Research Methods in 21st Century Astronomy

This course provides a structured introduction to some of the key methods used in 21st century astronomy research, and the practice of astronomy in the US. In this course, you will gain hands-on experience with computational techniques for data analysis and modeling in python. These tools will provide a strong foundation for students pursuing further research in astronomy, and are also highly relevant to careers in data science. Students will be introduced to all aspects of the research process, from reviewing the literature, to producing high quality plots, to presenting their research to their peers. The second pillar of the course is considering how we approach science: what each of us bring to the table, and how we can conduct research ethically.

Learning Objectives

At the end of the course, students will be able to:

- Use python/Jupyter notebooks to analyze and model astronomical data, specifically:
  - Read and clean data from various sources
  - Fit models to data
  - Create high-quality plots
- Conduct a literature review
- Describe current and near-future research programs/observational facilities
- Discuss the ethical issues related to conducting research in the US

Teaching Methods and Philosophy

This is an experiential learning course, with few lectures. In class, you will work on tutorials and projects which are designed to teach students how to conduct research in astronomy, from gathering data to assessing trends to producing data visualizations. Tutorials will focus on teaching analysis techniques through example, and projects will involve more open-ended exploration of astronomical topics.

Texts and Materials

There are no required textbook for the course. Freely available online documents and tutorials will be used to supplement course instruction in Jupyter notebooks a needed. Jupyter notebooks are hosted on the Dartmouth hub, no local installation is necessary. Students will be required to bring their laptop to class.

Assessment and Grading

- Homework assignments (including reflections): 60%
- In-class (or zoom-class) participation: 15%
- Final project or mini-projects (TBD): 25%

The homework assignments include programming assignments (jupyter notebooks), paper reviews, and reflections on class discussions.

Late policy

Homeworks are (generally) due on Tuesdays before class. If you would like an extension on the homework, you may have an extension until Thursday night (2 1/2 days). If you find that you would need longer than this to complete the assignment, please get in contact with Prof Newton to make arrangements.

Honor Principle

As in any Dartmouth endeavor, students in this course are expected to abide by the Dartmouth honor principle. Violation of the academic honor principle includes but is not limited to: presenting someone else's work as your own, copying someone else's work, and copying solutions from this class. You are, however, *encouraged* to work collaboratively with the other students and the TA on your assignments. You should fully understand your final work, and your final presentation of the work should be your own.

Student Accessibility and Accommodations

Students requesting disability-related accommodations and services for this course are encouraged to schedule a meeting with me as early in the term as possible. This conversation will help to establish what supports are built into my course. In order for accommodations to be authorized, students are required to consult with Student Accessibility Services (SAS;Getting Started with SAS webpage: student.accessibility.services@dartmouth.edu; 603-646-9900) and to request an accommodation email be sent to me. We will then work together with SAS if accommodations need to be modified based on the learning environment. If students have questions about whether they are eligible for accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

Religious Observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.