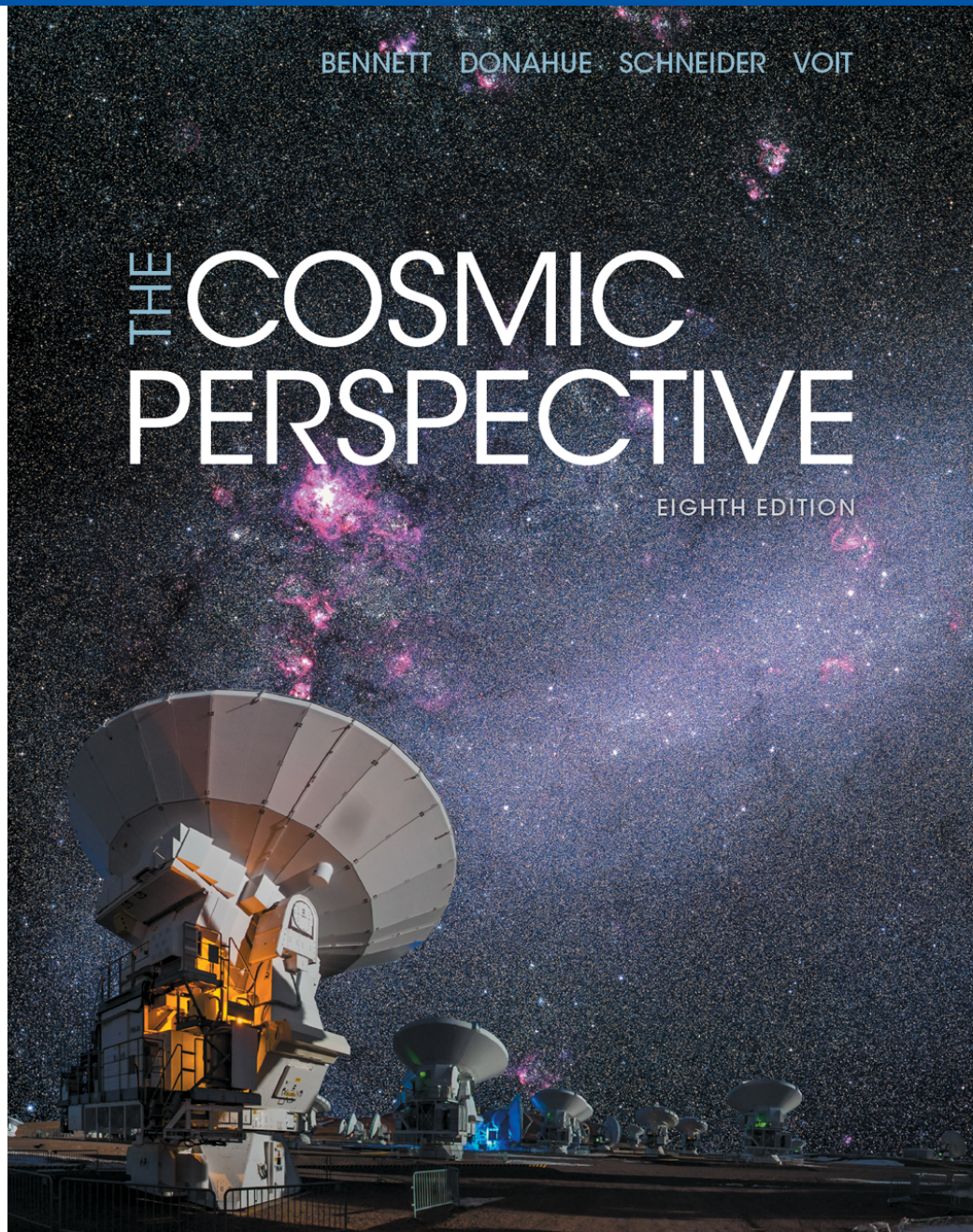
Review Clickers

Chapter 11: Jovian Planet Systems



If Jupiter were the size of a basketball, Earth would be the size of a(n)

a) bacterium.
b) grain of rice.
c) marble.
d) orange.
e) grapefruit.

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- Jupiter mass: ~ 320 Earth masses
- Jupiter radius: ~ 11 Earth radii

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b) a month
c) a year
d) several years
e) several decades

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Distance from Sun: ~ 5.2 AU

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b) all have many moons, but only Saturn has rings.
c) have moons, but Uranus and Neptune have only one or two.
d) are massive and rotate slowly.

