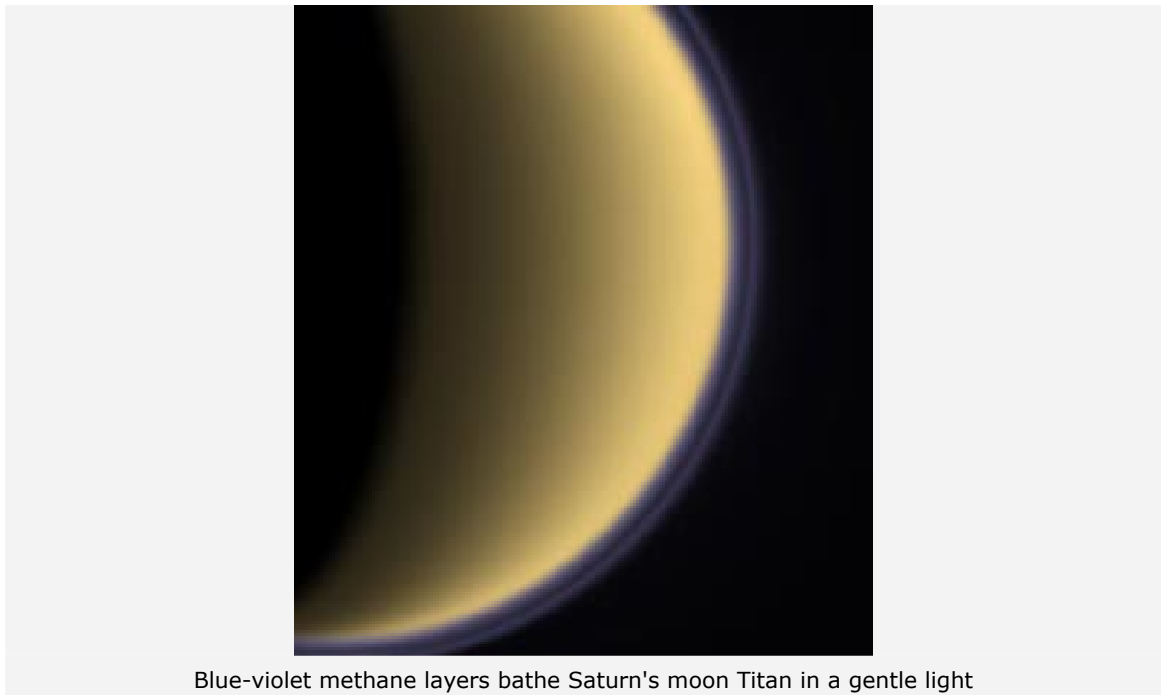


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Cassini space probe studies Saturn's moon Titan up close: what's hiding under the cloudy murk?

26 October 2004



Blue-violet methane layers bathe Saturn's moon Titan in a gentle light

Pasadena/Cologne/Berlin – Today, at 18:44 CET, the US/European space probe Cassini will come closer than we have ever been to Saturn's largest moon Titan. The NASA/ESA spacecraft will fly over Titan's dense, cloudy atmosphere at a speed of over 6 kilometres per second and at a height of just 1200 kilometres to perform a wide range of scientific experiments. Scientists are particularly interested in the pictures that will be taken by the spectrometer for visible light and near infrared (the Visible and Infrared Mapping Spectrometer or VIMS). This instrument is able to see through Titan's atmosphere, so dense it is impenetrable to the human eye, and give us a glimpse of the moon's mysterious surface. The German Aerospace Center (DLR) is directly involved in evaluating the data from the spectrometer. "With a resolution of 20 – 30km per pixel, the mapping spectrometer can identify very specific chemical elements and molecules. I think we're on the right track to unlocking a few of Titan's secrets," says Dr. Ralf Jaumann from the DLR's Institute for Planetary Research in Berlin-Adlershof. "We're about to enter one of the most exciting phases of the Cassini mission!"

