Mega Moons

## Vocabulary (underlined in script)

**Ejecta deposits**: Crater-impact surface material, pulled back down to its original object by gravity, that surrounds the crater (responsible for the distinct outlines we see around craters)

**Orbit**: The curved path of a celestial object or spacecraft around a star, planet, or moon, esp. a periodic elliptical revolution.

**Synchronous rotation**: A planet's moon takes the same amount of time orbiting the planet as it does rotating. This means the same side always faces the planet.

**Tidal force**: The force exerted on an object by the body around which it is orbiting, due to the gravitational pull on the near face of the object being much stronger than the far side.

## Outline

**Takeaway**

*Moons are satellites of planets. Some planets have many moons, some have only a few and others don’t have any moon at all. This presentation will focus on the different kinds of moons in our solar system, their origins and how they size up to other objects in the solar system.*

**Mercury**

* This is **not a moon**. This is the planet nearest to the sun, Mercury. Notice similarities between this planet and our moon.
* Introduce the concept of an **atmosphere**. Also, age of some space objects as evidenced by impacts…older objects have more; the farther back in time you go, the more “junk” there was in space. Mercury lacks an atmosphere, which would have also protected the planet from smaller impacts.

*Potential Questions: What are some similarities between Mercury and Earth’s Moon? Why don’t the two inner planets have moons?*

**Moon**

* Leading origin theory: about **5.45 billion years ago**, a Mars-sized **object collided with our planet**, the ejected **matter formed our Moon**.[[1]](#footnote-1)
* **Synchronous rotation** explains the “Dark Side of the Moon.”
* **Tidal force** **of the Moon** on the Earth’s oceans **causes high and low tide**. The Moon’s orbit may also help to stabilize our planet’s axis, regulating the seasons.
* **Maria** (Latin for “seas”) are impact craters that filled with lava shortly after the Moon was formed.
* **First human landing was on 7/20/1969**, though orbiters and probes visited prior to the landing. NASA’s Lunar Reconnaissance Orbiter (LRO) orbits the moon today, giving us detailed and updated images of our satellite.

*Potential Questions: Why isn’t there life on the Moon?*

**Phobos and Deimos: Asteroid Moons of Mars**

* **Both probably captured asteroids** from the asteroid belt. They have surface materials similar to asteroids there.[[2]](#footnote-2)
* Named for the two sons of the Greek god of war, Ares. *Phobos* means fear or panic. *Deimos* means flight.
* **Phobos**
  + **Stickney**: a massive crater over half the size of the moon itself
  + **Nearly shattered**. Might compare it to a jawbreaker cracked throughout or an egg with its shell cracked.
  + Slowly pulled toward Mars, in 10 million years: will either crash into Mars OR will break up and form a ring of dust around the planet.[[3]](#footnote-3)
* **Deimos**
  + Smaller than Phobos (9.3 x 7.5 x 6.8 mi)
  + Smoother/softer-looking **craters lack ejecta deposits** because Deimos does not have a significant gravitational pull.

**Life on Europa?**

* Smallest Galilean moon (smaller than our own moon). The Galilean moons are the moons discovered by Galileo: Ganymede, Io, Callisto, and Europa.
* **Icy surface containing a massive ocean below**.
* **Hydrogen peroxide (H2O2) on the surface**, which decays into oxygen in the presence of liquid water.
* **Life requires water and energy** . . . if there’s water under the surface and hydrogen peroxide fell into it, **both ingredients** may be **present**, if life there absorbs oxygen for energy.

**The Erupting Moons: Io and Enceladus**

* Volcanic activity is often a result of tidal forces at work.
* **Io: The Most Volcanic**
  + Moon of Jupiter (slightly larger than our Moon)
  + **Most volcanically active body** in the known universe.
  + Irregular elliptical orbit because its being affected by Jupiter’s orbit, Ganymede’s (the largest moon in the solar system) and Europa’s as well. This also explains the intense level of volcanic activity (tidal forces).
  + Volcanic plumes up to 190 mi above surface!
  + **Tidal forces cause surface to bulge up to 330 feet** (on Earth, *water* tides differ 60 ft . . . IO IS SOLID!)
  + **Tidal force/pressure causes extreme heat**, maintaining the molten subsurface responsible for the constantly-renewing solid surface
* **Enceladus and Ice Geysers**
  + Ice moon of Saturn
  + **Reflects almost 100% of light**, (high albedo) so the surface is extremely cold
  + Tidal force at work under the surface: the moon’s south pole is unusually warm, tiger stripes and plains suggest the liquid water under the surface is constantly renewing the surface
  + Ice and vapor in the atmosphere, and images of **ice geysers** have been collected from Cassini spacecraft.
  + The **ice** produced as a result of the geysers **gets swept up into the planet’s rings**.

*Potential Questions: Why isn’t our moon volcanic?*

**Titan: Moon of Saturn**

* **One of two places in the solar system with stable liquid on its surface**. These hydrocarbon lakes and seas are made up primarily of **methane**, but water has been observed in the atmosphere.
* **A thick atmosphere** of methane provides a greenhouse effect here.
* **Prebiotic environment**: with warmth, many of the chemicals present could provide a habitat for bacteria or life, in general. Right now, though, it’s *probably* too cold.

*Potential Questions:*

**Triton, Captive Moon of Neptune**

* Only large moon with a **retrograde** orbit (revolves around its planet in the opposite direction of the planet’s rotation)
* **Was possibly a Kuiper Belt Object** (outer region of the solar system), **similar composition to Pluto**.[[4]](#footnote-4)
* Crust of frozen nitrogen, thin atmosphere of methane and nitrogen, and a core of rock and metal.
* **Volcanoes,** with ices and water instead of magma, possibly heated by tidal friction or greenhouse-effect created by methane.[[5]](#footnote-5)
* Smooth volcanic plains and mounds

*Potential Questions:*

**Conclusion (All-Sky)**

* Stars = suns, probably w/ at least one planet, moon/s around those planets
* Moons can be different objects, have different origins
* Also affect the rotation/wobble of planets, some may even contain life!

**For further reading**

**“Tidal Locking” (Wikipedia)**: <http://en.wikipedia.org/wiki/Tidal_locking>

**Article on potential habitability of Titan:** <http://www.space.com/1544-scientists-reconsider-habitability-saturn-moon.html>

**Article on icy plumes of Enceladus and tidal forces:** <http://news.discovery.com/space/enceladus-saturn-tides-plumes-cassini-130731.htm>

**Life on Europa?**: <http://newswatch.nationalgeographic.com/2013/08/08/nasa-ponders-life-seeking-mission-to-europa-moon/>

1. “Origin of the Earth and Moon”, NASA. https://solarsystem.nasa.gov/scitech/display.cfm?ST\_ID=446 [↑](#footnote-ref-1)
2. “All About Mars: Martian Moons”, NASA. http://mars.nasa.gov/allaboutmars/extreme/moons/ [↑](#footnote-ref-2)
3. “Phobos Might Only Have 10 Million Years To Live”, Universe Today. http://www.universetoday.com/14258/phobos-might-only-have-10-million-years-to-live/ [↑](#footnote-ref-3)
4. “New capture scenario explain’s origin of Neptune’s oddball moon Triton”, UC Santa Cruz Currents Online. http://currents.ucsc.edu/05-06/05-15/triton.asp [↑](#footnote-ref-4)
5. “Voyager: Triton’s Volcanic Plains”, NASA. http://www.nasa.gov/mission\_pages/voyager/pia12184.html [↑](#footnote-ref-5)