

# Cassini Equinox Mission Quick-Look Flyby Facts

## Dione D2 Encounter (Rev 129)



### Quick Facts

Closest Approach: 05:16:11 Spacecraft Universal Time, April 7, 2010

Altitude: 500 kilometers (311 miles)

Speed (relative to target): 8.4 km/s (about 19,000 mph)

Closest Approach Latitude: 0 degrees North

### Science Highlights

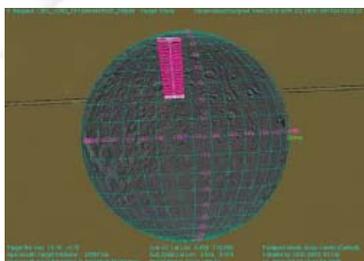
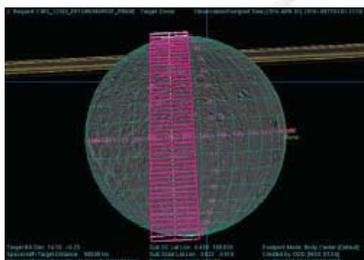
Could Dione have a secret plume that contributes to the E ring? This flyby focuses on a hunt for activity or a very thin atmosphere that could explain previous hints that Dione exhibits geologic activity. (Previous results were the drivers behind the decision to perform this close Dione flyby.)

In detail:

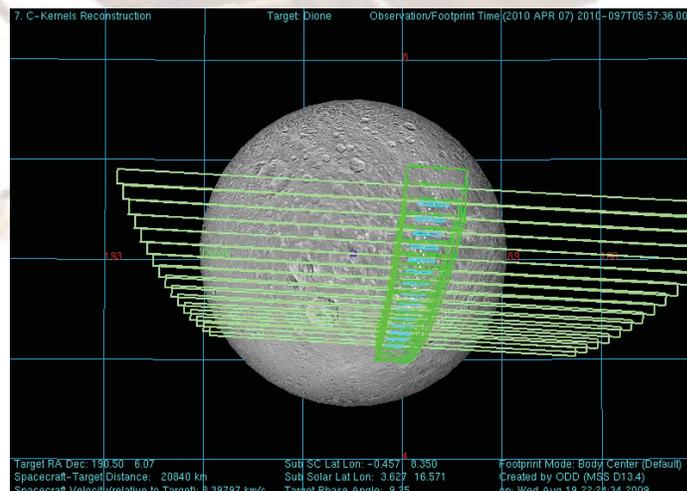
- fields and particles measurements of Dione's environment in this "downstream" flyby to follow-up on measurements made in the 2005 "upstream" configuration. Could Dione be a source of plasma?
- high resolution imaging of Dione at closest-approach
- [CIRS](#) thermal mapping of Dione's fissures to search for hints of activity

### Some Footprint Plots

Nightside [CIRS](#) Scans Over Fracture Regions (on inbound leg)



[UVIS](#) Dayside Scan ([CIRS](#) and [ISS](#) field of views also shown)



### Significance of This Flyby

- The first close Dione flyby was a 500 kilometer flyby - on Oct. 11, 2005 - passing through the upstream wake Dione creates in Saturn's magnetic field. Data were taken by magnetic and plasma instruments, remote sensing and the radar mapper.
- Dione orbits Saturn within the planet's magnetospheric plasma (charged particles). The plasma co-rotates with Saturn at an orbital speed faster than that of Dione, so the "upstream" side of Dione is the side which "sees" the bulk of the plasma; the "wake" or "downstream" side is shielded from the plasma to a certain extent by Dione itself, like a boulder in a stream.
- Plasma wave measurements taken by the Voyager spacecraft first indicated Dione may be a variable source of plasma to Saturn's magnetosphere (Kurth et al., Nature, 1981). Cassini magnetometer measurements suggest Dione is injecting mass into Saturn's local magnetic field (Khurana et al. 2007). Even though the inferred mass-loading rates are quite small (< 7 gm/s), a detailed investigation shows that they cannot be explained from sputtering from the surface alone. The strength of ion-cyclotron waves observed in Saturn's magnetosphere also show an enhancement close to Dione's position indicating that the moon is a source of newly ionized plasma.
  - This intriguing result, and the need for a downstream flyby of Dione to confirm it, were the primary drivers behind the design of this upcoming Dione flyby.
- There are suggestions of dark material on Dione's surface ([VIMS](#)) (Clark et al. 2008).
  - The Dione VIMS data show a pattern of bombardment of fine particles impacting the satellite from the trailing side direction. Multiple lines of evidence point to an external origin for the dark material on Dione, including the global spatial pattern of dark material, local patterns including crater and cliff walls shielding implantation on slopes facing away from the trailing side, exposing clean ice, and slopes facing the trailing direction which show higher abundances of dark material. Multiple spectral features of the dark material match those seen on Phoebe, Iapetus, Hyperion, Epimetheus and the F-ring, implying the material has a common composition throughout the Saturn system. However, the exact composition of the dark material remains a mystery, except that bound water and, tentatively, ammonia are detected, and there is evidence both for and against cyanide compounds. Exact identification of composition requires additional laboratory work. As with Phoebe, Dione's dark material appears to be external to the Saturn system and may be cometary in origin. VIMS has also reported a possible detection of material around Dione, which may indicate Dione is active and contributes material to the E ring, but this observation must be confirmed.

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### Sequence of Events

- Dark approach
  - Plume search
    - Dione in eclipse for part of this
  - Thermal mapping by [CIRS](#)
- Magnetic field and plasma science instruments are prime at closest approach
  - Measurements will be taken in the downstream wake Dione creates in the magnetic field -- Can be compared to a previous upstream encounter at Dione (016DI)
    - Measure the plasma environment
    - Look for plasma loading from Dione to Saturn's magnetosphere – evidence of thin atmosphere?
    - The Optical Remote Sensing instruments may catch Dione too (as good as 10 meters per pixel for [ISS](#))
- Low phase outbound
  - Optical Remote Sensing prime
  - Regional mapping of tectonic terrains
  - VIMS will continue to improve compositional mapping on Dione, with additional spatial coverage, higher resolution in some areas and to obtain more phase coverage to better understand the contaminants in the ice and microstructure of the surface.