Heating
Hot Rock
Tidal Heating

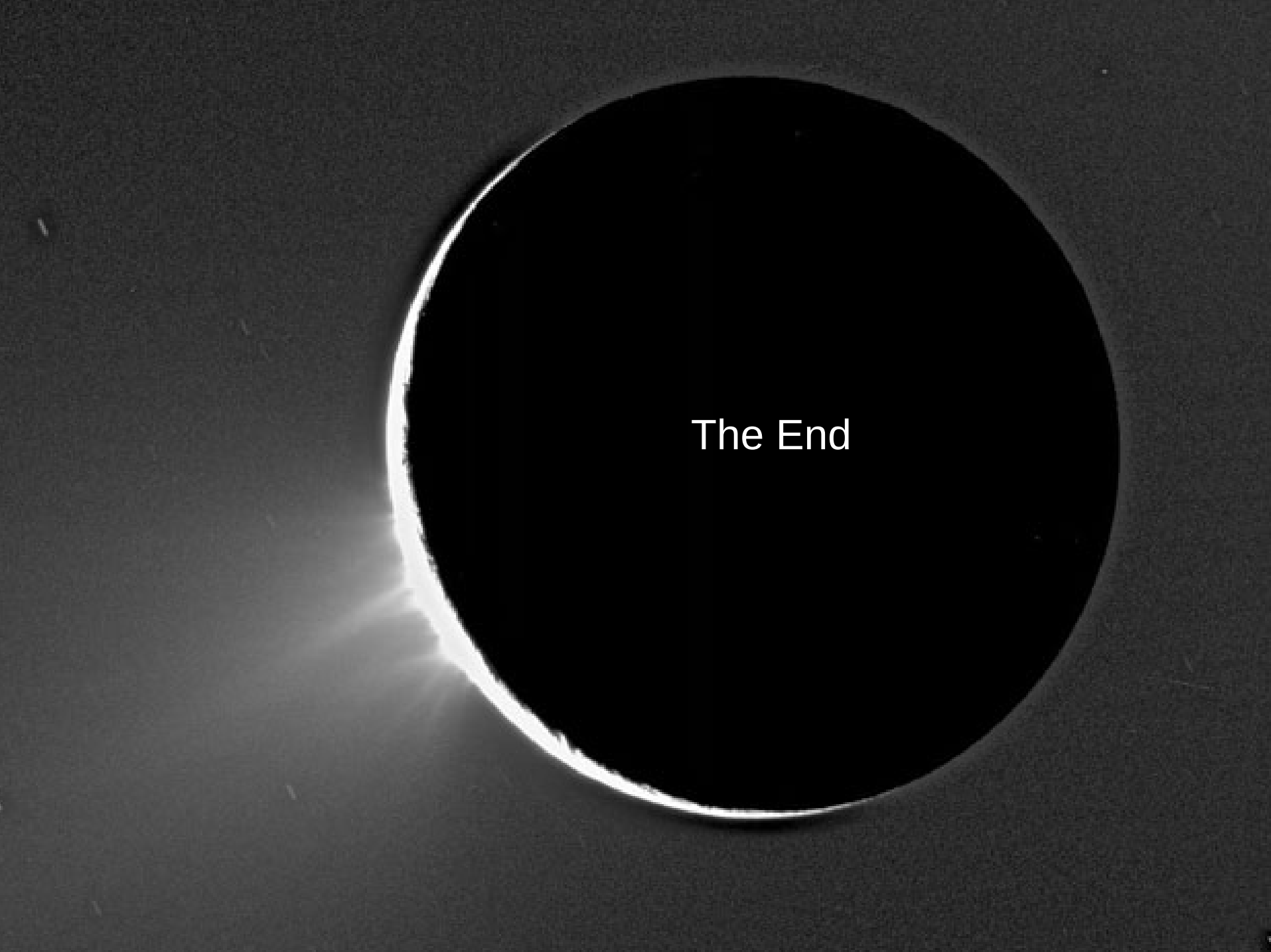
What might Cassini measure?

- Composition and size of particles
- Molecule with mass 28 - N_2 is the favorite, but CO is not ruled out
- Trace species - NH_3, CO, C_2H_2, C_3H_8,
- Hot spot temperatures - 135, 145, 155...
- Magnetic/gravitational/tidal signature of a salty ocean

Are we ready to advocate a new mission?

- **Pros** - benign radiation environment
- We know where to go - tiger stripes
- T > 273 K at 10's of meters depth (?)
- The L word - photochemical and hydrological cycles provide oxidants, organics, and liquid water (?)
- **Con** - cold interior model is not dead yet


main jet
fan jet


The End