Three Announcements

- Homework#1 due today.
  - If you didn't do it already, please put your homework in the box at the entrace hall RIGHT NOW. (Look for the box with a label "Komatsu".)
- Quiz#1 will returned after this class.
  - Pick up yours from the box after this class.
- 20min Quiz#2 on Tuesday
  - Details will be announced at the end of this class.

Station #1
The Solar System

Lecture 6: Welcome to the Solar System
Lecture 7: Formation of the Solar System
Lecture 8: Extrasolar Planets

Lecture 6
Welcome to the Solar System

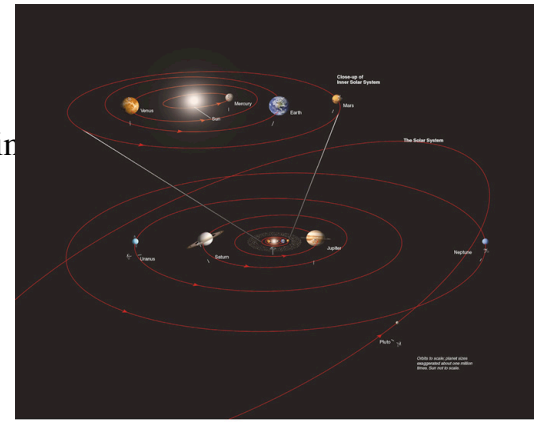
Reading: Chapter 8

Comparative Planetology

- Study the planets individually, or comparatively?
- Study the *similarities* among and *differences* between the planets
  - this includes moons, asteroids, & comets
- This approach is useful for learning about the big picture:
  - the physical processes which shape the planets
  - the origin and history of our Solar System
  - the nature of planetary systems around other stars

The Layout of the Solar System

- Large bodies in the Solar System have **orderly** motions:
  - planets orbit **counterclockwise** in same plane
  - orbits are almost circular
  - the Sun and most planets rotate counterclockwise
  - most moons orbit counterclockwise



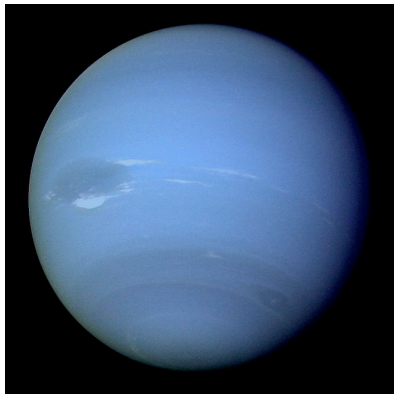
The Layout of the Solar System

- Planets fall into two main categories
  - Terrestrial (i.e. Earth-like)
  - Jovian (i.e. Jupiter-like or gaseous)

Terrestrial Planets	Jovian Planets
Smaller size and mass	Larger size and mass
Higher density (rocks, metals)	Lower density (light gases, hydrogen compounds)
Solid surface	No solid surface
Closer to the Sun (and closer together)	Farther from the Sun (and farther apart)
Warmer	Cooler
Few (if any) moons and no rings	Rings and many moons

