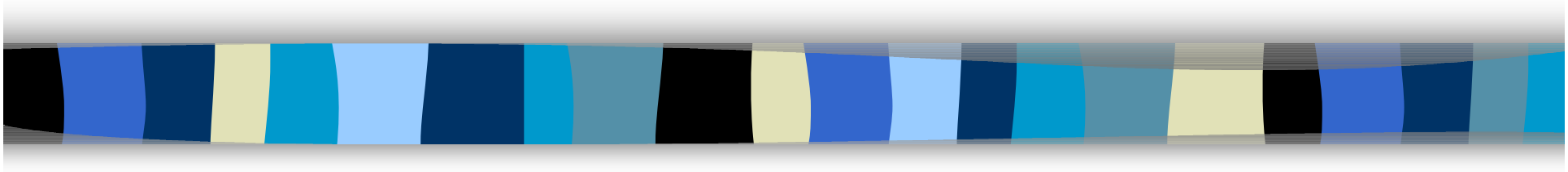
"He also made the stars"

Christians in Science



TITAN

Dr. Trevor Griffiths,

Christians in Science conference,
Leeds, Saturday 19 March 2005

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TITAN

Discovered by Christiaan Huygens

Date of discovery 1655

Mass (kg) 1.35e+23

Mass (Earth = 1) 2.2590e-02

Equatorial radius (km) 2,575

Mean density (gm/cm^3) 1.88

Mean distance from Saturn (km) 1,221,850

Rotational period (days) 15.94542

Orbital period (days) 15.94542

Mean orbital velocity (km/sec) 5.58

Orbital eccentricity 0.0292

Orbital inclination (degrees) 0.33

Escape velocity (km/sec) 2.65

Visual geometric albedo 0.21

Magnitude (Vo) 8.28

Mean surface temperature -178°C

Atmospheric pressure (bars) 1.5

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Amateurs processed Titan images first!

Enthusiastic amateurs processed raw images of Titan from Huygens probe faster than the space agencies. Within eight hours amateurs had used freeware image processing packages and created images with colour enhancement before ESA and NASA.
Organiser Liekens: "We would all like to thank ESA, NASA and the University of Arizona for organising the Cassini-Huygens mission, and for sharing these wonderful pictures with the world."

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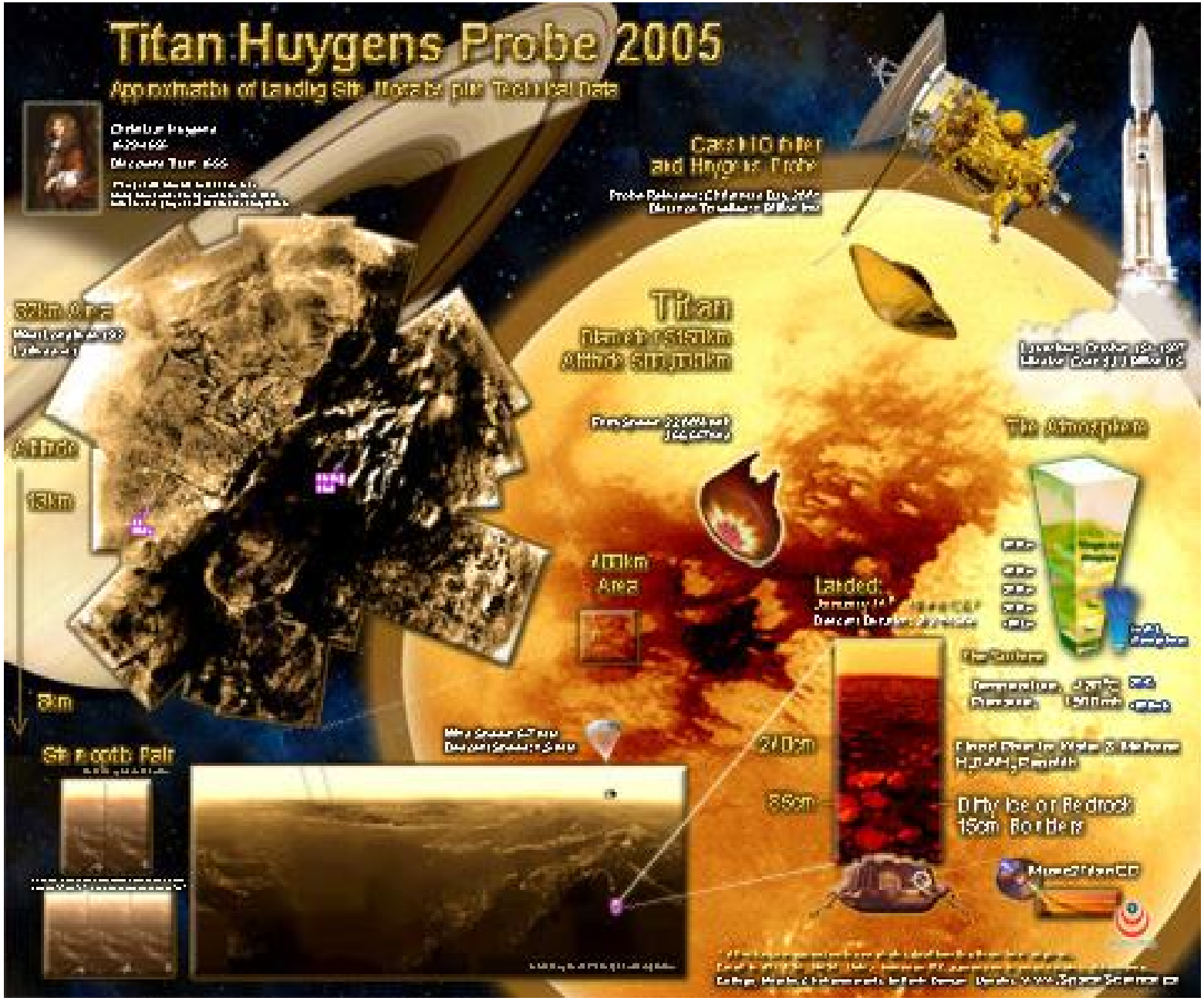

