PTYS 505B - Principles of Planetary Physics

Tuesdays and Thursdays, 9:30 AM - 10:45 AM, Kuiper Space Sciences Building, Room 312

Class Website
d2l.arizona.edu (student login required)

Instructor
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Office hours: stop by any time or email me for a guaranteed time

Objectives and expected learning outcomes
At the end of the course, students should be able to:

- Demonstrate mastery of the basic physics and analyze current research findings in the areas of dynamics, planet formation, and planetary interiors.
- Use basic basics and simple mathematics to estimate the main physical effects in planetary science problems.

Textbook
There is no required textbook. The following textbooks are recommended:

- An introduction to Planetary Physics, Kaula
- Solar System Dynamics, Murray and Dermott (Errata)
- Planetary Sciences, de Pater and Lissauer
- Lecture notes on the formation and early evolution of planetary systems, Armitage

Copies of these books are on reserve at the LPL library (Kuiper Space Sciences 409) and are also available for in-library use in the UA Library's Special Collections.

Class format
Class meetings will generally be built around reading assignments. Students are expected to be prepared with the material assigned prior to each class. We will use a combination of traditional lectures, open discussions and student-led presentations, according to topic and material. Although no formal attendance record will be made, class participation will be part of the grade, and homework assignments are likely to make more sense if you've been to class.

Grading
The grades will be on an A (90% and higher), B (80-89%), C (70-79%), D (60-69%), E (59% and lower) scale, and will be based on three components: class participation (25%), randomly collected homework assignments (25%) and three exams (50%, 13.7% each).

Due dates, late work, absences
Assignments are due in class on the due date. I would rather have late work than no work, although you should expect it to be for reduced credit. If you anticipate an absence on the due date of an assignment, please either turn in your work early or discuss alternative arrangements with me.

Academic integrity
You are expected to know and to abide by the University's Academic Integrity policy. Two primary points you need to know are these: (1) When you turn in (or present) work that uses published material (journal articles, web sites, etc.), you are expected to give the appropriate credit and cite the source(s). (2) Collaboration is encouraged on most assignments, as I strongly believe that we learn more by asking questions and explaining our answers to others' satisfaction. However, if you do work with someone, the work you turn in for grading must be written by you *in your own words*; if I get identical answers, I will divide the credit evenly.

Students with Disabilities
If you anticipate barriers related to the format or requirements of this course, please meet with me so that we can discuss ways to ensure your full participation in the course. If you determine that disability-related accommodations are necessary, please register with Disability Resources (621-3268; http://drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations.

Other classroom issues
We try to keep the classroom clean, and ask for your help. Please do not bring any food or drink (other than bottled water) into the classroom. If there are problems with a seat or with its writing table, please let me know, so that the problems can be addressed as soon as possible. Also, the common-sense rules of good conduct apply, such as cell phones turned off and no web-surfing or irrelevant extra-curricular activity during class.

Notice
The information contained in this course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Topics Covered
- **Celestial mechanics:** the two-body problem, the three-body problem.
- **Protoplanetary disks**: observations, MMSN, vertical structure, radial force balance, surface density evolution.
- **Planetesimal formation**: aerodynamic drag, planetesimal formation by coagulation, planetesimal formation by gravitational instability.
- **Terrestrial planet formation:** time scale for formation, gravitational focusing and the Safronov number, Impulse approximation.
- **Giant planet formation**: core accretion, envelope structure, gravitational instability.

- **Planet migration**: in gaseous disks in planetesimal disks.
- **Spherical planets in hydrostatic equilibrium**: equation of state, polytropes, relation between pressure-density and mass-radius.
- **Static distorted planets**: spherical harmonic representations, gravity anomalies, moments of inertia.
- **Rotational distortion**: Maclaurin and Jacobi theory, Radau-Darwin approximation.
- **Tidal distortion**: tides, hydrostatic response, Love numbers.
- **Rigid-body motion**: moment of inertia tensor, angular momentum of a rigid body, Euler's equations, effect of dissipation.
- **Energy sources in planets**: gravitational binding energy, thermal energy, radioactivity, tidal dissipation.