Planetary Systems: A Data-Driven Exploration

Time: Tuesday and Thursday 10:30-11:45 AM
Location: IfA 221

Instructors: Eric Gaidos (gaidos@hawaii.edu) and Dan Huber (huberd@hawaii.edu)
Office hours: by arrangement

A mere three decades ago the only planetary system we were aware of was our own. Now we know of thousands of systems; their diversity challenge our theories of planet formation and evolution, provide required context for understanding the Solar System, and are the foundation upon which rigorous searches for habitats and life elsewhere in the Universe will be built. This course will expose graduate students in planetary science and astronomy to the present state of knowledge of planetary systems using representative data at the field's leading edge, introduce key theoretical concepts and analytic and numerical tools with broad application, and develop teamwork, presentation, and publishing skills.

Course prerequisites: Undergraduate degree in physics, chemistry, astronomy, or planetary science or equivalent background. Students must have a laptop and be willing to install software and do some simple coding. Python will be the standard language used in the course. Familiarity will be very useful but is not required.

The course consists of six modules, each on a different aspect of planetary systems and centered around a different project working on a relevant data set. Students will work in pairs on these projects and present their findings on the 5th day of each cycle.

Day 1: Lecture on background concepts and theory
Day 2: Tutorial introduction to the data and tools
Day 3: Structured, tutored work session
Day 4: Unstructured work session
Day 5: Student presentations

Each student will write a Research Note based on a project from Modules 1-4 or a different, external project with the instructor’s permission. Research Notes of the American Astronomical Society (http://iopscience.iop.org/journal/2515-5172) are reviewed by an editor and published and citable but are neither peer reviewed nor copy-edited. They have a maximum of 1000 words, including titles, author names and affiliations and references, and up to 1 figure or table.

Schedule:

Jan 8  Orientation
Jan 10 - 24  Module 1: Detection, Enumeration, Diversity of Planetary Systems
Jan 29 - Feb 12  Module 2: Properties of Host Stars and their Planets
Feb 14 - 28  Module 3: Masses and Interiors of Planets
Mar 2 - Mar 28  Module 4: Formation and Compositions of Planets
Mar 14  Research Notes Topic Selection Deadline
Apr 2 - Apr 16  Module 5: Dynamics of Planets
Apr 18 - May 2  Module 6: Atmospheres, Climate, and Habitability
May 10  Final Research Notes manuscripts due

Grading:
Letter grade only
Course participation: 30%
Team Presentations: 30%
Research Note Manuscript: 40%

Student learning outcomes:
● Learn key theoretical principles of exoplanet science
● Acquire knowledge and experience with key analytical, statistical, and numerical tools
● Develop teamwork and organizational skills to carry out projects
● Improve scientific writing and presentation skills

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