PTYS 568 Exoplanets Syllabus
Fall 2025

Instructor Information

Professor Mark Marley, PTYS

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Kuiper 323

Office Hours: Mondays 1 to 2PM and by appointment (or drop in)

Course Description

Survey of discovery and characterization methods of extrasolar planets. Focus is on developing an appreciation for the underlying physical processes controlling exoplanet atmospheres and interiors and the methodologies used to discern these processes. Course will involve significant use of open-source codes to provide hands on learning of modern exoplanet science. Students will be able to construct 1D model atmospheres for extrasolar planets, compute transmission spectra, and interpret the results. There will also be significant number of lectures by guest lecturers.

Course Prerequisites or Co-requisites

All students enrolled in the astronomy, physics, planetary science, and optical science PhD programs are welcome to take this class. Exceptions can be made on a case-by-case basis.

Course Format and Teaching Methods

Course Modality – Live in person

Course Objectives

Students will gain an appreciation for the history of exoplanet science, the importance and types of exoplanets, the processes sculpting their atmospheres and interiors, and the methods used to model and study these objects.

Expected Learning Outcomes

Students will be able to describe the current state of exoplanet knowledge as well as the methodologies used to understand their interiors and atmospheres. Students will be able to utilize several open-source codes to carry out scientific investigations of these objects. Students will also be able to read, understand, summarize, and report on current papers in the field.

Required Texts and Materials

There will be readings from these and other sources. Most material can be found online without needing to own the physical textbook, but some readings will require the hardcopies which will be on reserve in the LPL library.

Seager Exoplanets: https://a.co/d/9HCcy42

dePater & Lissauer planetary science topics: https://a.co/d/bnDszYZ (Updated edition)

Perryman Exoplanets: https://a.co/d/3kHpQzK (Second Edition)

Schedule of Topics and Activities

Approximate class schedule attached.

Assessments

Homework: There will be four or five homework assignments, most of which will include components using various public codes. Basic coding skills are required (you will not need to be an expert programmer, but some previous experience will be helpful). (25%)

Students may discuss any aspect of the homework with other classmates, but the final product should be the result of individual work.

Class participation and paper presentations: Students will present papers relevant to the current lectures (approved ahead of time) to the class. Students will be graded on their presentations as well as the questions and discussions they raise during lecture and other student presentations. (20%)

Exams: There will be two in-class written exams during the semester to review material covered to that point. There will not be a final exam. (25%)

Project: Students will be responsible for preparing a project on some aspect of exoplanet science. The project can involve a literature review of a particular topic, a coding project, or original research. The topic must be approved by the instructor. (30%)

Final Examination: None

Grading Scale and Policies

50% of your grade will be based presentations/participation and 50% on several projects.

The grading scale will be as follows:

90 – 100 A

80 – 89.9 B

65 – 79.9 C

50 – 64.9 D

< 50 E

Final Examination or Project

Detailed information about the Project will be provided in class. In brief, students will conduct independent research into a topical problem related to an extrasolar planet or class of planets and present the work in class and in a written report.

Safety on Campus and in the Classroom

For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): https://cirt.arizona.edu/case-emergency/overview

Also watch the video available at https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/common/learningeventdetail/crtfy000000000003560

Nondiscrimination and Anti-harassment Policy

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please see: http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

University Policies

All university policies related to a syllabus are available at: https://catalog.arizona.edu/syllabus-policies. By placing this link in your syllabus, you no longer need to have each individual policy included in your syllabus.

Subject to Change Notice

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

Graduate Student Resources

Please consider including a link to the University of Arizona's Basic Needs Resources page: http://basicneeds.arizona.edu/index.html