Cassini Mission Update

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Launched on October 15, 1997 from KSC

7 Year cruise on Venus-Venus-Earth-Jupiter Gravity Assist trajectory

30 June / 1 July 2004
Saturn's Upper Level Clouds

Montage of diverse atmospheric phenomena.

The South Polar Storm

Rotation of the Vortex

Thermal Structure

Light from the Interior, 5,000 nm

Reflective Sunlight

Rev 28 High Phase Observation (Sun obscured by planet)
ENA generation mechanism

Krimigis et al, 2004

Saturn in atomic and molecular hydrogen emission

Saturn’s “Northern Lights”
RIDGE CHARACTERISTICS

Length ~ 4680 km
Width ~ 100 km
Height up to 20 km
Very steep flanks, slope angle partly >30°!
Age ~ same as surroundings (4.4 - 4.5 By)
Structure: single or double ridge

Porco et al. (2005)
ENCELADUS
SECOND MOON OF SATURN
RADIUS: 252 KM
DENSITY: 1608 KG/M³
ATM. PRESSURE: NIL
GEYSER COMPOSITION:
WATER VAPOR
NITROGEN
HYDROCARBONS
SURFACE COMPOSITION:
WATER ICE
HYDROCARBONS
GEOLOGICAL STATUS:
ACTIVE
Fine, icy particles jet from vents in Enceladus’ active south polar region. The plume towers at least an Enceladus diameter above the surface.

*Images yielded evidence that the geologically young south polar region of Enceladus may possess reservoirs of near-surface liquid water that erupt to form geysers.

**GEYSER COMPOSITION**
(Waite et al. 2006; Hansen et al., 2006)

\[
\begin{align*}
\text{H}_2\text{O} & : 91 \pm 3 \text{ %mol} \\
\text{CO}_2 & : 3.2 \pm 0.6 \text{ %mol} \\
\text{N}_2 & : 4 \pm 1 \text{ %mol} \\
\text{CH}_4 & : 1.6 \pm 0.4 \text{ %mol} \\
\text{CO} & : < 0.9 \text{ %mol} \\
\text{NH}_3, \text{ HCN}, \text{ C}_2\text{H}_2, \text{ C}_3\text{H}_8 & : < 0.5 \text{ % mol (i.e., detected)}
\end{align*}
\]

Inferred from a combination of INMS and UVIS data

2 \text{NH}_3 \rightarrow \text{N}_2 + 3 \text{H}_2

\text{CO or CO}_2 + \text{H}_2\text{O} \rightarrow \text{CH}_4

\text{HEAT} T \sim 1400 \text{ K}

Basaltic Magma
G-Ring Structure

Stellar occultations by the rings: azimuthal view angle determines opacity and elevation angle gives wake thickness.
Cassini measurements by the UVIS instrument (Colwell et al. 2006, 2007) and the VIMS instrument (Hedman et al. 2007) show that the measured transmission during a stellar occultation is a strong function of the observation geometry. These measurements are consistent with measuring the fractional area of the rings that is not covered by opaque clumps of particles. They do not measure the mass inside the clumps!

Colwell's Granola bar model

If the simulation cell is too small, it underestimates the connectivity of the "spider web." These spider webs tend to reduce angular momentum transport due to gravitational torques?

This simulation cell is too small!

Fraction of surface covered by high-density clumps is > 95% for measured optical depth > 3

Puzzling F ring Gossamer Structures

In this high phase angle image of the F ring, gossamer structures suggest that unseen objects are perturbing the ring.
Feature Type: Opaque
- 1 observed feature
- 600 m wide
- \( R = 139917 \) km
- Sharp edges
- Stellar signal goes to background level

Propellers in A ring show Moonlet Locations

COLLISIONAL CASCADE