# Saturn and the Icy Moons Titan and Enceladus under Cassini-Huygens Perspective

The aim of this work is to investigate the triumphs obtained by the Cassini-Huygens mission sent to probe Saturn, its rings and its moons, with emphasis on the results on the icy moons Titan and Enceladus. The structure of this research was divided into four main parts: Saturn and its moons (before Cassini), a Cassini mission, Cassini-Huygens spacecraft Saturn and its moons (after Cassini and beyond). Firstly, the understanding about Saturn, Titan and Enceladus available before the mission will be detailed. In the next, the objectives of the mission will be exanimated. After that, we will cover the journey of the spacecraft from Earth to Saturn system, passing through Venus and Jupiter to benefit from the gravitational pull of these planets until reaching the planet. The Huygens spacecraft was sent to Titan in order to get information about the surface of this moon, while the Cassini spacecraft was hurled towards Saturn and penetrated its atmosphere. In the third part, we will focus in the scientific instrument and experiments which composed the Cassini spacecraft and the European probe Huygens such as plasma spectrometer, cosmic dust analyzer, infrared spectrometer, mass spectrometer; imaging system, magnetosphere imaging instrument, magnetrometer, radar, radio and plasma wave observers, thermal radioisotope generator, ultraviolet spectrograph and visible and infrared mapping spectrometer. Finally, in the fourth and last part, the understanding of Saturn, Titan and Enceladus in the post Cassini era will be presented, showing how the space environment around Saturn behaves, in particular, how the magnetosphere of this planet is coupled with its main moons and atmospheric phenomena such as auroras observed at the poles of this Jovian planet will be investigated.

References

[1] P. M. Schenk, *et al., Enceladus and the Icy Moons of Saturn*, Arizona LPI, **2018**.
[2] R. M. C. Lopes, *et al. Cryovolcanic features on Titan's surface as revealed by the Cassini Titan Radar Mapper*, Icarus, 186, 395–412, **2007**.
[3] M. K. Dougherty, *et al., Saturn from Cassini-Huygens*, Springer, **2009**.
[4] M. K. Dougherty e L. J. Spilker*, Review of Saturn's icy moons following the Cassini mission*, Rep. Prog. Phys., 81, 065901, **2018**.
[5] M. Meltzer, *et al., The Cassini-Huygens Visit to Saturn: An Historic Mission to the Ringed Planet*, Springer, **2015**.

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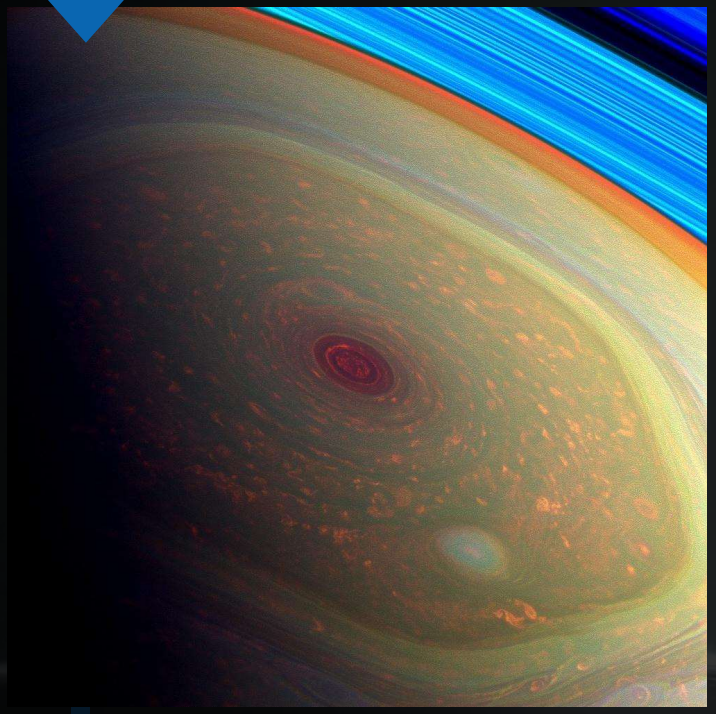
# Cassini-Huygen's triunphs

