A6570_outline_2015

ASTRONOMY 6570 -- PHYSICS OF THE PLANETS

Tues & Thurs, 11:40 - 12:55 pm, SSB 301
Instructor: P. Nicholson, room 418
(nicholso@astro.cornell.edu)

Course Outline: Fall 2015
(revised 26 Oct 2015)

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0. INTRODUCTION (2 lectures)................. Aug 25 - 27
   1. Historical review
   2. Coordinate systems & Time scales

I. ORBITAL MECHANICS (5 lectures)............. Sept 1 - 15
   1. Kepler's laws & planetary orbits
   2. Perturbation theory & orbital precession
   3. Secular perturbations & resonances

II. ROTATION, FIGURES & GRAVITY FIELDS (4) .... Sept 17 - 29
   1. Rotation & oblateness
   2. Gravity fields & figures of equilibrium
   3. Free & forced pole precession

III. TIDES & ORBITAL EVOLUTION (4) .......... Oct 1 - 15
   1. Tidal torques & evolutionary timescales
   2. Evolution of the Earth-Moon system

IV. REFLECTED & THERMAL RADIATION (3) ......... Oct 20 - 27
   1. Thermal emission & thermal equilibrium
   2. Sub-surface temperature profiles
   3. Photometric measurements

Va. PLANETARY ATMOSPHERES (1) ............... Oct 29
   1. Vertical structure; scale height, homopause, exobase

VI. PLANETARY RINGS (2) ..................... Nov 3 - 5
   1. Structure & equilibrium configuration; shepherding
   2. Waves, wakes, ringlets & gaps

Vb. PLANETARY ATMOSPHERES (2) ............... Nov 10 - 12
   2. Radiative equilibrium profiles; 2-stream approx.
   3. Zonal winds and geostrophic balance

VII. PLANETARY INTERIORS (4) ................. Nov 17 - Dec 1
   1. Seismology & the Earth's interior
   2. Terrestrial planets & icy satellites
   3. Jovian planets: observational constraints
   4. Jovian planet models; polytropes & "real" planets

VIII. REVIEW SESSION (1) .................... Dec 3

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Guest lectures:

Due to Cassini & DPS meetings, PDN will be away from Ithaca on
Oct 20 & 22 and Nov 3 - 10. Maryame El Moutamid and Peter Gierasch
will be guest lecturers on these dates.

Grading:
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6 bi-weekly problem sets will account for 67% of the course grade; a term paper with accompanying in-class presentation (to be scheduled during the Final exam week) will cover 33%. There will be no mid-term or final exam.

Homework due dates:
1. Introductory material .......... Sept 11
2. Orbital mechanics .............. Sept 25
3. Planetary figures ............... Oct 16
4. Tidal evolution ................ Oct 30
5. Atmospheres & radiation ....... Nov 13
6. Planetary rings & interiors ...... Nov 27

Reference books:
A good general text at the level of this course is:


Much of the material we will cover can also be found in one or more of the following more specialized texts:

Murray & Dermott "Solar System Dynamics" (1999)
Hubbard "Planetary Interiors" (1984)
Andrews "Intro. to Atmospheric Physics" (2000)

Lecture Notes:
The lecture notes from 2013 are already posted on the Course website, linked from the Astronomy Dep't web site (astro.cornell.edu), and linked to individual lecture topics.