Syllabus

updated. August 24 2009

PTYS/ASTR 553: Solar System Dynamics

Fall 2009: Tues, Thur 11:00-12:15 p.m. – Kuiper Space Sciences Building Room 312

Instructor:

Prof. Renu Malhotra
Office: SS–527A; Tel: 626-5899
Office hours: Anytime I am around and not busy with something or someone else; for guaranteed time, please make an appointment.

Course Description

The goal of the course is to develop quantitative skills to analyze and understand the orbital motions of planets, moons, minor planets and dust complexes in planetary systems, both in our solar system and in extra-solar systems. Topics covered will include: classical analyses of the two-body, three-body and N-body problem; Hamiltonian formulation and canonical perturbation theory; modern numerical techniques; secular perturbations; mean motion and secular resonances; adiabatic evolution and resonance capture; chaotic dynamics; spin-orbit coupling; dust dynamics. The course will include case studies of intriguing planetary dynamical problems, such as resonances and chaos in the asteroid belt, the transport of comets, the spin-orbit resonance of Mercury, the chaotic obliquity of Mars, resonances in giant planet satellite systems, resonance dynamics in extrasolar planetary systems (e.g., Upsilon Andromedae and GJ876), orbital migration of planets, the origin of Plutinos in the Kuiper Belt, the sculpting of circumstellar debris disks by unseen planets, and interplanetary superhighways.

Prerequisite(s): MATH 254 (ODEs), PHYS 422 (Advanced Classical Mechanics), or consult instructor before enrolling.

Textbook

"Solar System Dynamics", by C.D. Murray and S.F. Dermott, Cambridge University Press, UK, 1999. It is available in paperback.

Class format:

Classes will generally be built around problem-solving, investigating real-life dynamical problems in our solar system and in extra-solar planetary systems. We will use a combination of traditional lectures, round-table discussions and student presentations, according to topic and material. Students are expected to be prepared with the material assigned prior to each class.

Grades:

Regular grades are awarded for this course: A B C D E.
There will be frequent homework assignments, and a take-home final exam. The grades will be based on the greater of: the final exam or a weighted average of the final exam and the homeworks.

URL

http://www.lpl.arizona.edu/∼renu/ptys553_fall2009