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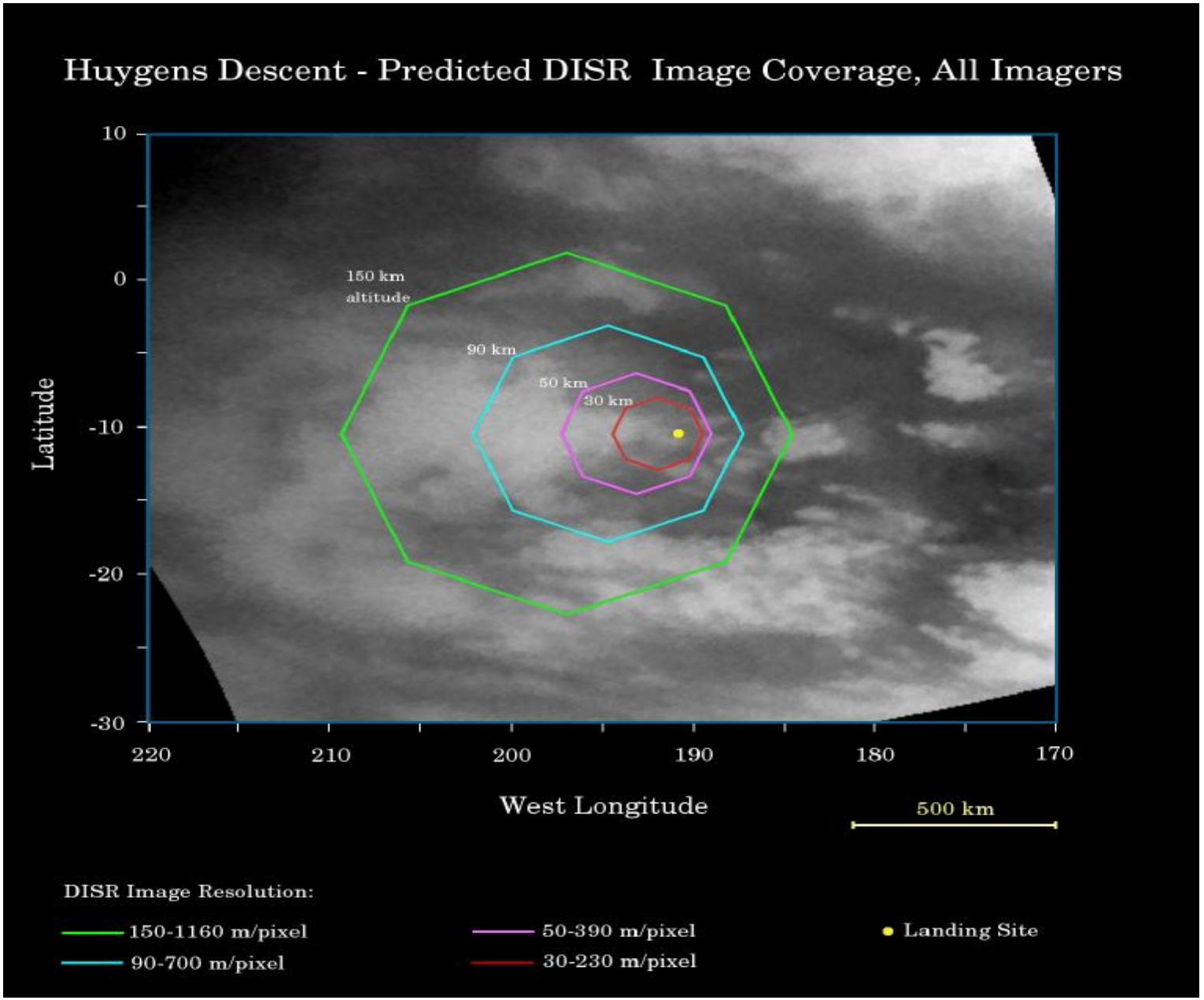

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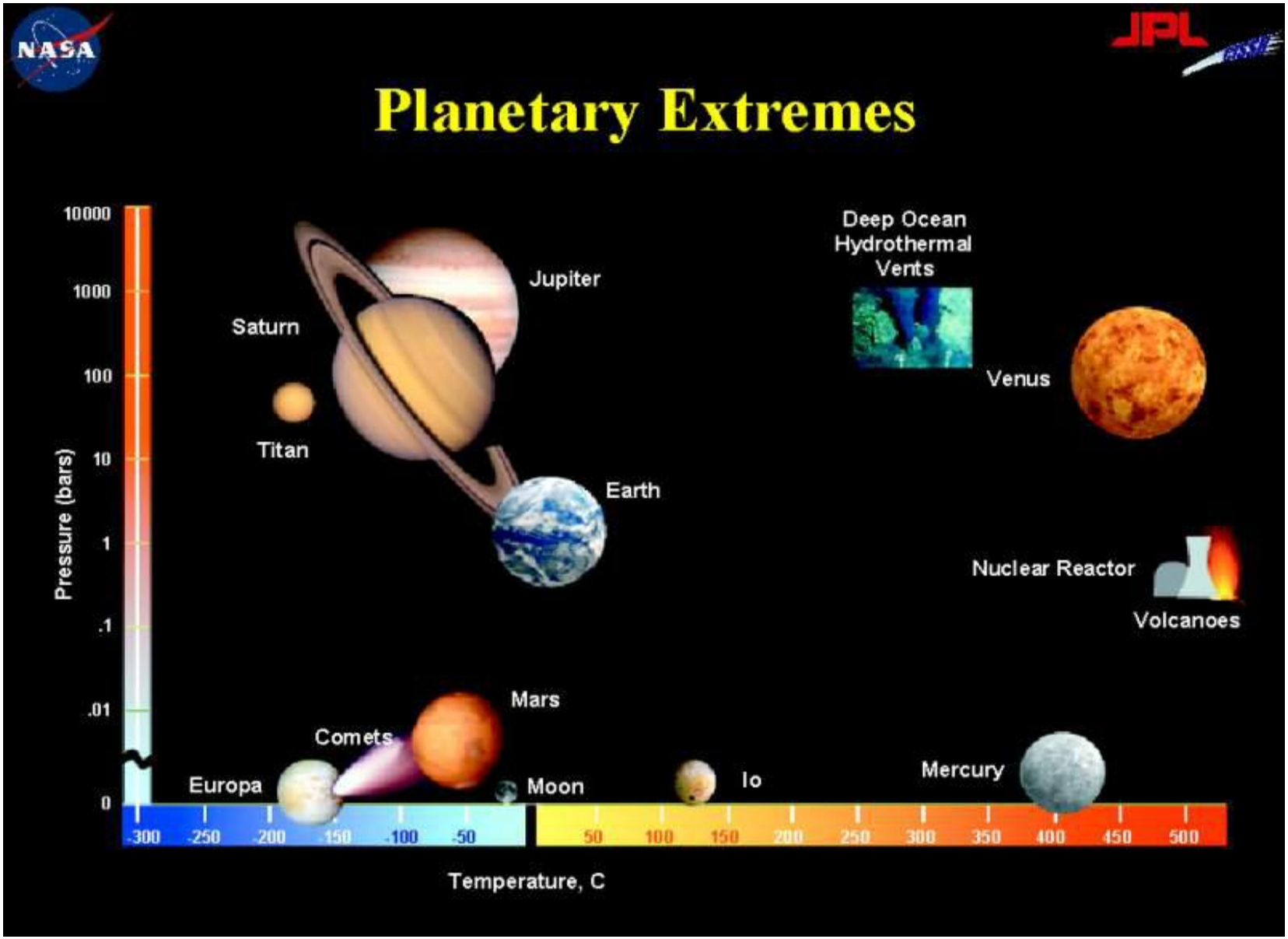

