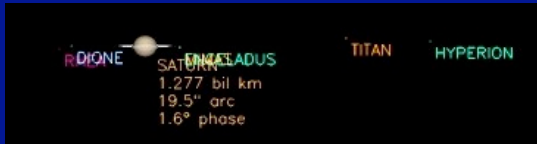
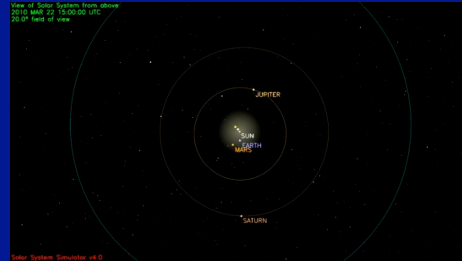


Moons of Saturn



Leaving Jupiter, and going twice as far out in the solar system



Saturn is a different planet, and further from the Sun than Jupiter, so it is not a surprise to find differences in the moons. We will talk about two, Titan and Enceladus

Titan: bright enough to be seen in a Wal-Mart telescope

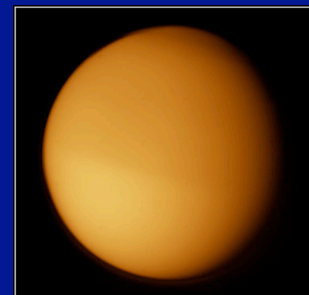


1944: discovery that spectrum had absorption lines of methane: a moon with an atmosphere. Known to be about twice the mass and about 50 percent larger in diameter

First real look at Titan in 1979 with Voyager flyby

Atmosphere so dense the surface is not visible

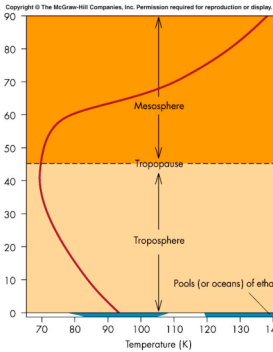
Atmosphere primarily nitrogen (like Earth) but clouds are aerosols (smog) of some sort



Titan

© Copyright 1998 by Caltech & JPL/NASA

Inferences about the surface of Titan

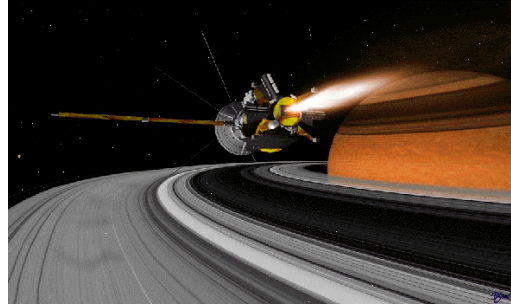


Conditions at surface
Are close to "triple
Point" of substances
Such as Methane and
Ethane (oceans of
Gunk?)



Was speculated on
after Voyager flyby

25 years later...another spacecraft on a mission

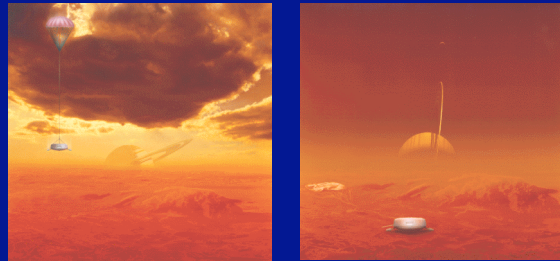


The Cassini and Huygens spacecraft

The Huygens lander



Concept of the Huygens lander...an artist's conception



Pictures of Titan from the approaching Cassini spacecraft

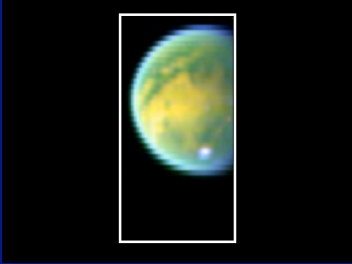
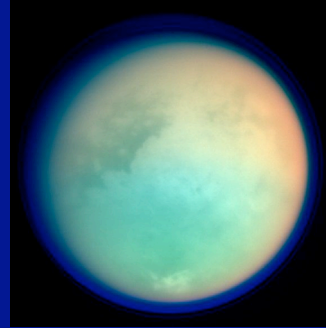
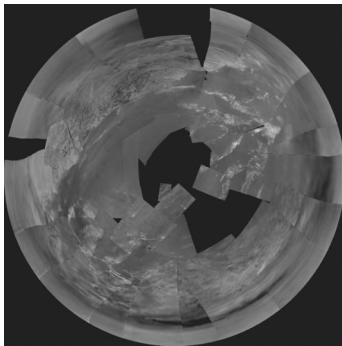


