PTYS568 Exoplanets: *Discovery & Characterization*

Kuiper Space Sciences 309, time: Tues/Thurs 2:00 – 3:15pm

COVID Guidance

As we enter the Fall semester, the health and wellbeing of everyone in this class is the highest priority. Accordingly, we are all required to follow the university guidelines on COVID-19 mitigation. Please visit www.covid19.arizona.edu for the latest guidance.

Description of Course

This course will cover observational and theoretical ideas pertinent to planets orbiting stars other than the Sun. Discovery and characterization techniques will be emphasized along with associated theory. The format will alternate from traditional lectures, guest lectures by local or visiting experts, and student-lead presentations.

Learning Outcomes

Upon the completion of this course you will be able to compare and contrast exoplanets on the basis of mass, age, equilibrium temperature, gravity, abundances, habitability and orbital properties. You will be able to rank exoplanets by relative difficulty of discovery and atmospheric characterization. You will also possess the fundamental knowledge necessary to construct a complete model atmosphere and spectrum sufficient to interpret spectroscopic observations.

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.

Instructor and Contact Information

Prof. Travis Barman
Office: Kuiper Space Sciences 436
Office Hours: 3:00pm to 4:00pm Wednesday, or by appointment
Email: barman@lpl.arizona.edu

Course Topics

Part 1 (*Exoplanet Discovery*)
Introduction & Background
Radial Velocity
Transit
Direct Imaging
Exoplanet distributions (mass, period, etc.)

Part 2 (*Exoplanet Atmospheres*)
Atmospheric Structure and Radiative Transfer
Chemistry and Opacities
Lessons learned from Brown Dwarfs

Part 3 (*Exoplanet Characterization*)
Bulk Structure and Composition
Transits: Secondary Eclipses & Irradiated Atmospheres
Transits: Spectroscopy
Direct Imaging: Giant Planet Evolution
Direct Imaging: Giant Planet Spectroscopy
Special topics (TBD)

Required Texts or Readings

A reading list will be maintained on D2L

Assignments and Examinations: Schedule/Due Dates

Projects: There will be two to three projects involving exoplanet data and/or numerical modeling. Basic coding skills are required (you will not need to be an expert programmer but some previous experience will be helpful). Students may discuss any aspect of the projects with other classmates, but the final product should be the result of individual work. A written summary of the project will be submitted along with all source code.

Class participation and 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 other student presentations (or guest lectures). You will be called upon to ask a question at the end of guest lectures and student presentations.

Final Examination: None

Grading Scale and Policies

50% of your grade will be based on 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

You are strongly encouraged to review the additional university policies for this course found here: https://academicaffairs.arizona.edu/syllabus-policies