Course Syllabus - PTYS 505B - Principles of Planetary Physics

Modality: In-person

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

Instructor Information

Instructor: Isamu Matsuyama
Office: Kuiper Space Sciences 527A
Email: isamu@arizona.edu
Office hours: By appointment (email to arrange an in-person or remote meeting)

Course Meetings

Tuesdays and Thursdays, 11:00 AM – 12:15 PM
Kuiper Space Sciences Building, Room 312

Recommended Textbooks

There is no required textbook. The following resources are recommended and available on reserve at the LPL Library (Kuiper 409) and in the UA Library's Special Collections:

- 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

Objectives and expected learning outcomes

By the end of this course, you will be able to **derive and apply** the fundamental equations of celestial mechanics, **analyze** planet formation processes, **calculate** planetary interior properties, and **evaluate** the role of tides and energy dissipation in shaping planetary systems. You will also strengthen your ability to **formulate and solve quantitative problems** that integrate physics with planetary science.

Topics Covered

- **Celestial mechanics:** Kepler's laws of planetary motion, equations of motion, the two-body problem, the restricted three-body problem.
- **Planet formation**: protoplanetary disks, aerodynamic drag, planetesimal formation by coagulation, planetesimal formation by gravitational instability, time scales for formation, gravitational focusing.
- **Planetary interiors:** hydrostatic equilibrium, relation between pressure-density and mass-radius, spherical harmonic representations, gravity anomalies, moments of inertia, Radau-Darwin approximation, moments of inertia, tides, tidal energy dissipation.

Class structure and approach

The course emphasizes active learning through readings, lectures, discussions, and student-led presentations. You will be expected to prepare in advance, participate in class, and collaborate with peers

to deepen your understanding. The classroom environment will be interactive, balancing traditional lectures with discussions and problem-solving activities.

Expectations

Preparation: Complete assigned readings before class.

Participation: Active participation is required and contributes to your grade.

Homework: Homework assignments are designed to help you practice and reinforce course concepts. Only a selection of assignments will be graded, chosen at random. Completing all of them thoroughly will prepare you for exams and ensure credit when selected.

Collaboration: Collaboration is encouraged, but each student must submit their own work in their own words.

Grading

- Class participation: 25%
- Homework Assignments: 25%
- Three exams: 50% (16.7% each)

Homework Submission Guidelines

- Only a selection of assignments will be graded. However, all assignments should be completed in full to maximize learning and to prepare for exams.
- Submit assignments by 11:00 AM (start of class) on the due date.
- Combine work into a single PDF file with your name clearly included.
- Submit by email to the instructor.
- Late Policy:
  - 1 day late: –20% of total possible points
  - Each additional day late: –10% per day

Absences and Alternate Arrangements

If you anticipate an absence, submit assignments early or contact the instructor in advance to discuss possible accommodations.

Generative AI use

You may use generative AI tools (e.g., ChatGPT, DALL·E, Bard, Perplexity) to support your learning when aligned with course objectives. However:

- Do not input confidential information.
- AI may produce inaccurate or biased content—you are responsible for verifying facts.
- Use of AI tools must be acknowledged and cited.
- Failure to disclose AI use will be treated as plagiarism/cheating.

Academic integrity

You are expected to follow the University's Academic Integrity policy. In brief:

- Cite all sources of published material.
- Collaboration is encouraged, but submitted work must be your own. Identical answers will result in shared credit.

Accessibility and Accommodations

Students requiring accommodations should register with Disability Resources (621-3268; drc.arizona.edu) and inform the instructor as early as possible to ensure full participation.

Classroom Conduct

- Food and drinks (other than bottled water) are not permitted.
- Please report any broken seats or desks.
- Turn off phones; avoid unrelated web browsing or extracurricular activities during class.
- Maintain respectful and professional conduct.

Campus Safety

For emergency procedures, visit: cirt.arizona.edu.

University Policies

- Nondiscrimination and Anti-Harassment Policy
- University Syllabus Policies

Subject to Change Notice

Except for grading and absence policies, the syllabus is subject to change with reasonable notice.