

Today's Class: Gas Giants – Saturn & Titan

Reading: Uranus, Neptune, and Their Moons – Chapter 11 in *Cosmic Perspective*



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Last Class

- Inside Jupiter
 - Source of heat
 - Magnetosphere
- Atmosphere of Jupiter
- The moons of Jupiter
 - Io: Active volcanoes
 - Europa: Possible ocean & life?

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Class Exercise

Do you think a human expedition to Europa to search for life in this moon's ocean will be feasible during this century? Why or why not?



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Today's Class

- The Saturn System
 - Titan
 - Enceladus
- NASA's Cassini mission

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Saturn



Saturn

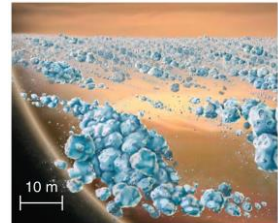
- Giant and gaseous like Jupiter
- Spectacular rings
- Many moons, including cloudy Titan

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Saturn


- Rings are NOT solid; they are made of countless small chunks of ice and rock, each orbiting like a tiny moon.



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Ring Formation

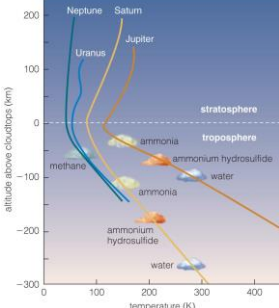


- Jovian planets all have rings because they possess many small moons close in.
- Impacts on these moons are random.
- Saturn's incredible rings may be an "accident" of our time.

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Jovian Planet Atmospheres




- Other jovian planets have cloud layers similar to Jupiter's.
- Different compounds make clouds of different colors.

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Saturn's Colors

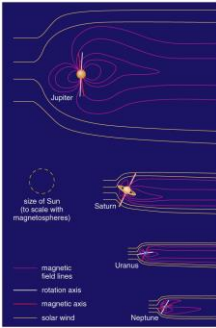


- Saturn's layers are similar, but deeper in and farther from the Sun (more subdued).

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Other Magnetospheres




- All jovian planets have substantial magnetospheres, but Jupiter's is the largest by far.

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Medium and Large Moons

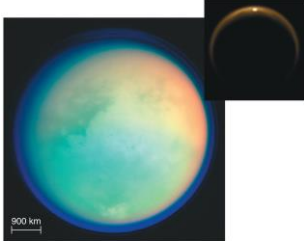


- Enough self-gravity to be spherical
- Have substantial amounts of ice
- Formed in orbit around jovian planets
- Circular orbits in same direction as planet rotation

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Titan's Atmosphere



- Titan is the only moon in the solar system to have a thick atmosphere.
- It consists mostly of nitrogen with some argon, methane, and ethane.

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Titan's Surface

- *Huygens* probe on Cassini provided first look at Titan's surface in early 2005.
- It found liquid methane and "rocks" made of ice.

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NASA's Dragonfly mission to Titan

video

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Enceladus – Geysers of Water

- Ice fountains of Enceladus suggest it may have a subsurface ocean.

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NASA's Cassini Mission

Cassini-Huygens: Mission to Saturn
BY THE NUMBERS

2.5 MILLION Images executed	4.9 BILLION Data returned since launch
635 Satellite orbits collected	3,948 Satellite images published
6 NAMED MOONS discovered	294 ORBITS completed
162 TARGETED FLYBYS of Saturn's moons	453,048 Images taken
27 NATIONS participated	360 Orbits burns

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Cassini at Saturn/Titan

Cassini probe arrived July 2004 (launched in 1997).
Ended mission in 2017.

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NASA's Cassini Mission: The End

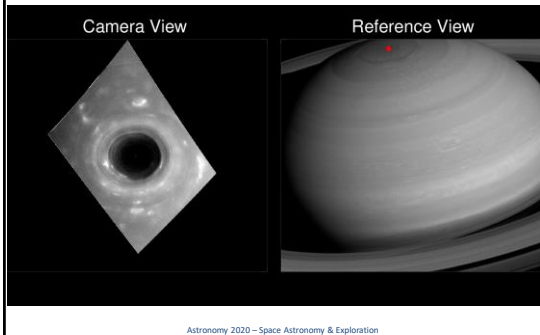
Cassini's Final Hour

- Exosphere/Thermosphere
- Ionosphere
- "Ring rain"
- Magnetic Field

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Saturn's Atmosphere



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What did we learn Today?

- The Saturn System
 - Titan
 - Enceladus
- NASA's Cassini mission

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