

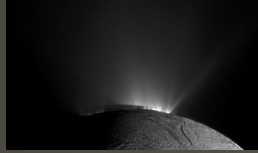
Moons and Rings of Saturn

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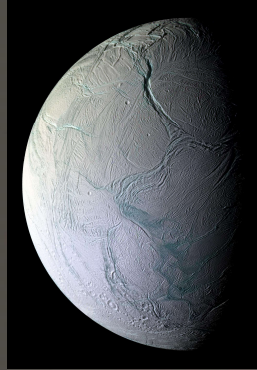
Introduction

- This project is looking at Saturn and its interesting set of moons and rings.
- While it is not the only planet to have rings in our solar system, it does have the most complex set of them.
- Saturn is a gas giant comprised mostly of hydrogen and helium and has 53 confirmed moons.
- The number of rings is subject to how you look at it but could be considered to have 7 up to more than 30 rings.
- Additionally, a few Saturn's moons have the capability to sustain life on them.

Enceladus



Up: Southern Pole of Enceladus emitting water/ice
Photo: NASA



Right: Enceladus
Photo: NASA/JPL/Space Science Institute

- Enceladus is about 310 miles in diameter
- Has global ocean of salt water beneath its icy surface
- Hydrothermal vents release jets of water containing amino acids from its southern pole
- Most of ice fails to escape the moon's gravity and falls back
- Is the most reflective body in our solar system
- Information collected by Cassini points to the possibility of life

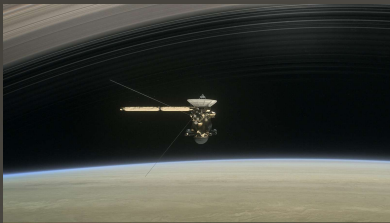
E Ring



E Ring with Enceladus at the center
Photo: NASA/JPL/Space Science Institute

- First observed in 1966
- Is considerably more diffused compared to Saturn's traditional rings
- Loose collection of debris primarily consisting of ice orbiting Saturn
- The ice is from the jets of water from Enceladus
- Spans 75,000 to 260,000 miles from Saturn

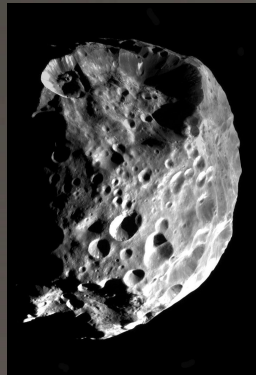
Cassini Mission



Artist representation of Cassini over Saturn
Image: NASA/JPL-Caltech

- Launched in 1998
- Collected information about Saturn's systems for about 20 years (13 of those orbiting Saturn)
- First mission to orbit Saturn, land in the outer solar system, and sample an extraterrestrial ocean
- Revealed a lot of information about Saturn's moons and rings - including the possibilities of life on other objects in our solar system
- Discovered three of the moons discussed in this project: Enceladus, Phoebe, and Iapetus

Phoebe



Phoebe
Image: NASA/JPL

- Phoebe has a radius of about 66.2 miles
- Orbits in the opposite direction of and on a different axis than other moons around Saturn
- Very dark and reflects little sunlight
- Could be a Centaur - Kuiper Belt objects that migrated from outer solar system to inner solar system
- Named after a goddess that Greeks named Artemis and Romans called Diana

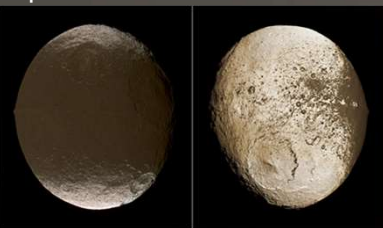
Phoebe Ring



Artist representation of the Phoebe Ring
Image: NASA/JPL-Caltech/Keck

- Has a radius of about 3.7 million to 10 million miles
- Composed of tiny dust and debris of the same composition as Phoebe that is difficult to see except through infrared
- Discovered by Wide-field Infrared Survey Explorer Spacecraft and Spitzer Telescope

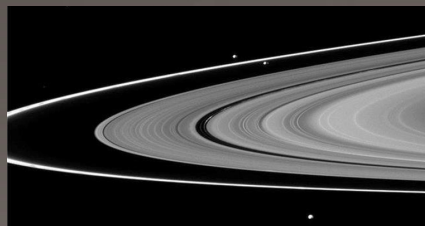
Iapetus



Iapetus
Image: NASA/JPL-Caltech/Space Science Institute

- Third largest moon
- Composed of $\frac{3}{4}$ ice and $\frac{1}{4}$ rock
- Always has the same face towards the sun
- Is believed to collect space particles from Phoebe
- Iapetus' rotation is longer than 79 days
 - This means the temperature cycle is very long
- Iapetus has an equatorial ridge of a 6 mile high chain of mountains
- Named after the Greek god Iapetus

F Ring and Shepherd Moons



F Ring between the Shepherd Moons, Prometheus and Pandora
Image: NASA/Kobe University

- A pair of moons: Prometheus and Pandora
- The F-Ring is in-between the orbit of the two moons
- Pandora is 88,000 miles away from Saturn while Prometheus is 87,000 miles away
- Pandora disrupts the ring while Prometheus maintains it
- F-Ring first observed by the Pioneer 11 team and Pandora and Prometheus first observed by the Voyager 1.

Conclusion

- Saturn provides us with ample opportunities to study various planetary properties.
- Even excluding Enceladus, there are multiple places in our solar system that could house some form of life on them.
- While Cassini's mission is over, there is still much more to learn about Saturn from the data it has recorded.
- The rings are relatively young in age and are replenished by their nearby moons.
- The particles making up the rings vary in size from grains of sand to 10-15 meters wide
- The rings probably form by destruction of a moon, moons that were unable to form, or by materials lost by the inner moons.

References:

- 1) <https://solarsystem.nasa.gov>
- 2) <https://www.sciencedirect.com>

(1) Mathematics and Statistics Department

(2) (3) Geography, Geology, and Environment Department