Image at infrared wavelengths

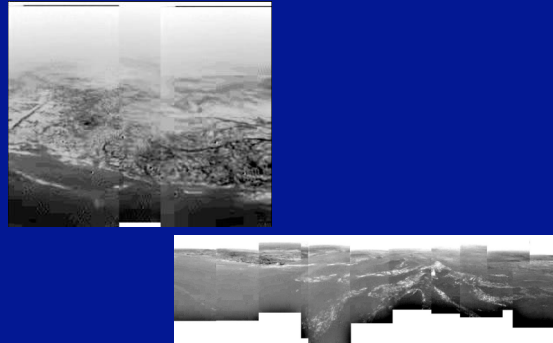
A new view of Titan (from close up)



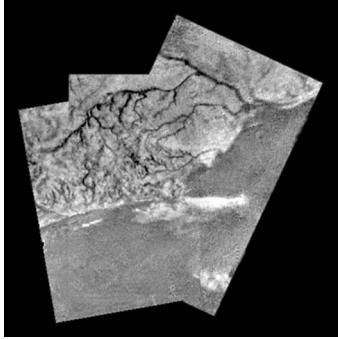
The view from Huygens on the way down



Closer to the surface



Titan has flow channels, too



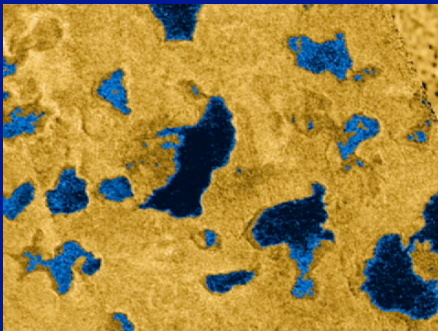
On the surface

"rocks" are blocks of ice

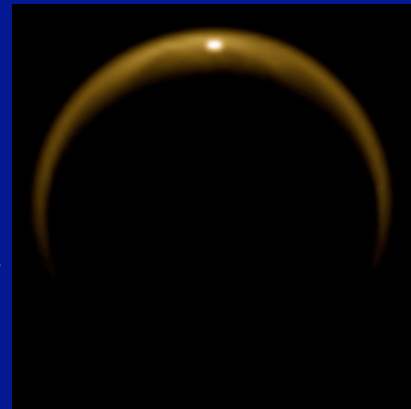
The most remote human "base" in the universe: nearly a billion miles from the Sun



Cassini radar shows lakes of methane



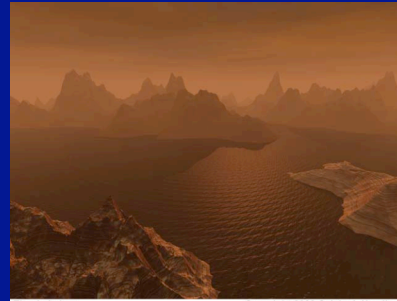
Recent observations from Cassini show different manifestation of methane lakes: sunlight glints from the lake surfaces



Reasons for the interest and importance of Titan: it has a dense atmosphere and a “hydrological cycle” based on another compound. Despite its alien nature, in some ways it is the most Earth-like object in the solar system

A more general reason of interest is that Titan may be a showcase for the organic chemistry which can occur in outer space, even if that organic chemistry never developed to the point of forming life. Finally, it is possible, although only remotely possible, that a form of life has evolved on Titan in which liquid methane and ethane play the role of water for life here on Earth. One of the many arguments against this is that the extreme cold of Titan means that chemical reactions would go very slowly.

The surface of Titan: an artist's view



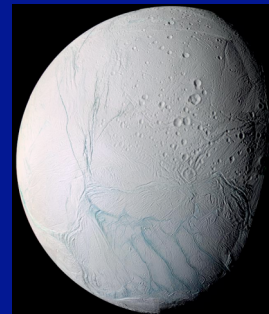
Titan's Lakes Copyright 2008 Calvin J. Hamilton

Another moon of Saturn: Enceladus

- Diameter=500km
- Mass = 0.0012 that of Earth's Moon
- Orbital period=1.37 days
- Semimajor axis of orbit=238,000 km
- Semimajor axis of orbit = 4.0 X radius of Saturn

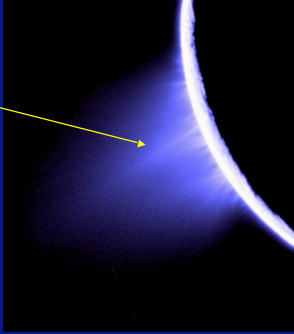
Not that much greater than Roche Distance. Tides should be important

Cassini gives a closeup view of Enceladus

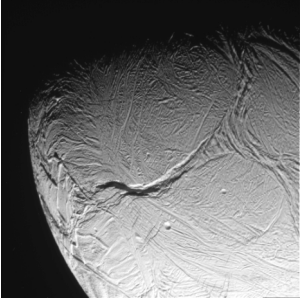


Why Enceladus is of interest

Water geysers coming from the "tiger stripes"



Enceladus: another case in which subsurface water flows up through cracks to the surface of the object



Summary: several moons of the outer planets, in addition to being amazing natural spectacles, may be abodes for primitive forms of life, or at least give us some insight into the astro-biochemical processes which gave rise (or didn't) to life. Future spacecraft will have much to explore. Stay tuned.