

# Exploring moons other than Earth's

**ASTRONOMY** After many flybys of Titan, Saturn's largest moon, a large number of features were detailed, including one thought to be an impact crater and named *Ganesha Macula* (after the elephant headed Hindu god), observes **C Sivaram**

The third week of October last year saw the landmark launch of lunar bound spacecraft Chandrayaan. While being justifiably jubilant at this achievement, we may recall that in the same month, just a few days earlier, on October 9, the Cassini spacecraft took close looks at Enceladus, the intriguing moon of the planet Saturn.

The Cassini spacecraft skimmed within 20 kilometres of the surface of Enceladus, marking the closest approach to any of the Saturnian moons. While Chandrayaan was orbiting our moon, hardly half a million kilometres away, Cassini was just a few kilometres away from Saturn's moon, nearly one and a half billion kilometres away, 4,000 times further away from our moon.

Cassini's instruments and camera made really close observations of the plumes and jets spouting out of Enceladus, the results showing that the material is rich in water vapour, ice and organic compounds.

Again on October 31, 2008, Cassini approached within 170km of the surface of Enceladus, viewing its

south pole, the geysers spouting out water vapours, etc. originating from 'tiger stripe' fractures.

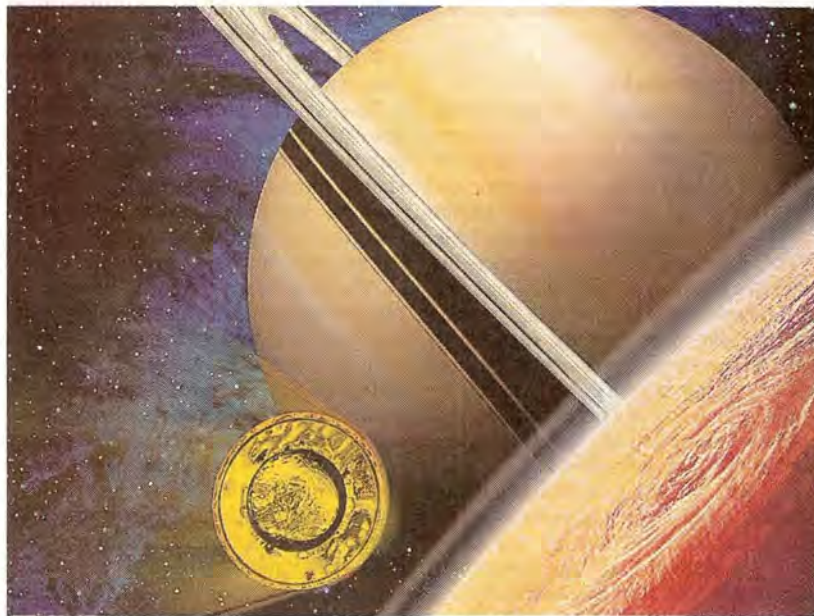
Considering that the spacecraft was swishing past the moon at nearly 70,000 kilometres an hour getting high resolution pictures (and sending it to earth, more than a billion kilometres away) was quite an achievement.

## Tiger stripe fractures

The four main tiger stripes are named Alexandria Sulcus, Cairo Sulcus, Baghdad Sulcus and Damascus Sulcus (like all features on Enceladus, they are named after people and places in Richard Burton's translation of the *Arabian Nights*).

A sulcus stands for a furrow or ridge; and these features seem similar to mid-ocean ridges on earth's sea floors.

The geysers eject few hundred kilograms per second of gas and dust into the space surrounding Enceladus, the material being mainly water vapour and ice; contribute to most of the mass found in Saturn's magnetosphere and its giant and tenuous E ring.



**STUDYING TITAN** An artist's impression shows the Huygens probe entering the upper layers of Titan's atmosphere. PHOTO COURTESY: ESA

Cassini took high resolution photographs of six of the eight known jet sources. What generates the geysers (which spew out as much water as the Yellowstone geyser) is a puzzle.

Liquid water, even an ocean, could be present below the moon's frozen surface. The vents could be nozzles that channel water vapour from a warm and liquid source to the surface of Enceladus at supersonic speeds.

Also on October 6, Nasa's Messenger spacecraft skimmed just 200 kilometres above the scarred surface of the planet Mercury.

It found a weak magnetic field nearly aligned with the planet's rotational axis (two-degree tilt). It imaged most of Mercury's previously unseen terrain and details of bright craters like Kuiper and Thakur. It found no major geological differences between the planet's hemispheres quite unlike that, for example on Mars and on the moon, where dark volcanic plains are concentrated on the nearside (to the earth) and almost absent on the far side. The spacecraft will fly by Mercury once more, on September 29, 2009 and this will set the probe on course to return to Mercury in March 2011 when it will begin orbiting the planet.

## Crater named after Ganesha

The same Cassini spacecraft while orbiting

Saturn's largest moon Titan, dispatched a craft to land on Titan, the Huygens probe (named after the discoverer of Titan-Christian Huygens).

After many flybys of Titan, a large number of features were detailed, including one thought to be an impact crater and named *Ganesha Macula* (after the elephant headed Hindu god!).

This is a prominent 200km circular feature, similar to pancake domes seen on Venus, where they are believed to be built up by eruptions of molten magma like on earth. But however on frozen Titan, features like Ganesha erupt a slushy cryomagma composed of melted water ice mixed with ammonia.

Others think it may be a shield volcano, like Hawaii's Big Island which looks similar to Ganesha on Titan. A flow named Rohe Fluctus, 300 metres thick, lies about two thousand kilometres from Ganesha, suggesting that cryovolcanism, like plate tectonics on earth, could be crucial for morphological changes.

All in all, while Chandrayaan is orbiting our nearest celestial neighbour, hardly half a million kilometres away, let us pause to think of the wonders being found at the same time by spacecraft exploring the distant moons of a giant planet two billion kilometres away.

(The author is with the Indian Institute of Astrophysics)