Cassini Equinox Mission Quick-Look Flyby Facts

Enceladus E9 Encounter (Rev130)

Quick Facts

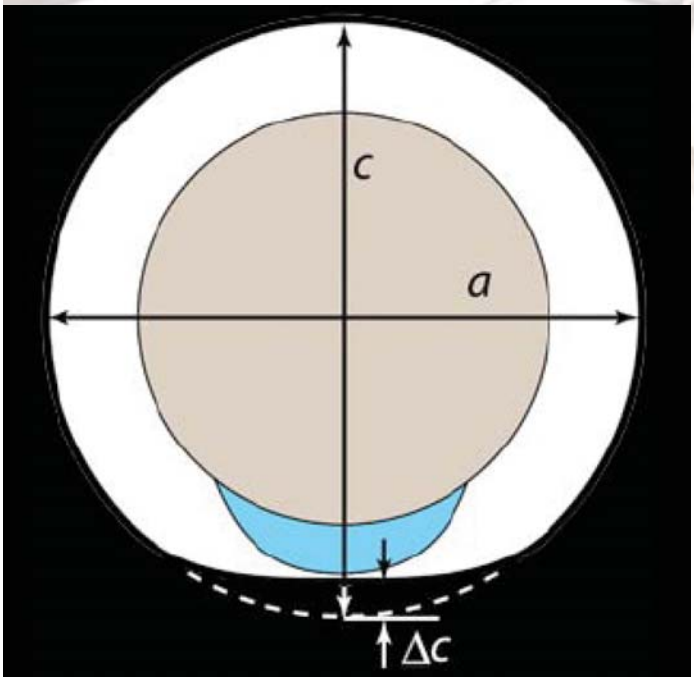
Closest Approach: 00:10:17 Spacecraft Universal Time, April 28, 2010

Altitude: 100 kilometers (62 miles)

Speed (relative to target): 6.5 km/s (about 15,000 miles per hour)

Diapir on Enceladus?

The south polar depression is a possible result of localized heating and melting. Credit: Collins & Goodman (2007)



Science Highlights

This close flyby of Enceladus offers the first measurement of the moon's gravity field in the warm, plume-spewing south polar region. Gravity measurements should reveal much about what lies beneath. There are broad hints that the area is underlain by a diapir, an intrusion of less-dense material, perhaps water. The long-anticipated flyby may confirm whether such a diapir exists, reveal its size and density, and help determine how it is associated with the watery plume that erupts from the region. If such a diapir exists, a gravity anomaly will be present and measureable by the radio science subsystem.

In detail:

- Cassini's own radio link to Earth will measure the gravity field under Enceladus's south polar region. Small variations in the gravity field, which reflect the density of the interior, will push and pull on Cassini. These changes in the flight path may result in tiny changes in the arrival of the spacecraft's signal at NASA's Deep Space Network antennas. Scientists on the Radio Science Subsystem (RSS) experiment will calculate the gravity field from those measurements.
- The flyby will be performed under the attitude control of Cassini's reaction wheels.

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Significance of This Flyby

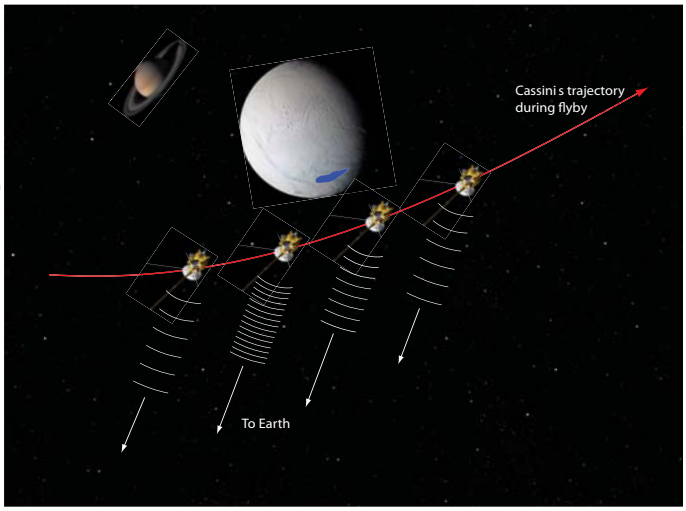
· Measurements from this flyby should reveal whether there is an anomaly in the gravity field at the south pole. The gravity measurement is a key test for two different hypotheses about Enceladus's interior. One theory is that a global ocean exists beneath a thin ice crust. Another argues that there's a diapir underneath the active south polar terrain that is the source of the moon's plume. Some scientists postulate that the active terrain may have formed above a diapir closer to Enceladus's equator. Water shooting out of the plume would cause the territory to lose mass, and over time, the terrain would migrate to the pole through the force of Enceladus's rotation to give greater rotational stability to the moon.

· The electron environment around Enceladus will be investigated by MIMI and other fields and particles instruments, which will seek to measure local gradients in the magnetic and electric fields. Electron beams moving toward Enceladus will be measured by the low-energy-mass spectrometer and by CAPS.

· The RPWS: will look for evidence of local ionization (other than charge exchange) in the plumes, and measure plasma waves and other interactions of Enceladus with its magnetic environment. The instrument will also determine the amount and size of dust particles from vents contributing to the plume.

Measurement Principle

As the spacecraft approaches Enceladus, its gravity accelerates the spacecraft, and, as a result of this perturbation, the radio signal to Earth is shifted in frequency. A subsurface diapir near the South Pole (illustrated in blue) may further perturb the spacecraft motion very slightly and change the Doppler profile. The nature of the change depends on whether the diapir density is lower than its surroundings or not.



An artistic illustration of the Doppler effect used to measure the gravity field of Enceladus during a flyby by the Cassini spacecraft.

Sequence of Events

· Encelaudus 's Gravity Field Experiment
  · Starts at 2010-117T14:00:00 (Spacecraft Event Time [SCET]) Ends at 2010-118T16:03:00 (SCET)
  · Duration: 26:03:00