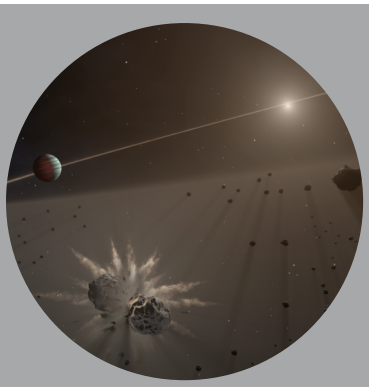

Adv. Topics: Planetary Astrophysics

PHYS 480/581

Instructor Info

Prof. Diana Dragomir

PAIS 3226

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dragomir@unm.edu

Course Info

MATH 1522 and PHYS 2310.

Mon & Wed

3:30pm - 4:45pm

PAIS 1160

Office Hours

By appointment

PAIS 3226

TA Info

John Houghteling

jhoughteling@unm.edu

Course Overview

This is an upper undergraduate/graduate PHYS course that will introduce the physics of planetary systems. Because the topic is so large, it will be impossible to cover everything in just one semester. A tentative course schedule is given at the end of this syllabus, but it will almost certainly change and evolve as the course progresses. I intend to interweave the study of our own solar system with the study of exoplanets, since they share a common underlying physics and chemistry. The general topics we will cover are: orbital mechanics from 2-body problem to more complicated cases; energy transport; planetary atmospheres, surfaces and interiors; minor bodies; and planet formation and evolution. If time permits, we may also discuss the emerging star-planet connections that observations of extrasolar systems are hinting at, and/or the topic of life elsewhere.

About Me

I am an observational astronomer whose focus is on exoplanets. I aim to measure the properties of explanets (particularly, but not exclusively, sub-Jovian exoplanets), and how these properties correlate to the planets' formation and evolution. Therefore I also have a keen interest in planetary science, astrochemistry and astrobiology, and I look forward to sharing that with you.

Material

Required Text

Planetary Sciences, de Pater and Lissauer, 2nd edition. Cambridge University Press. 2015. (ISBN: 978-0521853712)

Lecture Notes on the Formation and Early Evolution of Planetary Systems, Philip J. Armitage, arxiv link.

Credit-hour statement

This is a three credit-hour course. Class meets for two 75-minute sessions of direct instruction for sixteen weeks during the Fall 2024 semester. Please plan for a minimum of six hours of out-of-class work (or homework, study, assignment completion, and class preparation) each week.

Grading Scheme

The details of the grading scheme and grading components could be subject to minor changes, but if so I will inform the class ahead of time during lectures and via email.

15%	Class participation and attendance
15%	Quizzes based on assigned readings and lecture material
20%	Homework assignments and questions for Journal Club
15%	Paper presentations (i.e. Journal Club)
30%	Research proposals
5%	Feedback on your peers' proposals

Assignments will be longer for students enrolled in PHYS 581 (grad students).

Note: If you take this class "Credit/No Credit", according to university policy, your final grade must be a "C" or better in order to receive credit.

Class Participation

Class participation will consist of questions to answer, or short calculations or problems to solve, either individually or in groups. I will usually ask a student (one from each group, time permitting) to briefly present their group's answers. Evidently you must be present in class and participate in these problem solving sessions in order to get the participation points.

Quizzes

There are assigned readings for every class (except for the first class). Every one or two weeks, I will give a short in-class quiz about the topics recently covered in class and/or from the readings.

Homework Assignments and questions for Journal Club

There will be five or six homework assignments spread out over the course of the semester. They will be due every $\sim$3 weeks. They will be posted on the course webpage. Homeworks are to be submitted in class. Credit for late homework will drop by 15% for every day late within a week, and no credit thereafter. While you may discuss the homework assignments with your classmates, the work you hand in must be entirely yours.

Graduate students will need to complete the entire assignment for full marks, but there will be one question in each assignment which will be optional for undergraduate students. Often, homework will also require that students submit questions for upcoming Journal Club presenters (see next section).

Paper presentations

Every student will present and discuss a published research article (paper) in class. A list of papers will be provided. Undergraduate students will work in pairs while grad students will present a paper individually. Overview of the paper should take $\sim$15 minutes, with questions and discussion taking up another 5-10 minutes. You will be expected to project the paper and scroll through it for your presentation and you are also encouraged to use the whiteboard. Slides are not allowed. Your presentation should contain a contextual discussion of the paper (including other related works that have been published since the paper) and make clear connections with material covered in class and/or in the textbook. In every homework, students will be expected to ask three questions about each of two papers to be discussed in the coming weeks (except on the one they will be discussing).