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What is the structure of Jupiter like?

a) rocky core, thin atmosphere
b) rocky core, thick atmosphere
c) gaseous on the outside, then liquid hydrogen, more dense metallic hydrogen, rocky core
d) gaseous on the outside, then liquid hydrogen, then helium, then the other elements

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What are the most common *elements* in the atmospheres of the jovian planets?

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b) hydrogen and helium
c) oxygen and nitrogen
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e) none of the above

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What are the most common hydrogen compounds in the atmospheres of the jovian planets?

a) water (H_2O), methane (CH_4), ammonia (NH_3)
b) water and carbon dioxide (CO_2)
c) water and carbon monoxide (CO)
d) sulfur dioxide (SO_2) and propane (C_3H_8)
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Since there are a lot of flammable gases on Jupiter, such as methane and propane, if you lit a match, would Jupiter burn?

a) yes
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b) no

Burning requires oxygen and there is not enough of it in Jupiter's atmosphere

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a) escape into space.
b) condense and make rain.
c) condense and make clouds.
d) form compounds.

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Jupiter does *not* have a large metal core like Earth. How can it have a magnetic field?

a) The magnetic field is left over from when Jupiter accreted.
b) Its magnetic field comes from the Sun.
c) It has metallic hydrogen inside, which circulates and makes a magnetic field.
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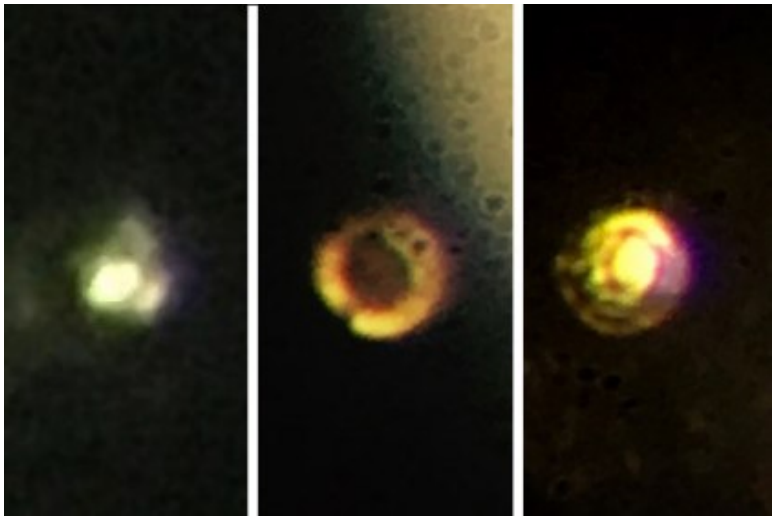
Credit: Isaac Silvera / Harvard U.



First generation of metallic hydrogen in the lab – enormous pressure is the key!

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a) are found on Earth.
b) are found on Jupiter.
c) indicate the presence of a magnetic field.
d) occur when particles in the solar wind hit a planet's atmosphere.
e) all of the above

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Jupiter is about three times as massive as Saturn, but only slightly larger. Why?

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b) It is made of less dense material.
c) Adding mass increases gravity and compresses the interior.
d) They are made of different gasses.
e) none of the above

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Looking at a jovian planet in different wavelengths of light allows us to