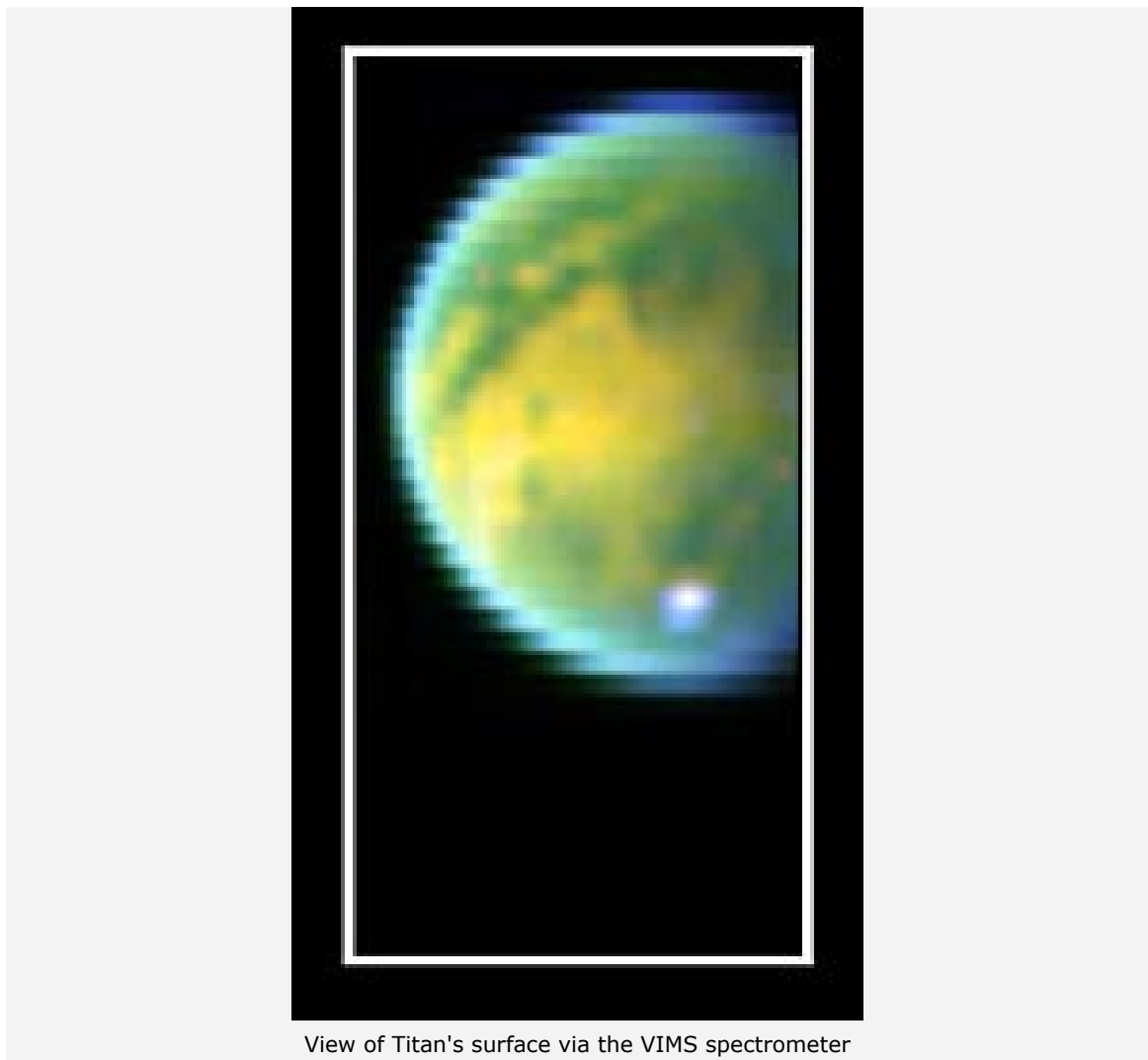
Saturn's moon Titan: almost as complex as a planet

Within the Saturn system, the Saturnian moon Titan is an extremely complex world in its own right and many of its characteristics make it seem almost like a small planet of the inner solar system. With a diameter of 5150 kilometres, it is larger than the planet Mercury and the second largest satellite in the Solar System after Jupiter's moon Ganymede. Titan circles Saturn at a distance of more than one million kilometres and is mantled by dense clouds of nitrogen and hydrocarbons (such as methane and ethane) as well as traces of water and ammonia. Because the temperatures around Saturn, 1400 million kilometres away from the Sun, are extremely low, chemical reactions happen much more slowly and the movement of the relatively volatile, gaseous molecules is also much slower. This means that

Titan does not lose its atmosphere immediately to space, as happened with Mercury, for example. On the surface of Titan temperatures reach as low as -180° Celsius, while in the stratosphere (above a height of 60 kilometres) it is 20° to 40° warmer

Surface of Titan: solid or liquid? Landing of European Huygens probe on 14 January 2005 to uncover some secrets

But one of the most exciting questions in planetary research has to do with the characteristics of Titan's surface. Since the two American Voyager probes made brief fly-bys of Saturn and Titan in 1980 and 1981, it has not been clear whether Titan's dense atmosphere and the 200km-thick methane smog above it conceal beneath them a solid surface or flat oceans of ethane and methane. After its arrival in the Saturn system on 1 July 2004, Cassini passed by Titan just a few days later at a distance of 338 000 kilometres and transmitted the first important data back to Earth. Dr. Jaumann, a member of the Cassini spectrometer team, explains: "At 150 kilometres per pixel, the resolution of the spectrometer data wasn't enough to identify any details on the surface, but it was sufficient to enable us to pick out large structures."



A circle-shaped structure spotted near the equator (330° west, 11° south) with a diameter of around 1500 kilometres is believed to be an impact crater created as the result of a violent collision between Titan and another object. Researchers have already named it 'Xanadu'. A number of wide structures, several hundred kilometres in length, and large connected areas can also be seen. Reflection from the surface in an infrared wavelength of 2.0 microns (thousandths of a millimetre) shows that the darker regions contain a lot of ice, while the brighter areas contain less ice and thus other materials (hydrocarbons, with perhaps even rock-forming silicates). In the south pole region, the surface is covered by a bright cloud of methane. This cloud changed in shape over time and was moving at a speed of about 170km/s. After a few hours, it dissipated.

The observations of the American Voyager probes in the early 1980s gave scientists much to puzzle over – but also gave rise to some extremely interesting ideas. The chemical components found on Titan and the theoretical possibility that there could be warmer liquid layers beneath its surface make this

body an extraordinary kind of laboratory. At this distance from Earth we can study processes as they may have happened in the first few hundred million years in the inner solar system, right up to point where life appeared, having perhaps formed in a 'primeval soup' like this one. The further examination of these fundamental questions is the key task of the European Space Agency's Huygens landing probe, which is due to separate from Cassini on 25 December and descend through the clouds of Titan before touching down on the moon's surface on 14 January 2005.

The mapping spectrometer VIMS (Visible and Infrared Mapping Spectrometer) on board Cassini can map a surface in 352 'colours' simultaneously in wavelengths of between 0.3 microns (blue) and 5.1 microns (medium infrared). All materials reflect light in a unique way. This means that we can identify molecules and compounds by the characteristic way in which they reflect or absorb 'discrete' colours of specific wavelengths. This is how the VIMS team will be identifying the composition of the atmosphere and surface of Titan after the fly-by. The VIMS team is made up of scientists from the USA, Germany, France and Italy and the VIMS centre is located at the University of Arizona in Tucson, Arizona.

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