Mars

Terrestrial



Neptune

Jovian

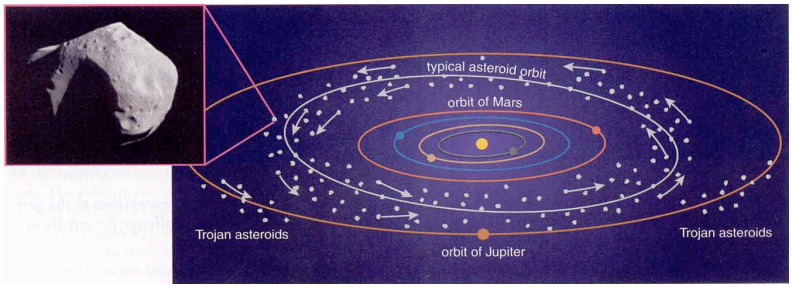
Photo	Planet	Average Distance from Sun (AU)	Temperature†	Relative Size	Average Equatorial Radius (km)	Average Density (g/cm³)	Composition	Known Moons	Rings?
	Mercury	0.387	700 K	·	2,440	5.43	Rocks, metals	0	No
	Venus	0.723	740 K	•	6,051	5.24	Rocks, metals	0	No
	Earth	1.00	290 K	•	6,378	5.52	Rocks, metals	1	No
	Mars	1.52	240 K	·	3,397	3.93	Rocks, metals	2 (tiny)	No
	Most asteroids	2–3	170 K	·	≤500	1.5–3	Rocks, metals	?	No
	Jupiter	5.20	125 K	●	71,492	1.33	H, He, hydrogen compounds‡	28	Yes
	Saturn	9.53	95 K	●	60,268	0.70	H, He, hydrogen compounds‡	30	Yes
	Uranus	19.2	60 K	●	25,559	1.32	H, He, hydrogen compounds‡	21	Yes
	Neptune	30.1	60 K	●	24,764	1.64	H, He, hydrogen compounds‡	8	Yes
	Pluto	39.5	40 K	·	1,160	2.0	Ices, rock	1	No
	Most comets	10–50,000	A few K§	·	A few km?	<1?	Ices, dust	?	No

More Far

Colder

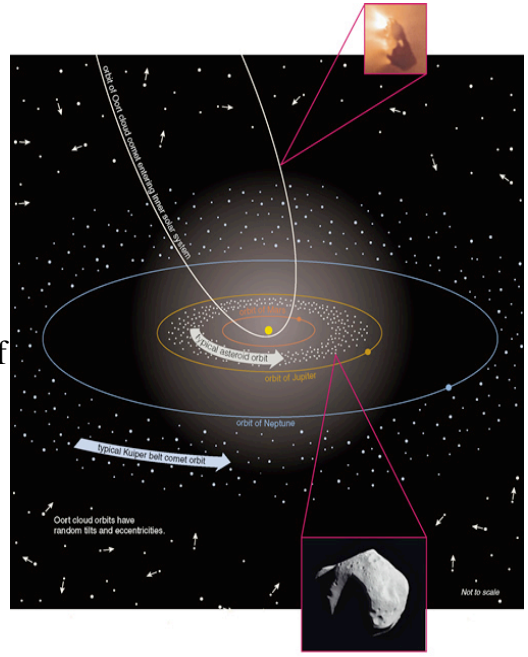
Non-planet Populations

- Asteroids
  - Their orbits are confined between Mars and Jupiter: Asteroid Belt.
  - The composition of asteroids is similar to that of terrestrial planets (rocks & metals).



Comets (Ices, rocks)

- Kuiper belt comets (Kuiper belt objects)
  - 30-100 AU
  - Orbits on the plane
  - Pluto may be one of them.
- Oort cloud comets
  - Much larger region (not known)
  - Orbits ***not*** confined on the plane



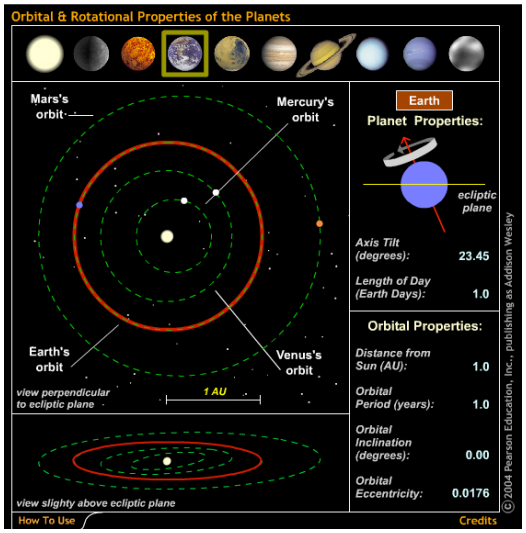
A Few Exceptions to the Rules…

- Both Uranus & Pluto are tilted on their sides.
- Venus rotates "backwards" (i.e. clockwise).
- Triton orbits Neptune "backwards."
- Earth is the only terrestrial planet with a relatively large moon.

