Syllabus

ASTR 598 - Time Domain Astronomy

Cross-listed as ASTR 497

Instructor: James Davenport (Jim)
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Class coordinates: Tuesdays & Thursdays, 10:30AM - 11:50AM, PAB305

Course Goals

The goals of this course are to discuss the physics that drive astrophysical variability - i.e. changes in brightness over time. Focusing on both intrinsic and extrinsic stellar variability, we will explore the history and seminal work, as well as highlight the exciting frontier areas for each type of variability. The class will be split between lectures and hands-on data-driven explorations. By the end of the course, students should know how to read common types of astronomy data, compute essential diagnostics using standard time series algorithms, and make key measurements and physical estimates.

Textbook and Reading

There is no assigned textbook for this course. Citations for facts, results, and figures will be included throughout lectures, which students can and should follow to learn more. Where possible, I will include recommended reading.

Here are a few overview papers that are of interest.
LSST Science Book, v2.0
The Development of our Knowledge of Variable Stars (C. Payne-Gaposchkin 1978)
Variable Star and Their Uses (T. S. Jacobsen 1934)

Code of Conduct

We all agree to abide by the relevant codes of conduct for UW, including those regarding academic misconduct and personal behavior. All cases of suspected academic misconduct will be reported to the Dean's office. Absolutely no harassing or disruptive behavior will be tolerated, either in-person on online. If you experience anything untoward during the course, by any classmate or the instruction team, please report it promptly to the professor or the Astronomy Department's academic coordinator.

Course Evaluation

Labs: 70% Final Exam: 30%

The majority of your grade will come from lab/homework assignments. These will be coding and data analysis focused, and hopefully mirror actual research you might do. We will focus on these labs together on Thursdays in class. It is possible to complete them in class! Labs will be turned in via Dropbox links.

Please bring your laptop to class on Thursdays for our collaborative work on the Labs. If you do not have a suitable laptop, please talk to the Instructor in the first week of class so we can arrange a loaner. Sample Python/Jupyter Notebook code will be provided. There will be no Jupyter Hub set up in advance, students are responsible for having their own functioning installation of Python.

Group work is encouraged! The labs may be challenging, and in real academic research we rarely work alone. Therefore you are encouraged to form homework alliances (even one class-wide super-team if you wish), and work on assignments together. *However,* **A) you must include written acknowledgment of your collaborators with each assignment** (hint: make sure partners are acknowledging each other, or there will be questions about the nature of the "collaboration"), and **B) every student must turn in unique homework** with their own code/results/answers.

There is no extra credit available.

The Final Exam will be hand-written. You will be given a series of light curves, which may be real or synthetic, and asked to provide your best analysis given the topics we have discussed in class.

Course Outline

This is an approximate outline, subject to change as needed
Weeks with Labs are in bold

- Week 01: Intro and Review
- **Week 02: Eclipses**
- **Week 03: Rotation**
- **Week 04: Pulsation**
- **Week 05: Flares and Stochastic Variability**
- **Week 06: Supernovae and Transients**
- **Week 07: R Cor Bor, Dippers, and Dust**
- Week 08: Microlensing
- **Week 09: Accretion**
- Week 10: - Thanksgiving break -
- Week 11: Long Timescales
  - Final Exam: Thursday, Dec 4, 2025 (final day of class)