The Case for an Enceladus Mission

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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.
Fig. 4. An average unocculted star spectrum ($I_0$) was computed from 25 time records

Water Fit for Column Density of 1.5e16 per sq. cm

Fig. 2. A compositional map of Enceladus

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

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)

Enceladus “Cold geyser” Model

H$_2$O vapor plus ice particles

H$_2$O Ice  \( T = 77\ \text{K} \)

Vent to surface

Pressurized Liquid H$_2$O Pocket  \( T = 273\ \text{K} \)

Hydrothermal Circulation & Conveeting Ice

Tidal Heating

Hot Rock

Tidal Heating
What might Cassini measure?

- Composition and size of particles
- Molecule with mass 28 - \( \text{N}_2 \) is the favorite, but \( \text{CO} \) is not ruled out
- Trace species - \( \text{NH}_3, \text{CO}, \text{C}_2\text{H}_2, \text{C}_3\text{H}_8 \)
- 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
The End