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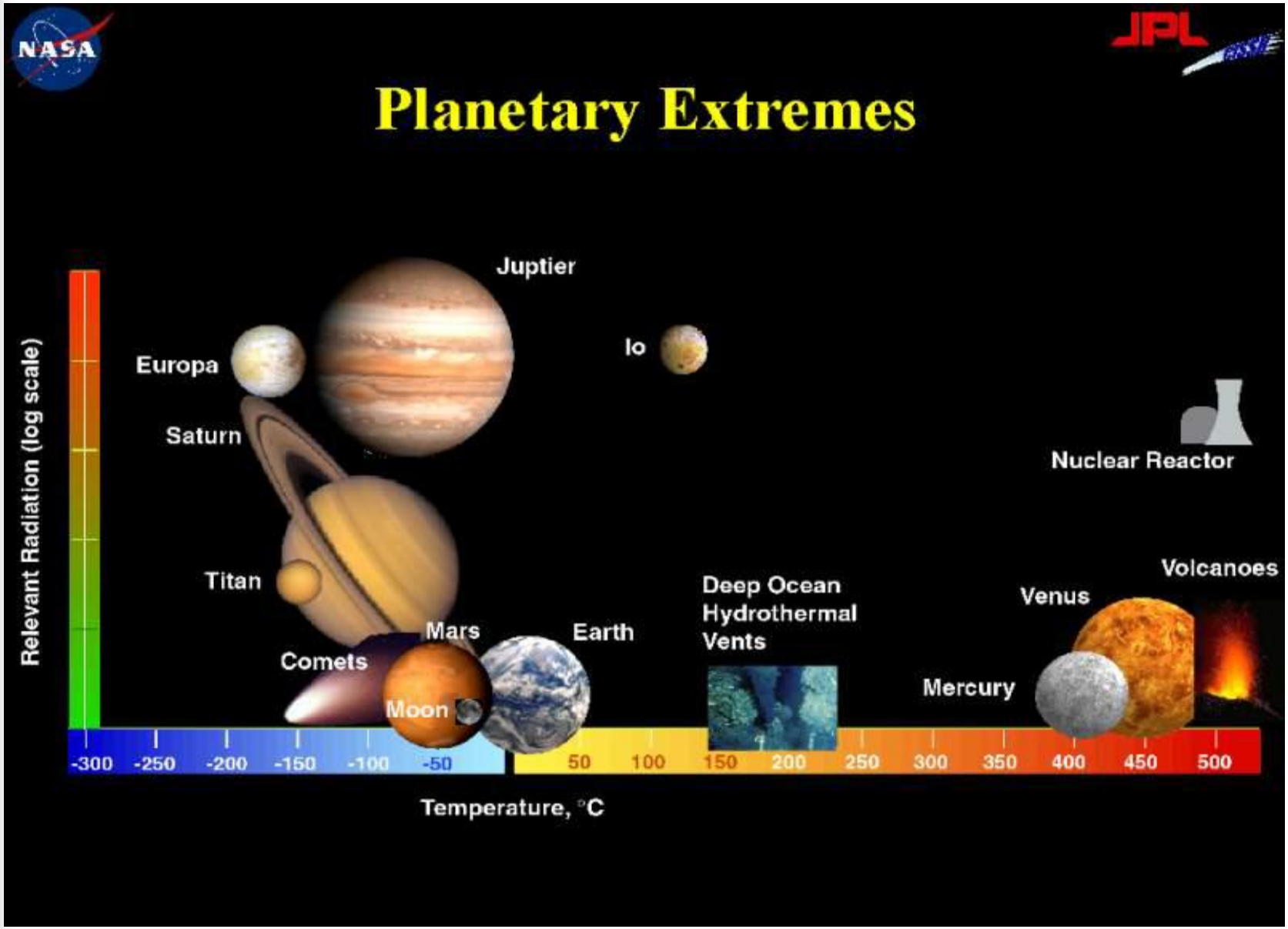

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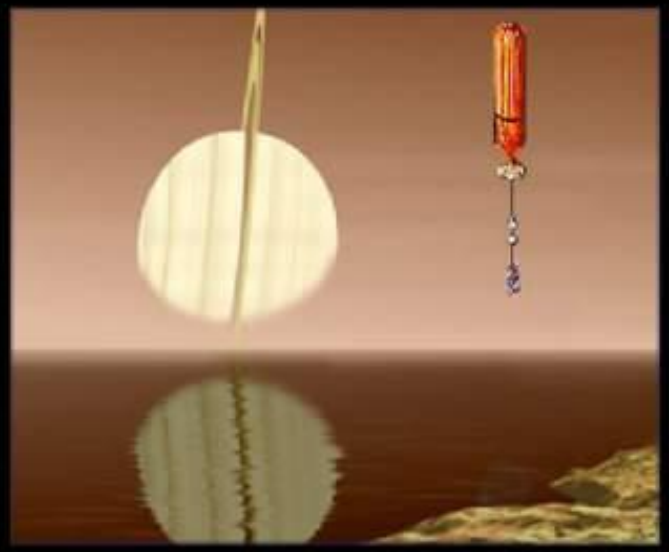
Titan Exploration: Beyond Cassini/Huygens



Titan may bridge the gap between life's chemical building blocks and more evolved environments such as Earth and Mars.

Critical Questions

- What prebiotic chemistry is taking place at Titan and what can it tell us about the primordial Earth... and the origin of life?
- What is the composition of Titan's surface and how does it interact with the atmosphere?
- How has Titan evolved over its history?