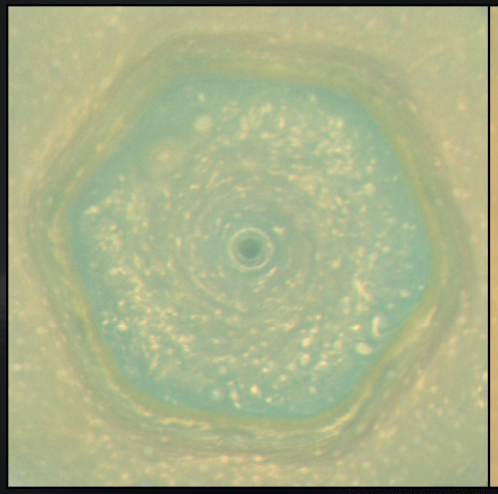
## Saturn's hexagon



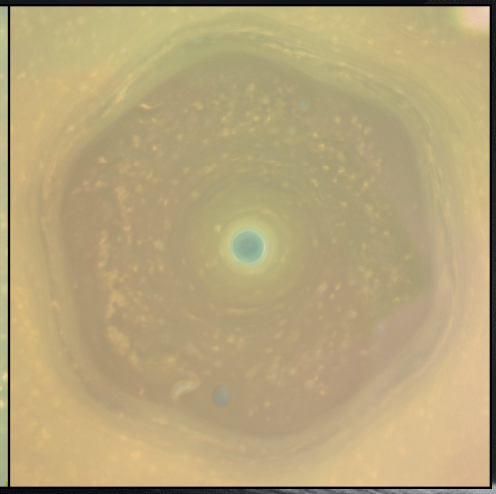
The Hexagon (false colors) by Cassini ISS.
Credit: NASA/JPL PIA14946

- CIRS and VIMS instruments determined the upper tropospheric temperatures: hotter at 79ºN and cold at 76ºN suggesting that the Hexagon is a stream jet, except for this shape;
- VIMS thermographs at 5 mm reveled that the clouds are composed by big particles.

Cloud velocities of 450 km/h insed the Hexagon!



Real color animation from 2013.



Real color animation from 2017

- **The Hexagon changed a little since it was discovered by Voyager 2**

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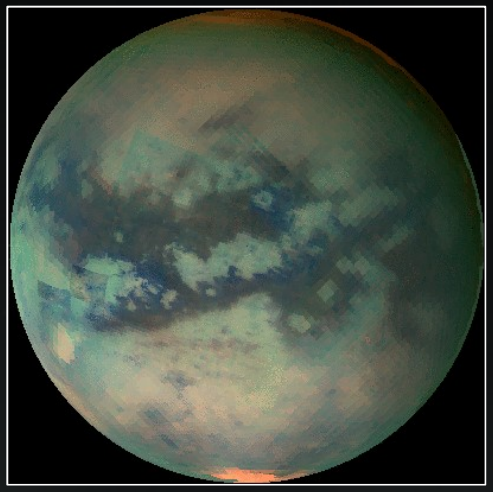
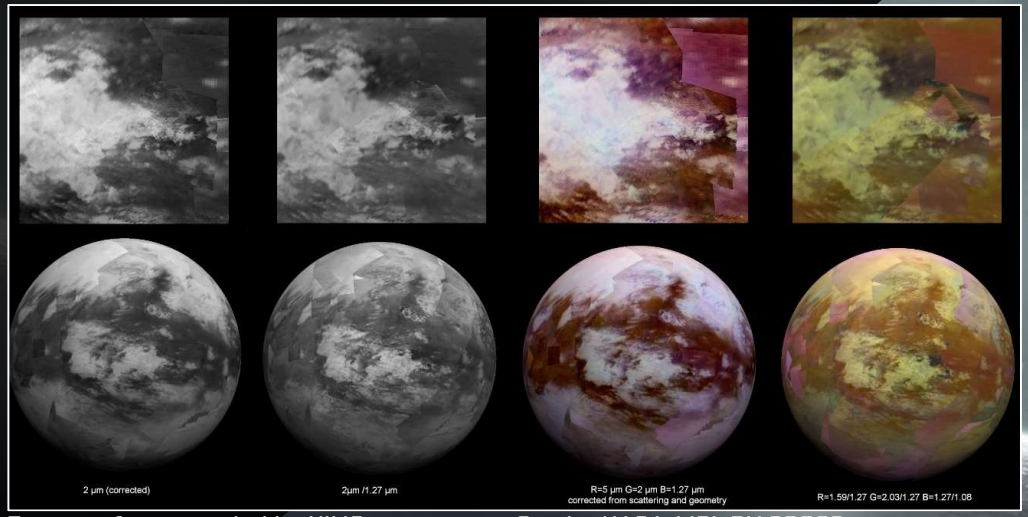
# Cassini-Huygen's triunphs