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b) see to different depths in the atmosphere.
c) see layers of different temperatures.
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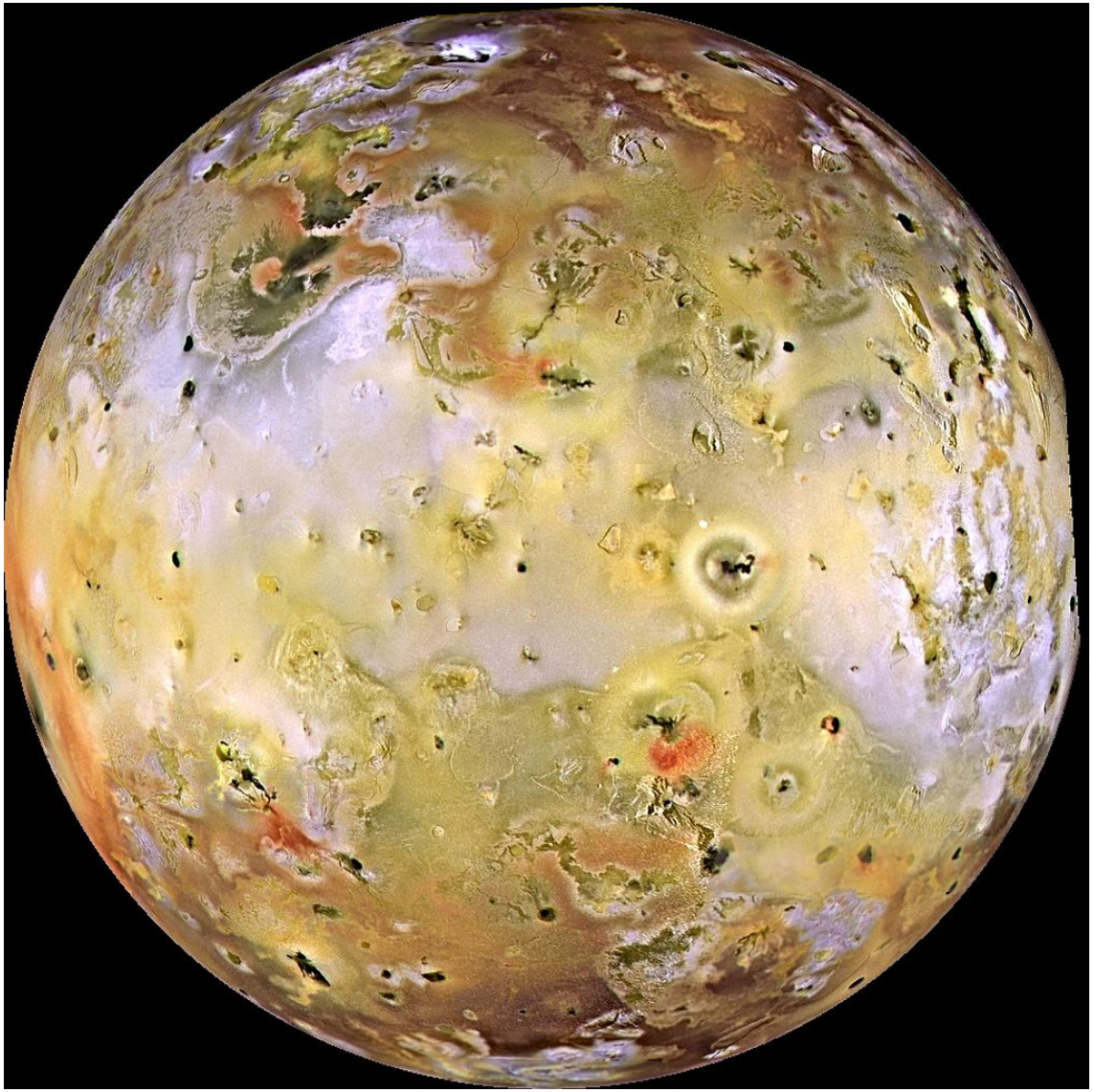

How does Io get heated by Jupiter?

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c) infrared radiation
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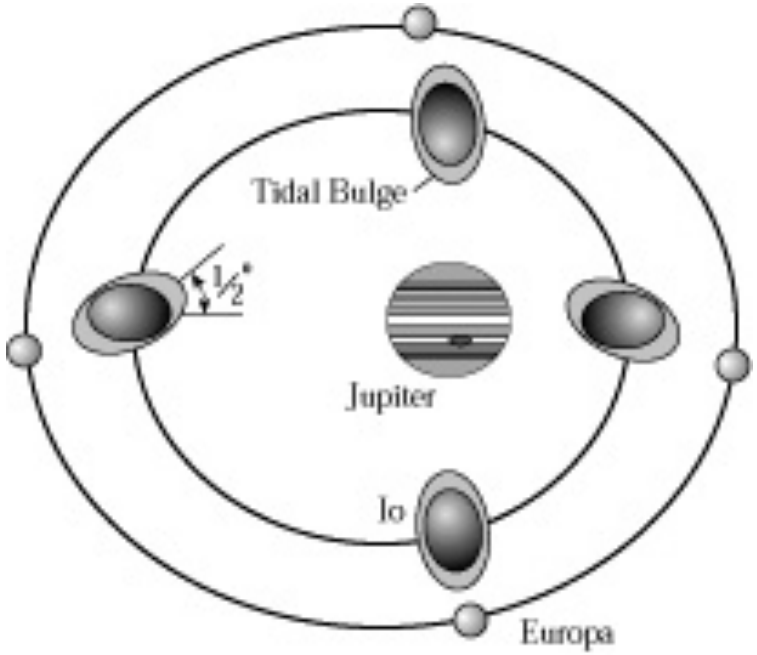

What would increase the tidal heating of a moon?

a) a more elliptical orbit
b) a larger size
c) a larger companion planet
d) all of the above
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How does the energy Jupiter radiates back to space compare to the energy from the Sun that falls on it?

a) Jupiter gives off more than it receives.
b) Jupiter gives off about as much as it receives.
c) Jupiter gives off less than it receives.

