Spring 2024 **ERTH 711 (*CRN 89256*) or ASTR 736 (*CRN 88640*)** **3 Credits**

Planetary Systems: A Data-Driven Exploration

Prerequisites: See below
Time: Tuesday and Thursday 9:00-10:15 AM
Location: POST 807 or IFA C-108
Instructors: Eric Gaidos (gaidos@hawaii.edu) and Dan Huber (huberd@hawaii.edu)
Office hours: by appointment
Course materials: Google drive folder TBD

Synopsis: Three decades ago the only planetary system we were aware of was our own. Now we know of thousands of systems; their diversity challenges our theories of planet formation and evolution, provides required context for understanding the Solar System, and is 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 it will develop teamwork, presentation, and publishing skills.

Course prerequisites: "B" (not "B-") or higher in ASTR 633 or ASTR 630 or ERTH 666 or an equivalent graduate-level course. ***Students must have a laptop and be willing to install and run software packages and do some simple supervised coding.*** Python will be the standard language used in the course. A general facility with computers and programming is expected; Python coding ability will be very useful but is not required.

The course consists of five 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

Term project: Each student will carry out a research project selected from a list of topics provided by the instructors and write a *Research Note* based on the results. . (Other suitable topics will be considered on a case-by-case basis). *Research Notes of the American Astronomical Society* 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 can include one figure or one table. See: *http://iopscience.iop.org/journal/2515-5172*

Schedule: (note: no lectures during the first week)

Jan 9 Tu Course orientation and software requirements (asynchronous remote)
Jan 11 Th Software installation (asynchronous remote)
Jan 16 Tu Project discussion and selection
Module 1 – Detection and Enumeration of Planetary Systems:
Jan 18 Th Science lecture
Jan 23 Tu Techniques lecture
Jan 25 Th Structured tutorial
Jan 30 Tu Unstructured work
Feb 1 Th Student presentations
Feb 6 Tu Student project progress reports I
Module 2 – Properties of Host Stars and their Planets
Feb 8 Th Science lecture
Feb 13 Tu Techniques lecture
Feb 15 Th Structured tutorial
Feb 20 Tu Unstructured work
Feb 22 Th Student presentations
Module 3 – Masses and Compositions of Planets
Feb 27 Tu Science lecture
Feb 29 Th Techniques lecture
Mar 5 Tu Structured tutorial
Mar 7 Th Unstructured work
Mar 12 Tu Student presentations
Mar 14 Th Student project progress reports II
=== SPRING RECESS ===
Mar 26 Tu Project work session I
Mar 28 Th Project work session II
Module 4 – Dynamics of Planetary Systems
Apr 2 Tu Science lecture
Apr 4 Th Techniques lecture
Apr 9 Tu Structured tutorial
Apr 11 Th Unstructured work
Apr 16 Tu Student presentations
Module 5 – Atmospheres of Planets
Apr 18 Th Science lecture
Apr 23 Tu Techniques lecture
Apr 25 Th Structured tutorial
Apr 30 Tu Unstructured tutorial
May 2 Th Student presentations
May 7 Tu Project work session III
May 9 Th Student project presentations (long session)

Grading (provisory): Letter grade only
Course participation: 30%
Team Presentations: 30%
Individual Research Project: 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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If you wish to report an incident of sex discrimination or gender-based violence, contact: Dee Uwono, Title IX Coordinator, Hawai'i Hall 124, t9uhm@hawaii.edu, 808-956-2299. As members of the University faculty, your instructors are required to immediately report any incident of potential sex discrimination or gender- based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and your instructors cannot guarantee confidentiality, you will still have options about how your case will be handled. Our goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need.

http://www.manoa.hawaii.edu/titleix/resources.html#confidential