The Sun – King of the Solar System

- How does the Sun influence the planets?
  - Its gravity regulates the orbits of the planets.
  - Its heat is the primary factor which determines the temperature of the planets.
  - It provides practically all of the visible light in the Solar System.
  - *Solar Wind*: High-energy particles streaming out from the Sun influence planetary atmospheres and magnetic fields.

A Brief Tour of the Solar System -- Motions



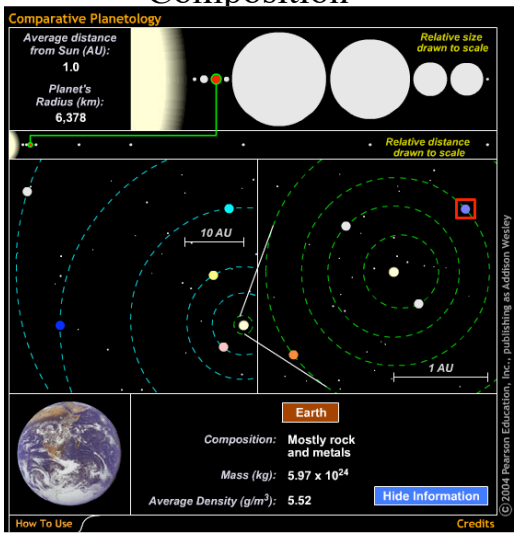
What is density?

density = mass/volume

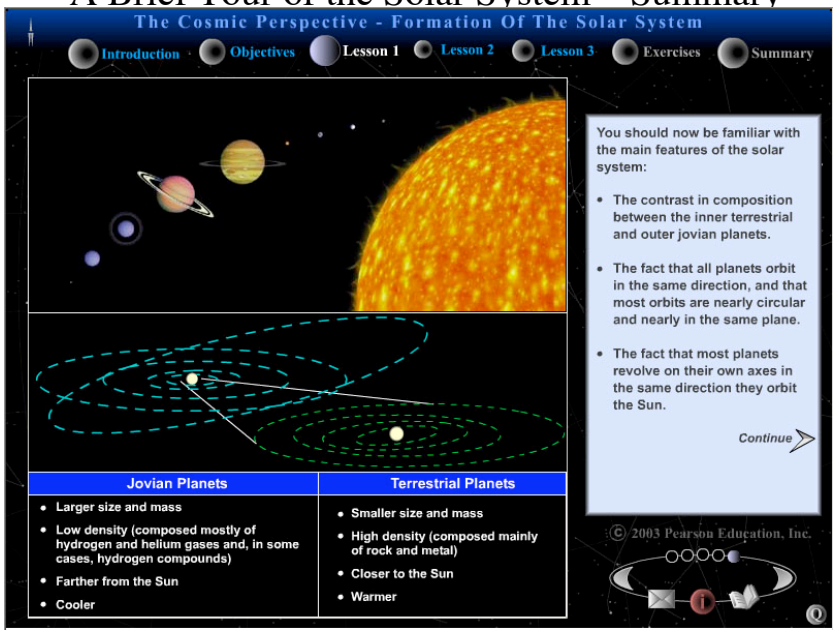
typical units: [g/cm^3]

Density of water is *defined* as 1 g/cm^3.

A Brief Tour of the Solar System – Composition



A Brief Tour of the Solar System – Summary



20min Quiz on Tuesday

- 11 Multiple-choice Problems
  - you choose the right answer from multiple choices (a) through (d). Problems will be chosen from "*Does It Make Sense?*" at the end of each chapter. Make sure that you know not only "yes" or "no", but also why it is "yes" or "no". (There will be two "yes" and two "no" in multiple choices!)
  - 3 problems from Chapter 5 (Laws of Motion)
  - 4 problems from Chapter 6 (Understand Light)
  - 4 problems from Chapter 8 (Welcome to the Solar Sys.)
- 3 Short-answer Problems
  - you answer in short sentences.
  - 1 problem from Chapter 5 on *Tides.*
  - 1 problem from Chapter 6 on *Spectra.*
  - 1 problem from Chapter 8 on *Kuiper Belt Objects.*