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Titan is the only moon with a thick atmosphere, and its surface

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b) has been seen by infrared light and spacecraft.
c) is warmed by a greenhouse effect.
d) has oceans of liquid methane and ethane.
e) all except A

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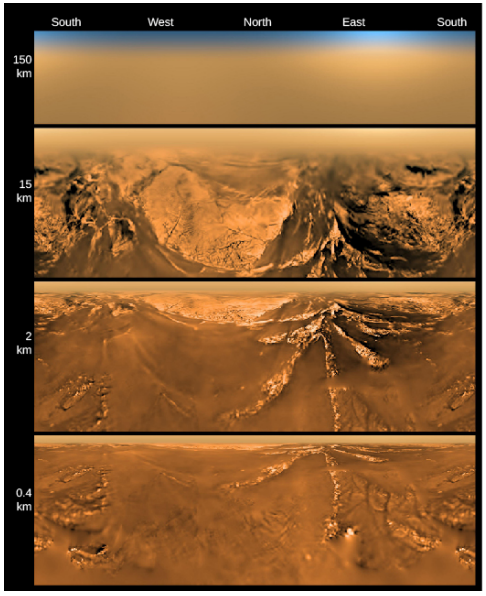

Image courtesy: ESA / NASA

What shape are moons?

a) spherical
b) large ones are spherical; small ones are irregular
c) small ones are spherical; large ones are irregular
d) Earth's and Jupiter's moons are spherical; Uranus' and Neptune's are not

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Why can icy moons be geologically active when a planet the same size would be "dead?"

a) Planets are older, so they have already cooled off.
b) Ice melts at a lower temperature than rock, making geological activity easier.
c) Many have tidal heating caused by their planet.
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Why do Jupiter, Saturn, Uranus, and Neptune all have rings?

a) They were left over from solar system formation.
b) They all captured particles.
c) All four planets had a large moon that disintegrated.
d) All have small moons and orbiting particles that constantly collide and make rings.

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Saturn's average density is less than water's. Suppose Saturn were placed on a much larger planet made entirely of water. What would happen?

a) It would float.

b) It would sink to the center of the water planet.

c) It would be spread out due to the rotation of the water planet.

d) It would merge into the water planet; denser materials sinking toward the core and lighter materials forming part of the atmosphere.

e) There would be a devastating impact and Saturn would be torn apart to form a giant ring system around the water planet.

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Would it be plausible to discover that Saturn's core is pockmarked with impact craters and dotted with volcanoes erupting basaltic lava?

a) Plausible. Saturn's moons also show impact craters and volcanoes.
b) Plausible. Saturn's atmosphere originated from the volatiles in impactors that were released via volcanic activity.
c) Implausible. No impactors would survive the immense pressures at the depth of Saturn's core.
d) Implausible. Any large impactor approaching Saturn would be broken up by tidal forces.
e) Implausible. Saturn's high rotation would prevent an impactor from reaching its core.

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Would it be plausible to discover that a jovian planet in another star system had a moon as big as Mars?

a) Plausible. There is no reason why jovian planets cannot have such large moons.
b) Plausible. Jupiter itself has several moons as large as Mars.
c) Plausible. Astronomers have already found large planets and moons around other star systems.
d) Implausible. Any moon that was as large as Mars would be torn apart by tidal forces.
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Would it be plausible to discover a new moon made almost entirely of metals such as iron and nickel, orbiting Neptune in its equatorial plane and in the same direction as Neptune rotates?

a) Plausible. At these large distances from the Sun, the moon could have a high metal content.
b) Plausible. The moon could be a captured asteroid.
c) Plausible. The moon could be a captured Oort cloud object.
d) Implausible. Solid objects at those distances are largely icy and rocky.
e) Implausible. Such a dense object would not last long before falling into Neptune.

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