About Quiz 4

This evening, 8:30 PM

Terrestrial planets (chapter 7; March 1 & 3)

Jovian planets (chapter 8; March 15 & 17)

Due dates

Planetarium reports: when this class begins

Quiz 4 corrections: Mon., March 22

Next Mastering Astronomy assignment (not yet posted):
Friday, March 26 at 5:30 PM.
Brooks Observatory telescope observing

Mon. - Thurs., March 22 – 55, 8:30 – 9:45 PM
(end time approximate)

See the class web page for weather updates.

Present your blue ticket with your name and my name written on it. If you don’t have a blue ticket, use a sheet of paper.

Please attend one session during the semester. You may also satisfy this requirement by attending a regular observing session after a Friday evening public planetarium show.

If you attend, a 1/2 to 1-page report/journal is due Wednesday of the following week.
Saturn’s moon Titan

Second largest moon in solar system, after Ganymede; Saturn’s only large moon

The only moon in the solar system with a significant atmosphere

Bulk density is 1.9 grams per cubic centimeter; suggests ice & rock bulk composition
Atmosphere

- Opaque in visible light because of haze & clouds
- Composition mostly nitrogen ($N_2$)
- Methane ($CH_4$) can exist as solid, liquid, or gas (similar to water on Earth)
- Other substances: various hydrocarbons
- A recent discovery: propane ($C_3H_8$) in upper atmosphere
How it got that way

- Water is frozen beneath surface
- Sunlight broke up ammonia (NH$_3$) molecules, hydrogen escaped
- Hydrocarbons like ethane (C$_2$H$_6$) formed

In conditions thought to exist at surface, ethane can rain out and form lakes

Seeing through the atmosphere to the surface with *Cassini*

- Short-wavelength infrared, just beyond visible: specific wavelengths
- Radar
Cassini findings. Here, “ice” means mixture of frozen volatiles: water, methane, ammonia

- Bright, icy hills, possibly volcanic (icy lava)
- Dry river beds emptying into large plains
- Liquid not directly visible
- Radar shows areas of low reflectivity (smooth); thought to be bodies of liquid
Huygens lander findings

- During descent, photographed river valleys
- Soft, mushy surface
- Ice boulders, smoothed by erosion
Saturn’s rings

From Earth, appear as thin, continuous sheets

But close examination shows many thin ringlets.

Ringlets in turn are made of small bodies, each in individual orbit around Saturn.

Rings give a strong echo of radar transmission, similar to echoes from icebergs.

Ring particles are probably ice-rich, house sized and smaller.
Gaps in rings (for example, Cassini division) are caused by repeated gravitational tug from satellite Mimas.

- Orbital period in gap is half the period of Mimas
- Repeated tugs eject ring particles from that location, gap is left

(Mimas & gap distances are to scale; sizes of bodies not to scale)
Jovian planets’ rings

Jupiter, Uranus, and Neptune also have rings, but they are thin, the ring particles are mostly dark (low reflectivity) and the rings are difficult to see.

Origin of rings

• Temporary: ring particles are being ground down to dust by collisions/impacts

• Satellites large and small are being pulverized as well; they are the source of new ring particles

• Number of particles in rings probably varies over time; brightness, visibility of rings may change.