Physics of Planets

Professor: James Wray

Day 1: Course Overview & Scope of Planetary Sciences

What is Planetary Science?

In this course we will study the forces and influences that determine the composition, structure and evolution of planets in our solar system and others.

Physics

Chemistry

Astronomy

Geology

Atmospheric Science

Engineering

Biology?

What will we cover?

Partially up to you … but here's the plan for now:

- Solar system overview
  - Sun, giant vs. terrestrial planets, minor planets, satellites/rings
- Basic planetary properties (observable vs. inferable)
  - Remote sensing vs. *in situ* observations
- Orbital dynamics
  - Kepler's & Newton's laws, orbital elements, 3-body problem, tides, dissipative forces
- Energy transport
  - Blackbody radiation, equilibrium temperature, energy transport, thermal profiles, greenhouse effect
- Atmospheric properties
  - Structure, composition, meteorology, clouds, photochemistry, formation and escape

What will we cover?

Partially up to you … but here's the plan for now:

- Planetary surfaces
  - Mineralogy/petrology, cratering, gravity-driven processes, tectonics, volcanism, winds, fluvial, glacial processes
- Planetary interiors
  - Earth's interior, hydrostatic equilibrium, heat sources/transport, constituent relations, gravity fields, isotasy
- Magnetospheres
  - Take "Intro to Space Physics & Instrumentation" – Spring 2013!
- Planet formation
  - Gas clouds to stars/planets, planet migration, satellite formation
- Astrobiology
  - Life on Earth, Mars, icy satellites, exoplanets

Motivations

Origins:

Understanding solar system formation and evolution

… and exoplanets!

Comparative Planetology:

Understanding how governing forces and boundary conditions dictate atmospheric/surface conditions and variability

Motivations

Astrobiology

How does life begin and evolve?

Is there life beyond Earth and, if so, how can we detect it?

What is the future of life on Earth and in the universe?

Course Structure & Assessment

- MWF Lecture …… 5%
  - Arrive on time for Mars updates!
- Roughly 7 HW assignments ….. 30%
- Midterm & Final …… 35%
- Term Project …….. 30%

  Consisting of:
  - A research paper
  - An oral presentation

- Office Hours: Tentatively W after class (12-1)

Course Structure & Assessment

HW Policies --

HW assignments will be due at the beginning of class. Late homework turned in by the following class will be deducted 20%. No credit will be given for assignments later than this deadline unless exceptional circumstances are demonstrated.

You are encouraged to work together on homeworks as it can be quite beneficial, but:

- everyone must turn in their own work
- you are individually responsible for the material!

Course Structure & Assessment

Website:

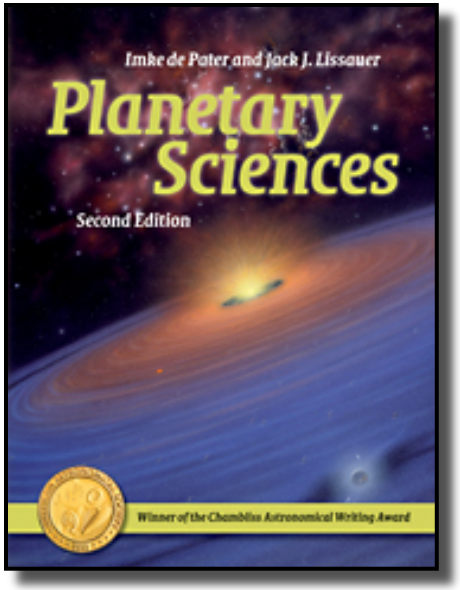
The course website will have the syllabus, lecture summaries, handouts and assignments:

http://wray.eas.gatech.edu/physicsplanets2012

Textbook:

Planetary Sciences, 2nd Edition

Imke de Pater & Jack Lissauer



Survey of the Solar System

The Sun

Giant Planets

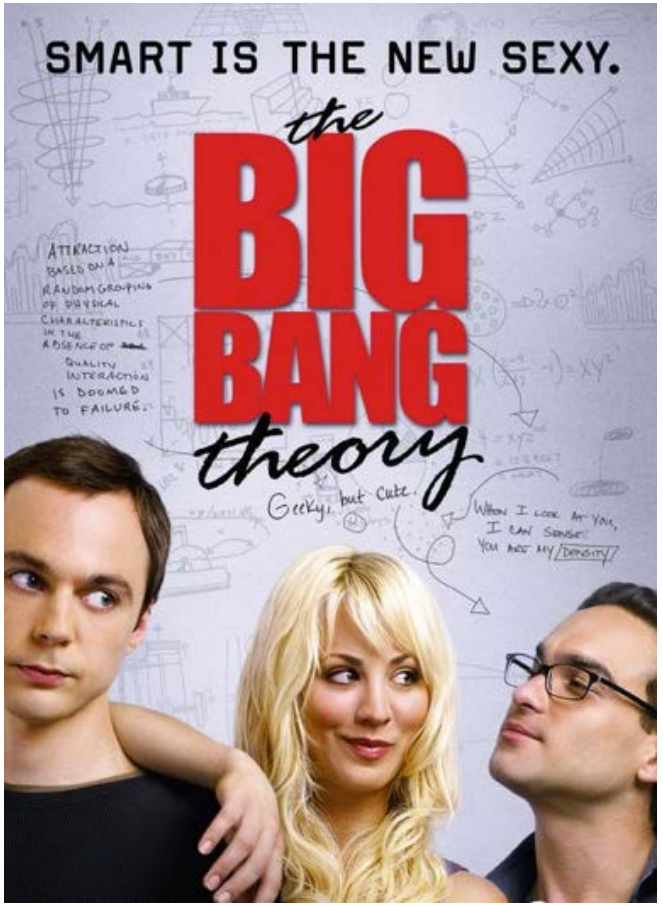
Terrestrial Planets

Satellite/Ring Systems

Formation Intro

The Beginning…

We start with The Big Bang Theory



http://www.youtube.com/watch?v=AEIn3T6nDAo

(1:11-2:15)

Survey

What do you hope to get out of this course?

Mini-Homework

Short exercise on ‘relativity’