- Atmospheric and surface measurements
- Aerial platforms, landers, surface rovers
- Atmosphere and surface sample return

Key Capabilities

- Balloon or aircraft mobility
- Aerocapture at Titan
- Miniature *in situ* chemistry lab
- Sample acquisition
- Bioload reduction
- Advanced propulsion

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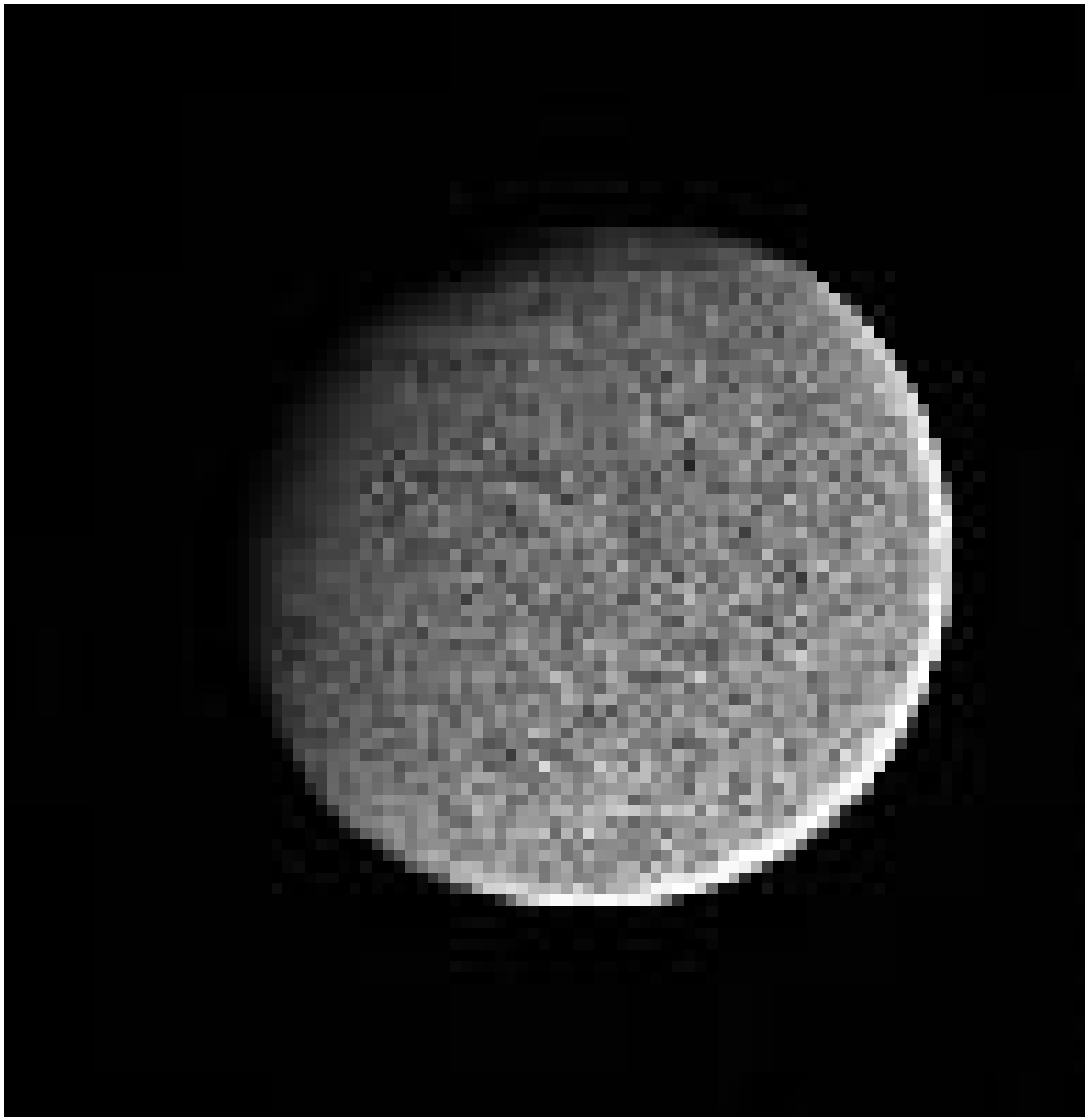

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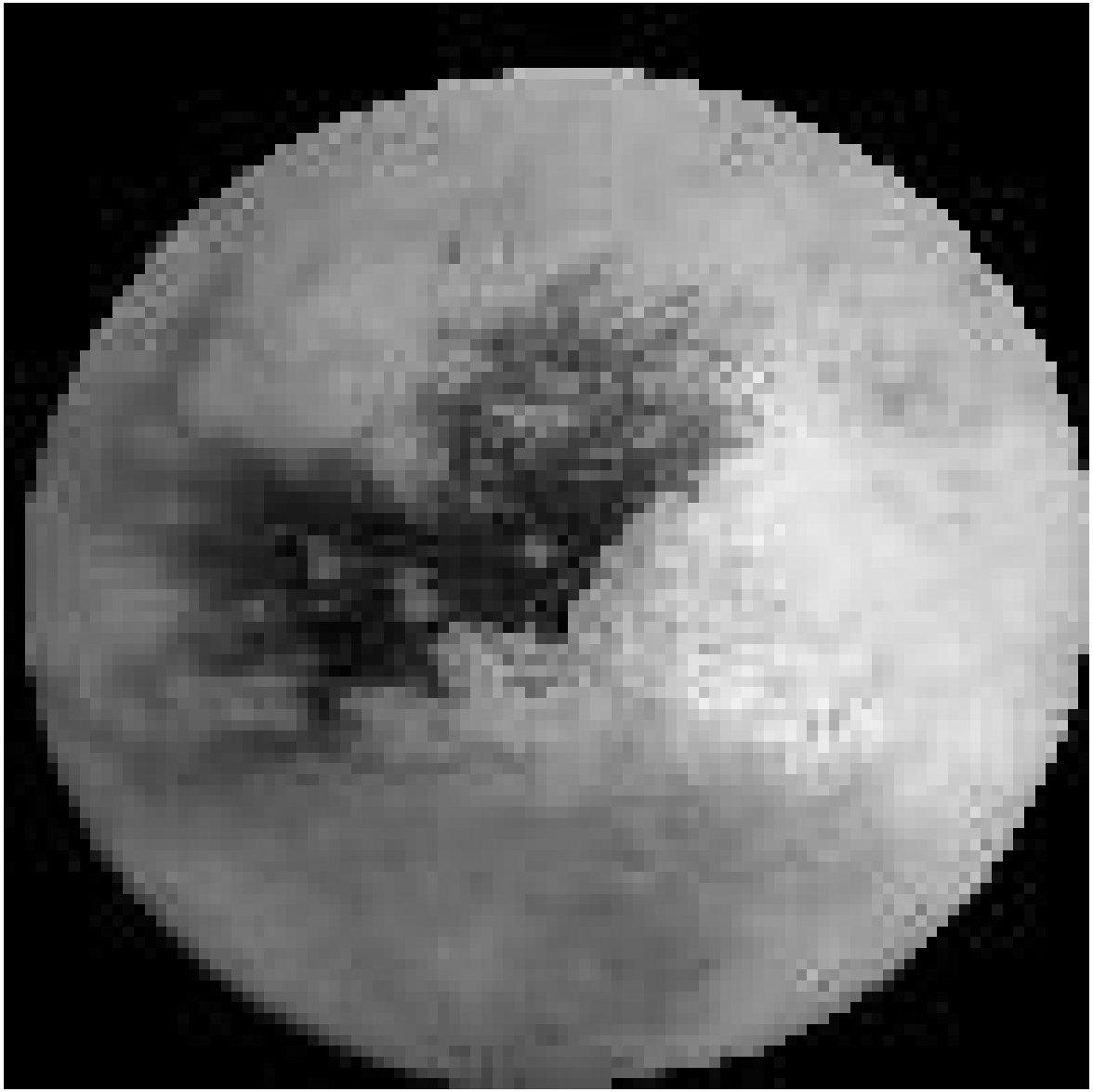

