Planetary Systems: A Data-Driven Exploration

Time: Tuesday and Thursday 10:30-11:45 AM
Location: POST 708 (Tuesday) and IfA 221 (Thursday)

Instructors: Eric Gaidos (gaidos@hawaii.edu) and Dan Huber (huberd@ifa.hawaii.edu)

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 instructors’ 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:

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<tr>
<th>Date</th>
<th>Event</th>
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<tr>
<td>Jan 8</td>
<td>Orientation</td>
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<tr>
<td>Jan 10 - 24</td>
<td>Module 1: Detection, Enumeration, Diversity of Planetary Systems</td>
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<td>Jan 29 - Feb 12</td>
<td>Module 2: Properties of Host Stars and their Planets</td>
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<td>Feb 14 - 28</td>
<td>Module 3: Masses and Interiors of Planets</td>
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<td>Feb 25 - Mar 26</td>
<td>Module 4: Formation and Compositions of Planets</td>
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Mar 14  Research Notes Topic Selection Deadline
Mar 28 - Apr 12  Module 5: Dynamics of Planets
Apr 16 - 30  Module 6: Atmospheres, Climate, and Habitable
May 2  Roundtable discussion: Life on Other Worlds?
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

Disability Access: The Geology and Geophysics Department will make every effort to assist those with disability and related access needs. For confidential services, please contact the Office for Students with Disabilities (known as “Kokua”) located in the Queen Lili‘uokalani Center for Student Services (Room 013): 956-7511, kokua@hawaii.edu, www.hawaii.edu/kokua

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