## Titan Unveiled

VIMS ISS



Titan unveiled by VIMS. Credit: NASA/JPL PIA02146




Titan surface unveiled by VIMS instrument. Credit: NASA/JPL PIA20022

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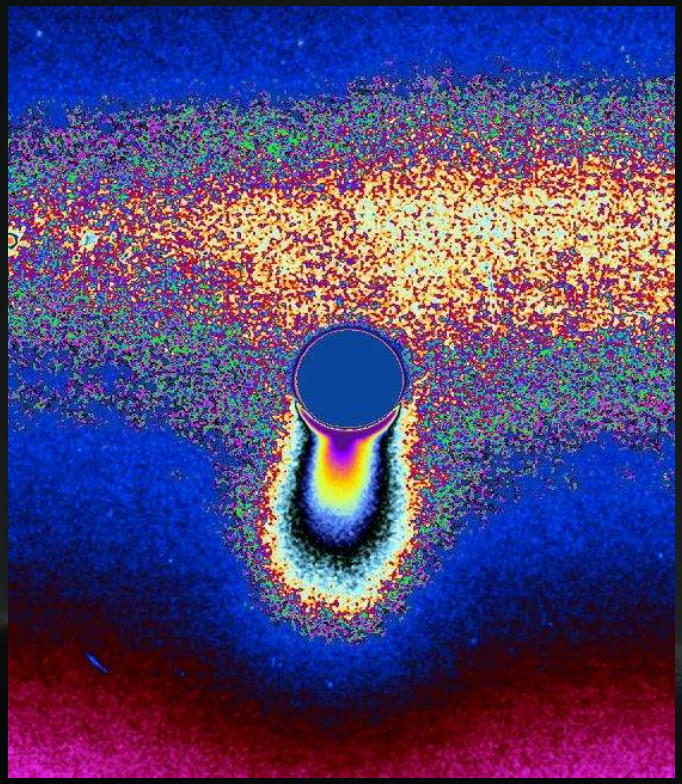
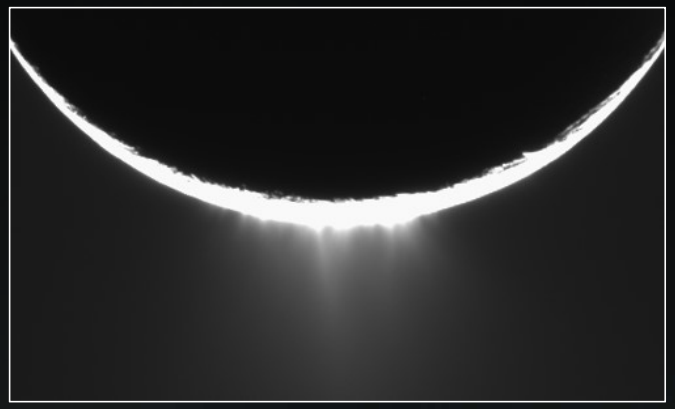
# Cassini-Huygen's triunphs

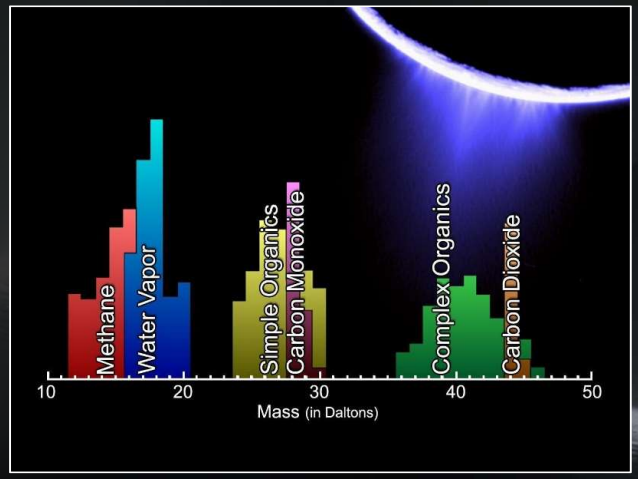
## Enceladus Plumes



Enceladus plume and Saturn E ring.
Credit: NASA/JPL PIA08226



Enceladus icy geysers. Credit: NASA/JPL PIA07762




Composition of the plume. Credit: NASA/JPL PIA10356

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Thanks for your AttentioN