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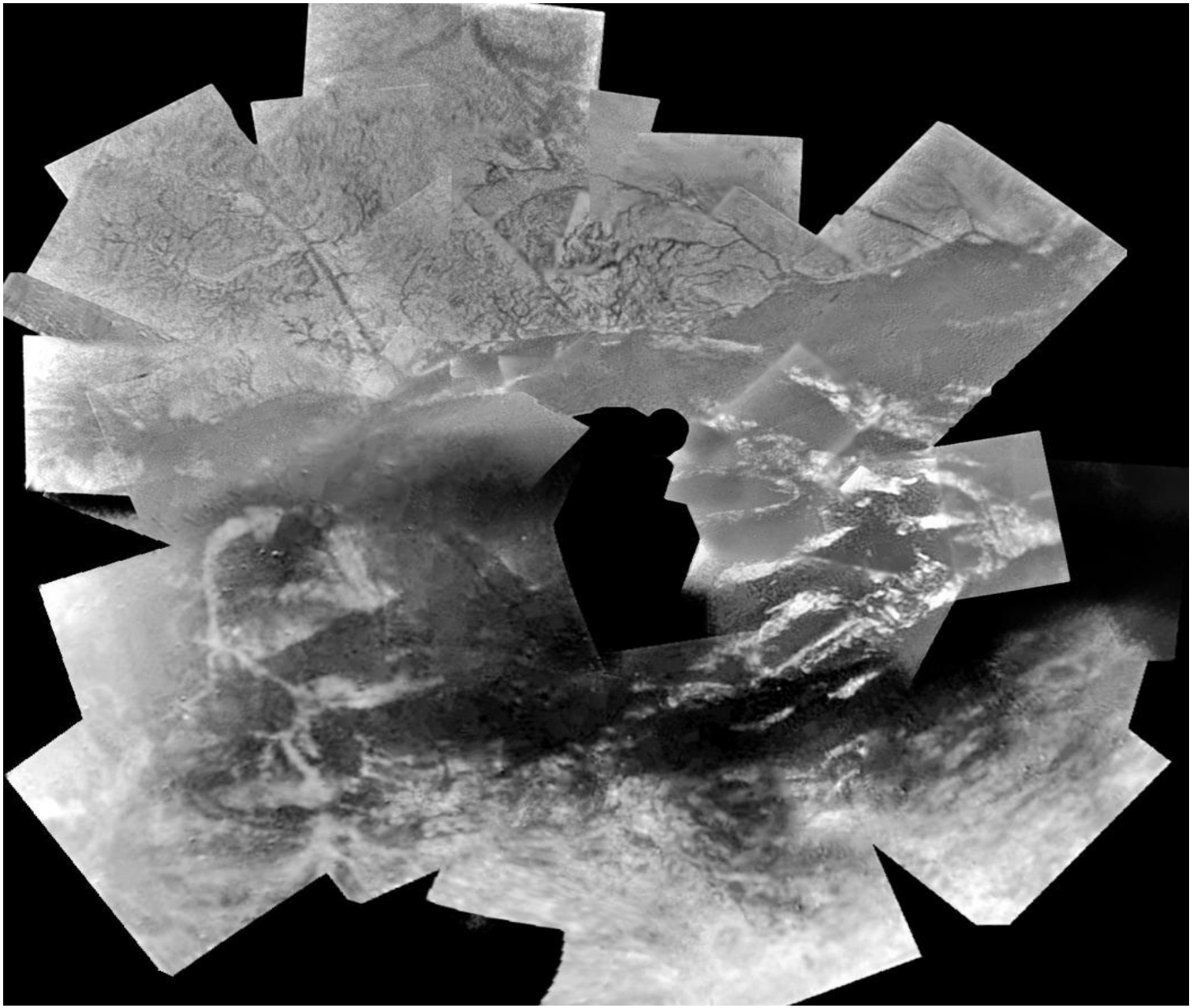

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METHANE ON TITAN.

Titan only moon in solar system with an atmosphere, nitrogen and approx 5% methane. Atmosphere 1.5 times thicker than earth.

Key is that the deep freezing conditions on Titan may have preserved chemical building blocks and an early life on earth scenario.

Fiona Stewart explains for Bellaonline Astronomy readers –

Although methane production could be an inanimate, inorganic, chemical reaction, there is a chance it is a natural bi-product of microbes living near or within the subsurface of Titan itself.

If this was so, then there is potential for life on Titan. With anticipation around the world, excitement mounts as further data is collected.

Is there life on Titan, Saturn's largest moon?

