Advanced topics in the Solar System

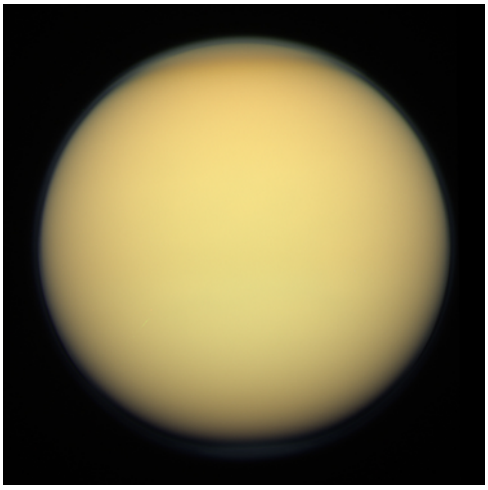
B2

Titan – A pale terrestrial world / Titan – bledý terestrický svět

Titan

Neither the most famous, nor the most glamourous-looking moon in the Solar System. Titan is one of Saturn's moons, and were you to look at it from its orbit, all you'd see would be a yellow-tinted pale and hazy ball.

Despite that, Titan is secretly one of the most fascinating places in our System. Not only is it Saturn's largest moon and the second largest in our System, it's also the only known moon to have a dense atmosphere and, more importantly, it is the only known object in the Solar System besides Earth with a clear evidence of stable bodies of surface liquid, meaning there are oceans on Titan just as there are oceans on Earth.



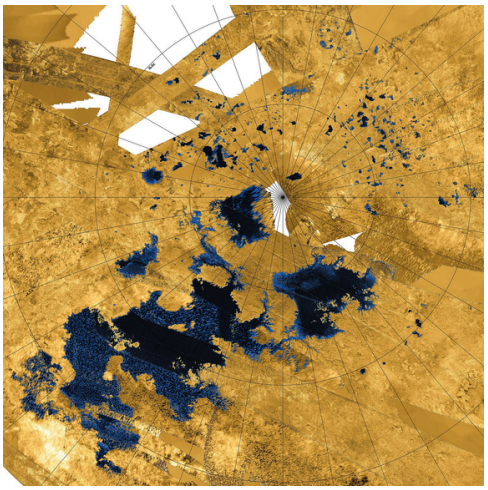
Titan as observed by the Cassini orbiter in December 2011

Oceans of what?

Much like Earth, Titan also has surface features similar to dunes, rivers, deltas, lakes and seas, but unlike Earth, those features are of liquid methane and ethane – organic compounds which on Earth are usually the byproduct of life.

Besides the fascinating surface, the moon is mainly composed of water ice with a rocky core surrounded by a crust of ice and a subsurface layer of ammonia-rich liquid water. Its atmosphere mainly consists of nitrogen, much like on Earth, but unlike on Earth, the second-most abundant element in the air is methane rather than oxygen. Its climate features weather much like ours, with rain and wind being rather frequent. Furthermore, while Earth has a water cycle, Titan has a methane cycle that is rather similar to ours. An interesting difference to our home is the periodicity of rain, which is measured there in years rather than days like in our case. Despite that, Titan is considered one of the most Earth-like celestial objects in the Solar System.

While carbohydrates are saccharides you'd find in your typical candies, you wouldn't want to eat hydrocarbons. These flammable organic compounds are abundant on Earth, and used in industry.



False-color radar mosaic of Titan's northern polar region, with lakes of hydrocarbons coloured blue

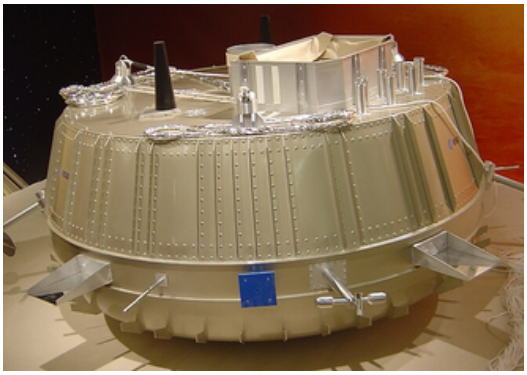
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Discovery and naming

The moon Titan was discovered by the Dutch astronomer *Christiaan Huygens* (in original Dutch pronounced hooy-khens) on 25th March 1655. Fascinated by Galileo's 1610 discovery of Jupiter's four largest moons and his advancements in telescope technology, Huygens, with the help of his elder brother, began building telescopes around 1650.



Huygens full-size replica, as presented in Paris in 2005

Observation and exploration

Without equipment, Titan can't be seen from Earth due to its size, distance, and especially proximity to Saturn and its rings. Due to this, observations of Titan were very limited before the 20th century.

Later Titan was more closely investigated by the Voyager I probe and by far the most important event in respect to Titan was the *Cassini–Huygens* mission, within which Titan's surface was mapped, and even more spectacularly, an atmospheric probe Huygens landed on its surface on 14th January 2005. Upon landing, the probe photographed a dark plain covered in small rocks and pebbles made out of water ice. Furthermore, Titan became the most distant body from Earth to have a space probe landed on it. In the year 2034, a NASA probe *Dragonfly* is expected to land on Titan once again.



Graphic concept of the Dragonfly mission, as visualised by NASA

- pale [peɪl] - bledý, světlý
- glamourous-looking [ˈglæmərəs ˌlʊkɪŋ] - úchvatně vypadající
- hazy [ˈheɪzi] - mlhavý, zamlžený
- deltas [ˈdeltəz] - delty (říční)
- ammonia [əˈməʊniə] - amoniak, čpavek
- abundant [əˈbʌndənt] - hojný, bohatě se vyskytující
- advancements [ədˈvɑːnsmənts] - pokroky, zdokonalení
- proximity [prɒkˈsɪməti] - blízkost
- investigate [ɪnˈvestɪgeɪt] - zkoumat
- pebbles [ˈpeblz] - oblázky, kamínky
- body [ˈbɒdi] - těleso (vesmírné), tělo

Write in your notebook

Do you know of any other moons in the Solar System where water ice is said to be found? What are, in your opinion, chances of life being found?

Why are space agencies interested in Titan in particular, what features make it stand out compared to other moons?

What impact does the proximity of Titan to Saturn have on its conditions?