Composite Infrared Spectrometer Inputs for the NASA Quarterly

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CIRS Highlights

• Science Highlights
  — Enceladus
    • Close flyby in August 2010 has provided higher-resolution local maps in south polar region
    • Thermal fits indicate temperatures as high as 190 K.
      – Fracture widths still not resolved, so actual temperatures may be higher.
  — Titan
    • Limb observations have provided evidence of organic ice clouds in lower stratosphere
      – Perhaps a mixture of HCN and HC$_3$N
    • Mapping over northern winter into spring is revealing the seasonal evolution of temperatures and organic molecules in the polar regions.
  — Rings
    • Thermal modeling of rings
      – CIRS data can constrain albedo, rotation, vertical mixing, and thermal inertia of ring particles
Rev 136 Enceladus Flyby, August 13 2010

- 2550 km altitude
- Penultimate remote sensing flyby of the Enceladus south pole for the entire mission
- Next and final ORS flyby is in December 2015

Example result: Complex thermal structure between Alexandria and Cairo Sulci
High Resolution Scan of Damascus Sulcus

- 700 meter resolution on one of the thermally brightest regions of the tiger stripes
- Simultaneous Saturn-light CIRS support image shows thermal emission is aligned with the fracture
- Best-fit temperatures up to 190 Kelvin: slightly warmer than previous high-quality temperature fits
- Some lower-temperature emission from detectors on either side of the fracture: this is the first time we’ve spatially resolved a tiger stripe in the cross-fracture direction
CIRS Discovery of Organic Ice Clouds in Titan’s Lower Stratosphere

- CIRS detected far-IR condensates in Titan’s lower stratosphere for the first time southward of latitude 50N
- Strong evidence that stratospheric ice clouds composed of nitriles are global in extent
- Discovered a broad stratospheric ice feature centered at about 160 cm⁻¹ (solid red curve in Fig. b)
- Cloud feature originates near an altitude of ~90 km, where HCN and HC₃N vapors first saturate and are expected to condense into ices
- Cloud feature at 160 cm⁻¹ is compatible with laboratory results for mixtures of HCN and HC₃N ice (solid black curve in Fig. b)
South pole getting colder
Hottest latitude follows sub solar point
Gas abundance increasing in north
South polar cap dissipation
Thermal modeling for Saturn’s rings
Ryuji Morishima, Linda Spilker

(Top) Schematic description of the model (Morishima et al. 2009, Icarus 201, 634-654)
Energy transfer by radiation (radiative transfer equation) + particle motion (thermal diffusion equation)

• Estimations of albedo, rotation, and vertical mixing of ring particles (Morishima et al. 2010a, Icarus, in press)
  Simulations with Nebula for ~ 6 cpu months
• Estimations of thermal inertia of ring particles (Morishima, Spilker, Ohtsuki 2010b, submitted to Icarus)
  Simulations with Nebula and Galaxy for ~ 2 cpu year

(Right) Albedo, fraction of fast rotators, and thermal inertia estimated from parameter fits
Solid curves are values estimated in Morishima et al. (2010a)
Diamonds are values estimated in Morishima et al. (2010b)
Red and black colors are for the cases with standard and bouncing vertical motions.