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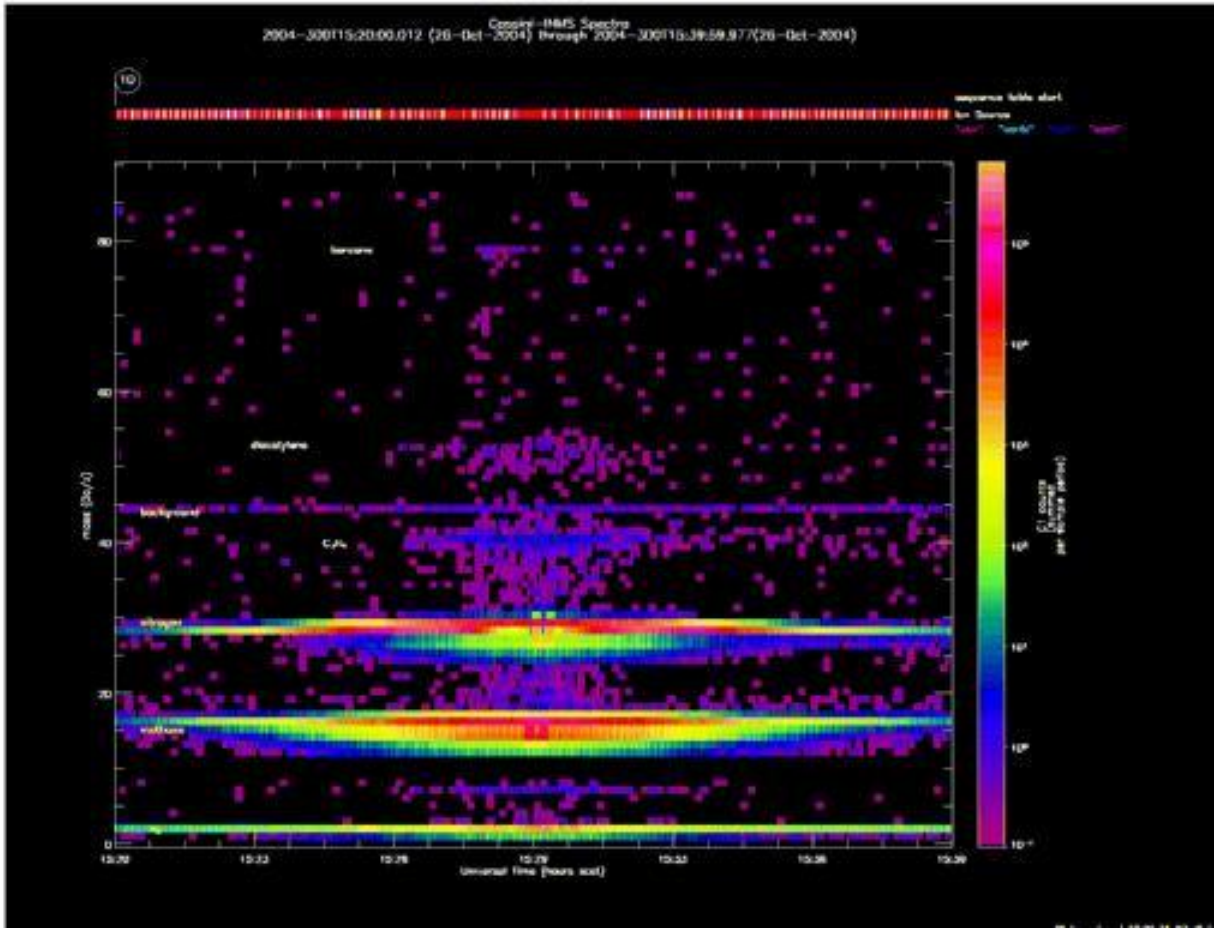
MULTIMEDIA FEATURES

Lots of Hydrocarbons **10.27.04**



This graph shows data acquired by Cassini as it flew by Titan at an altitude of 1,200 kilometers (745 miles) on Oct. 26, 2004 - its closet approach yet to the hazy moon. The data is from Cassini's ion and neutral mass spectrometer, which detects charged and neutral particles in the atmosphere. The graph reveals a diversity of hydrocarbons in the high atmosphere above Titan, including benzene and diacetylene.

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Astronomy Picture of the Day Jan 17 2005

Titan Landscape

Eerie orange light at ground level, rocks strewn could well be composed of water and hydrocarbons frozen solid at - 179 ºC. The light-toned rock below and left of centre is only about 15 centimetres across and lies 85 centimetres from the probe. Touchdown at 4.5 meters per second, surface consistency of wet sand or clay.
Huygen's probe transmitted data for more than 90 minutes after landing.
Titan's bizarre chemical environment may bear similarities to planet Earth's before life evolved.

This colour view across distant landscape on Titan. ESA's Huygens probe after a 2 1/2 hour descent through nitrogen and methane.

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Purple Haze

Encircled in a purple stratospheric haze, Titan appears as softly glowing sphere, this colorized image taken day after Cassini's first flyby. Two thin haze layers. Outer haze layer detached and floating high in atmosphere. The image falsely coloured: Titan retains normal pale orange hue, and both the main atmospheric haze and thin detached layer brightened and given purple colour to enhance visibility. Images reveal some haze key steps. Process thought to begin in high atmosphere, above 250 miles; uv light breaks down methane and nitrogen molecules. Products believed to react to form more complex organic molecules containing carbon, hydrogen and nitrogen that can combine to form the very small particles seen as haze.

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nature (10 March 2005)

Titan, the largest moon of Saturn, is the only satellite in the Solar System with a substantial atmosphere. The atmosphere is poorly understood and obscures the surface, leading to intense speculation about Titan's nature. Here we present observations of Titan from the imaging science experiment onboard the Cassini spacecraft that address some of these issues. The images reveal intricate surface albedo features that suggest aeolian, tectonic and fluvial processes; they also show a few circular features that could be impact structures. These observations imply that substantial surface modification has occurred over Titan's history. We have not directly detected liquids on the surface to date. Convective clouds are found to be common near the south pole, and the motion of mid-latitude clouds consistently indicates eastward winds, from which we infer that the troposphere is rotating faster than the surface. A detached haze at an altitude of 500 km is 150–200 km higher than that observed by Voyager, and more tenuous haze layers are also resolved.

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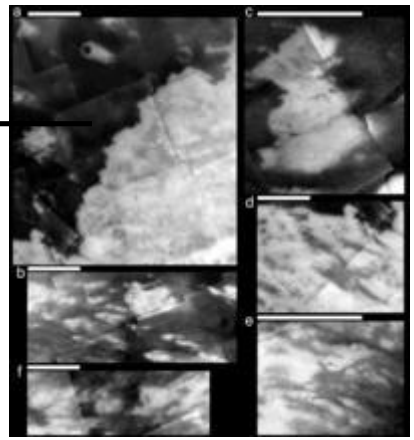
Cassini Images of Titan Reveal an Active, Earth-like World
March 9, 2005

(Source: Jet Propulsion Laboratory)

Saturn's largest and hazy moon, Titan, has a surface shaped largely by Earth-like processes of tectonics, erosion, winds, and perhaps volcanism. The findings are published in this week's issue of the journal Nature.

Titan, long held to be a frozen analog of early Earth, has liquid methane on its cold surface, unlike the water found on our home planet. Among the new discoveries is what may be a long river, roughly 1,500 kilometers long (930 miles). Scientists have also concluded that winds on Titan blow a lot faster than the moon rotates, a fact long predicted but never confirmed until now.



