ASTR 405: Exoplanetary Science

Spring 2017

- Professor: Stephen Kane
- Class times: Tuesday, 11:00pm-12:15pm; Thursday, 11:00pm-12:15pm
- Class location: BUS 130
- Textbook: The Exoplanet Handbook (Michael Perryman)
- Office: TH 309
- Office hours: Wednesdays, 2:00pm-4:00pm
- Phone: 415-338-2451
- Email: `skane@sfsu.edu` (write ASTR405 in subject)
- Course website: `http://physics.sfsu.edu/~skane/teaching/a405/`

Prerequisites:

- ASTR 115: Introduction to Astronomy
- PHYS 220: General Physics with Calculus I
- PHYS 330: Analytical Mechanics I

Course description:

The past 20+ years has seen a rapid expansion of the subject of planets outside of our Solar System (exoplanets). The expansion is such that the field now includes everything from exoplanet detection to the study of exoplanetary atmospheres. The topics included in this class are: the history of exoplanetary science, detection methods, planet formation, orbital dynamics, and exoplanetary atmospheres. We will also explore the statistics of exoplanetary systems, habitability, and draw comparisons with Solar System planets to place our own system in a larger context.

The course will require a working knowledge of astronomy, algebra, calculus, orbital mechanics, and coding (see course prerequisites). There will be a discussion component regarding the latest exoplanet research. Exoplanetary science is a very active research field and we will frequently read and discuss new research papers.

Requirements and Textbook:

- **Attendence:** Attendance is required for every lecture. Much of the assessment will be carried out in class and exams may contain questions covered in lectures but not elsewhere.
- **Textbook:** The textbook for the course is "The Exoplanet Handbook" by Michael Perryman. I also recommend "Exoplanets" edited by Sara Seager. These are available both used and new from the SFSU bookstore.
- **Electronic Devices:** In general, the use of electronic devices such as laptops, tablets, and cellphones is not allowed in class.

Course Assessment:

- **Homework (40%):** There will be five homeworks during the semester. Most problems will require analytic solutions, however there will usually be one problem per assignment that will involve graphing and numerical solution with computer software such as Mathematica, MATLAB, or any programming language. The homework solutions must be provided in a legible format such that it is possible to read and grade.
- **Literature Review (15%):** Students will be required to write a 4-page critique of a published paper. The chosen paper must be exoplanet-related and published in a refereed journal. The critique must include a summary of the paper, why the paper was chosen, and discuss aspects such as key results, their significance, and original ideas on future work.
- **Data Project (15%):** Students will be required to complete a project using exoplanet data using the NASA Exoplanet Archive, the Exoplanet Data Explorer, the Habitable Zone Gallery, or the Systemic Console. The written report may be up to 5 pages long (including plots).
- **Final Exam (30%):** The final exam will test on all material covered during the semester.

Final grades will be assigned as follows:
A = 90% to 100%
B = 77% to 89%
C = 65% to 76%
D = 50% to 64%
F = below 50%

Important Dates:

- February 10: Last day to drop without a W
- February 17: Last day to add by exception
- March 16: Literature Review Due
- March 20-24: Spring Break (No class)
- April 24-28: Kane travel (No class)
- May 4: Data Project report due
- May 16: Last class meeting
- May 18: **FINAL EXAM** 10:45am-1:15pm in BUS 130

Student Learning Outcomes:

After successfully completeing this course, students will:

1. Know the various ways that exoplanets are discovered.
2. Be able to estimate exoplanet properties from radial velocity and photometric data.
3. Know the physical characteristics of the exoplanet population.
4. Know how exoplanets form and dynamically interact.
5. Know how exoplanet atmospheric properties are determined.
6. Know what assumptions are made, and what limitations exist, in exoplanet research.
7. Master new scientific and technical methods with application to exoplanets and related fields.
8. Be much better prepared to carry out research in this field.

Wait List:

I am maintaining a waiting list. The list begins with the official university list. Other students who would like to enroll in the course may add their names to the waiting list during class. Students on the waiting list must sign in every day. Priority will be given to students who attend lectures and complete homeworks. Students who miss any classes or homework during the first two weeks will be dropped from the class and replaced with those on the waiting list.

Academic Integrity:

SFSU maintains a firm policy on plagiarism and cheating, which can be found in the SFSU Bulletin. The Physics and Astronomy department also maintains a set of guidelines stating specific practices that are prohibited and the procedures for handling cases of academic cheating or plagiarism. This policy can be viewed online at: `http://www.physics.sfsu.edu/policy/plagiarism.pdf`

Students with Disabilities:

Students with disabilities who need reasonable accommodations are encouraged to contact the instructor. The Disability Programs and Resource Center (DPRC) is available to facilitate the reasonable accommodations process. The DPRC is located in the Student Service Building and can be reached by telephone (voice/TTY 415-338-2472) or by email (`dprc@sfsu.edu`). Visit `http://www.sfsu.edu/~dprc` for more information.

Student Disclosures of Sexual Violence::

SF State fosters a campus free of sexual violence including sexual harassment, domestic violence, dating violence, stalking, and/or any form of sex or gender discrimination. If you disclose a personal experience as an SF State student, the course instructor is required to notify the Dean of Students. To disclose any such violence confidentially, contact: The SAFE Place - (415) 338-2208; `http://www.sfsu.edu/~safe_plc/`, Counseling and Psychological Services Center - (415) 338-2208; `http://psyservs.sfsu.edu/`. For more information on your rights and available resources: `http://titleix.sfsu.edu`.