Research proposals

Each student is expected to prepare “proposal" for a project addressing an open question in planetary astrophysics (4 pages for undergrads and 6 pages for grads, excluding figures and references). Your proposal could describe (feasible) observations, a new theory, or even a new instrument that would enable previously unattainable observations. More details will be provided separately, but we will discuss in class the key ingredients of a strong proposal and I will also share some examples of proposals. Students have the option to submit a proposal partway through the semester (due after fall break), at the end of the semester, or both. If both, then the best grade of the two will count.

Students will also be expected to reivew some of the proposals submitted (anonymously) and provide feedback, similar to an actual proposal review panel.

Learning Objectives

Upon successful completion of this course, students will be able to:

- Obtain a working knowledge of physical processes which shape the properties of planets, including gravity, radiation, and thermodynamics, and construct quantitative estimates of planet properties using these basic physics principles.
- Apply elementary classical mechanics to planetary orbits with an emphasis on Keplerś Laws, perturbations and resonances.
- Explain and quantitatively apply concepts of energy transport and atmospheric dynamics to planetary atmospheres.
- Compare and contrast terrestrial and Jovian planetary atmospheres and interiors.
- Compare and contrast the physical and orbital properties, as well as the architectures of Solar System planets and exoplanets.
- Explain the mechanisms of formation of the solar and extrasolar planetary systems.
- Synthesize material from a published research article, critically assess it, and present it clearly and concisely in oral form.
- Explain how future instruments, observations, or theoretical research could address open questions about the astrophysics of planetary systems.

Diversity and Inclusivity Statement

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Citizenship and/or Immigration Status: All students are welcome in this class regardless of citizenship, residency, or immigration status. Your professor will respect your privacy if you choose to disclose your status. UNM as an institution has made

a core commitment to the success of all our students, including members of our undocumented community. The Administration's welcome is found on our website.

Title IX

The University of New Mexico and its faculty are committed to supporting our students and providing an environment that is free of bias, discrimination, and harassment. The University?s programs and activities, including the classroom, should always provide a space of mutual respect, kindness, and support without fear of harassment, violence, or discrimination. Discrimination on the basis of sex includes discrimination on the basis of assigned sex at birth, sex characteristics, pregnancy and pregnancy related conditions, sexual orientation and gender identity. If you have encountered any form of discrimination on the basis of sex, including sexual harassment, sexual assault, stalking, domestic or dating violence, we encourage you to report this to the University. You can access the confidential resources available on campus at the LoboRESPECT Advocacy Center (), the Women?s Resource Center (), and the LGBTQ Resource Center (). If you speak with an instructor (including a TA or a GA) regarding an incident connected to discrimination on the basis of sex, they must notify UNM?s Title IX Coordinator that you shared an experience relating to Title IX, even if you ask the instructor not to disclose it. The Title IX Coordinator is available to assist you in understanding your options and in connecting you with all possible resources on and off campus. For more information on the campus policy regarding sexual misconduct and reporting, please see and CEEO?s website.

If you are pregnant or experiencing a pregnancy-related condition, you may contact UNM?s Office of Compliance, Ethics, and Equal Opportunity at ceeo@unm.edu. The CEEO staff will provide you with access to available resources and supportive measures and assist you in understanding your rights.

Accommodations for Students with Disabilities

UNM is committed to providing equitable access to learning opportunities for students with documented disabilities. As your instructor, it is my objective to facilitate an inclusive classroom setting, in which students have full access and opportunity to participate. To engage in a confidential conversation about the process for requesting reasonable accommodations for this class and/or program, please contact Accessibility Resource Center at arcsrvs@unm.edu or by phone at 505-277-3506.

If you need an accommodation based on how course requirements interact with the impact of a disability, you should contact me to arrange an appointment as soon as possible. At the appointment we can discuss the course format and requirements, anticipate the need for adjustments and explore potential accommodations. I rely on the Accessibility Resource Center for assistance in developing strategies and verifying accommodation needs.

Academic Integrity

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

COVID-19 and General Wellness

UNM is a mask friendly, but not a mask required, community. If you are experiencing COVID-19 symptoms, please do not come to class. You can communicate with me at dragomir@unm.edu and I can work with you to provide alternatives for course participation and completion. If you do need to stay home due to illness or are experiencing a wellness challenge, let me, an advisor, or another UNM staff member know that you need support so that we can connect you to the right resources.