Scrutinizing Titan's Surface

Tectonism (brittle fracturing and faulting) has clearly played a role in shaping Titan's surface. "The only known planetary process that creates large-scale linear boundaries is tectonism, in which internal processes cause portions of the crust to fracture and sometimes move either up, down or sideways," said Dr. Alfred McEwen, Cassini imaging team member from the University of Arizona, Tucson. "Erosion by fluids may accentuate the tectonic fabric by depositing dark materials in low areas and enlarging fractures. This interplay between internal forces and fluid erosion is very Earth-like."

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Since most of the cloud activity observed on Titan by Cassini has occurred over the south pole, scientists believe this may be where the cycle of methane rain, channel carving, runoff, and evaporation is most active, a hypothesis that could explain the presence of the extensive channel-like features seen in this region. In analyzing clouds of Titan's lower atmosphere, scientists have concluded that the winds on Titan blow faster than the moon rotates, a phenomenon called super-rotation. In contrast, the jet streams of Earth blow slower than the rotation rate of our planet.

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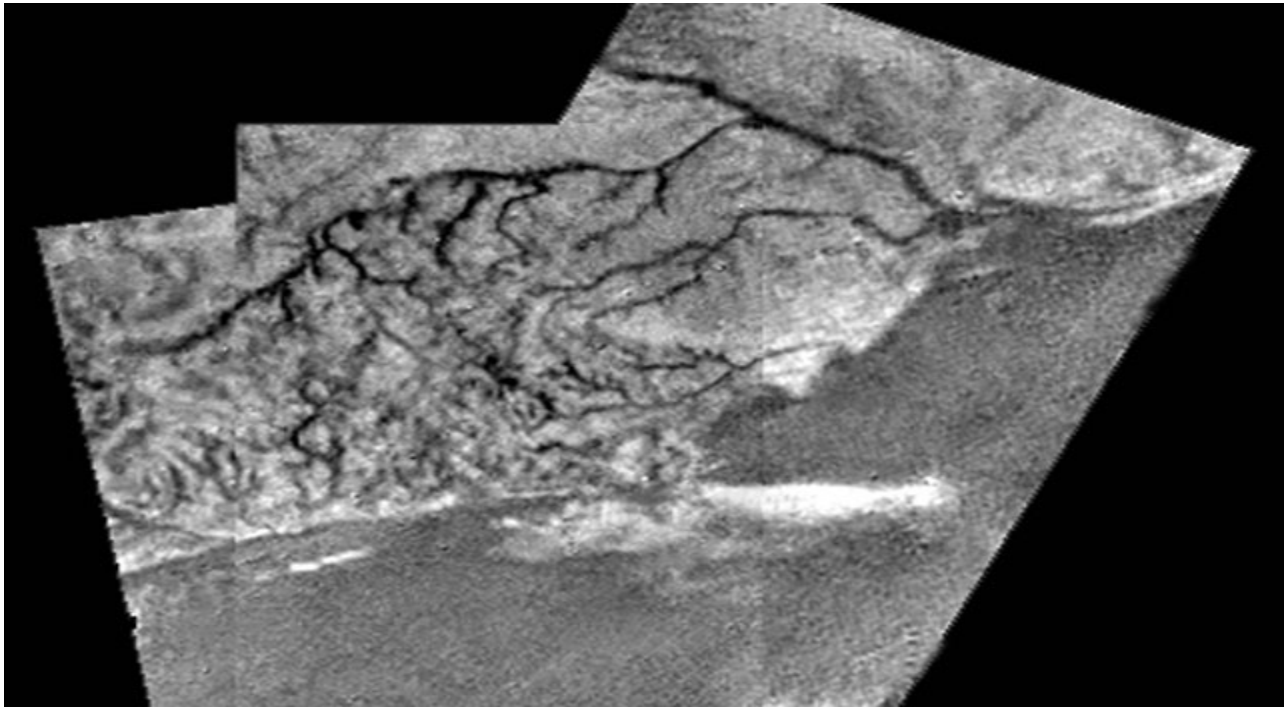

Riverbeds and Lakebeds Discovered on Saturn's Titan

Credit: ESA, NASA, Descent Imager/Spectral Radiometer Team (LPL)

Explanation: Methane rain, evaporating lakes, flowing rivers, and water ice-volcanoes all likely exist on Saturn's moon Titan, according to preliminary analyses of recent images taken by the successful Huygens lander. A snaking and branching riverbed is identified with the dark channel near the top of the above image, while a dark lakebed is identified across the image bottom. Both the riverbed and lakebed were thought to be dry at the time the image was taken but contained a flowing liquid - likely methane - in the recent past. Titan's surface was found to appear strangely similar to Earth even though it is so cold that methane flows and water freezes into rock-hard ice.

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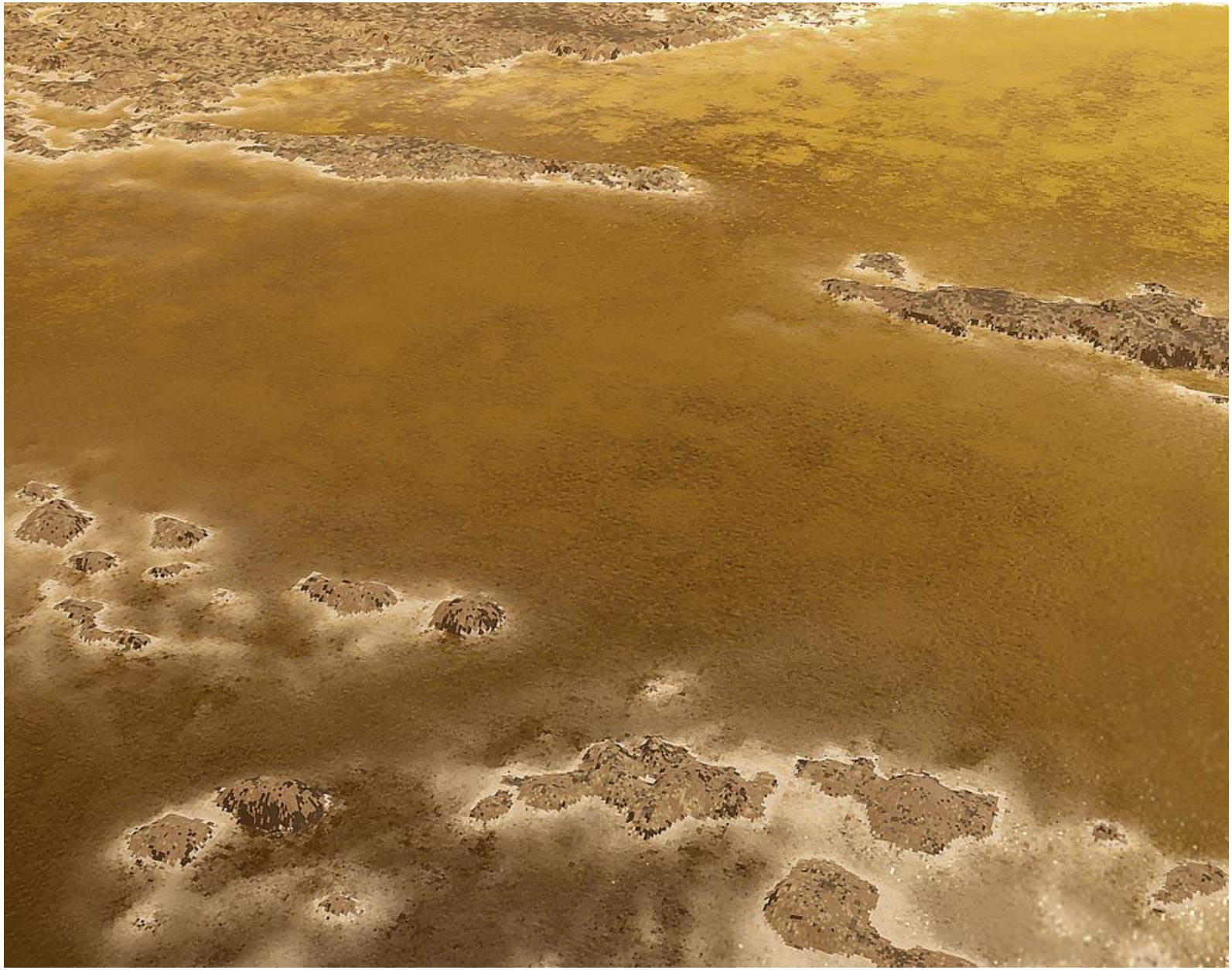

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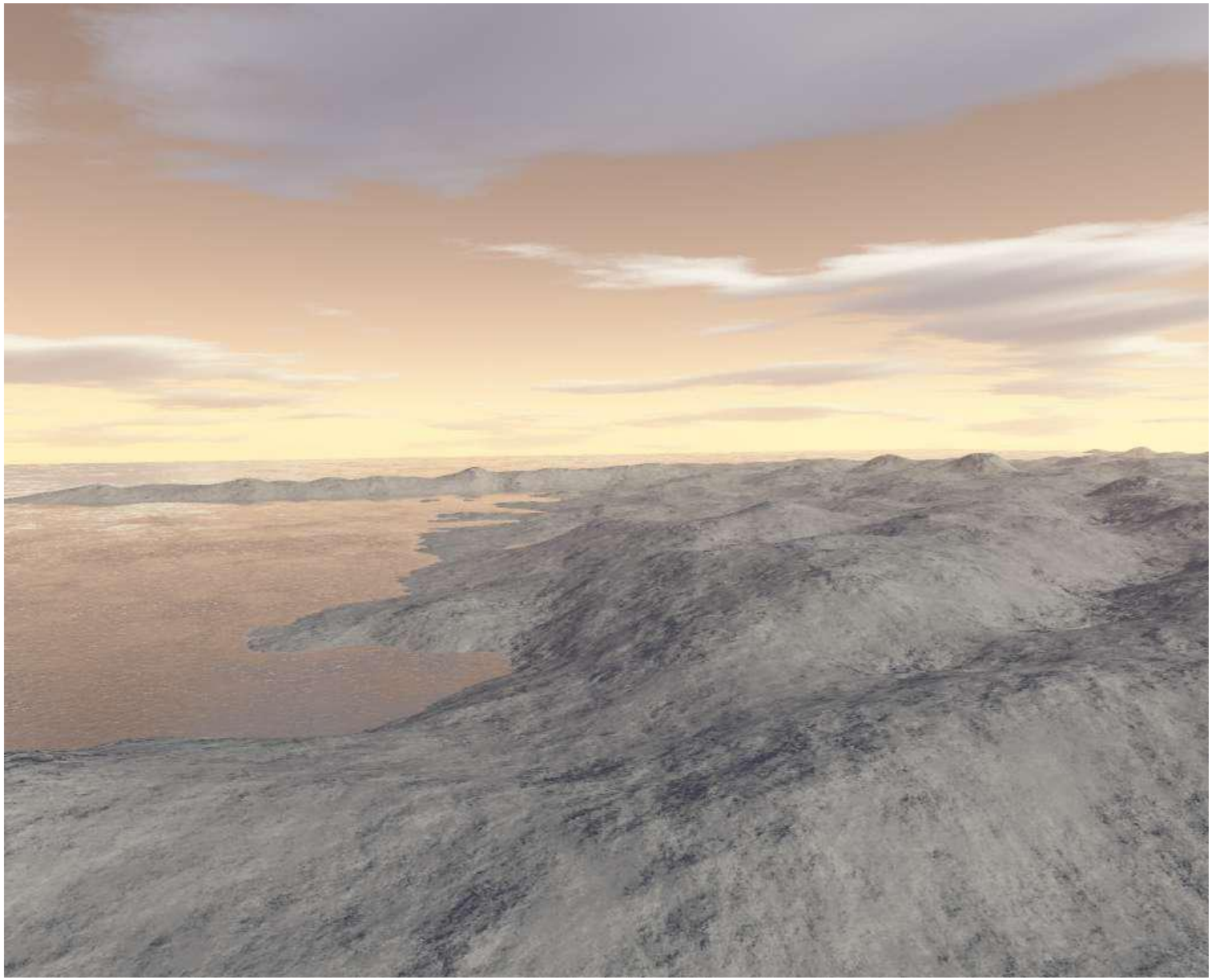

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Mercury Over Leeds 7 March 2005
Credit & Copyright: Tony Cook

Explanation: Have you ever seen the planet Mercury? This week might be a good time. Because Mercury orbits so close to the Sun, it never wanders far from the Sun in Earth's sky. If trailing the Sun, Mercury will be visible low on the horizon for only a short while after sunset. If leading the Sun, Mercury will be visible only shortly before sunrise. So at certain times of the year an informed skygazer with a little determination can usually pick Mercury out from a site with an clear horizon. Above, a lot of determination has been combined with a little digital trickery to show Mercury's successive positions during March of 2004. Each picture was taken from the same location in Leeds, England exactly 33 minutes after sunset. Over the next two weeks, Mercury will again be well placed for viewing above the western horizon at sunset, but by the third week in March it will have faded and dropped into the twilight.

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