NAU NORTHERN ARIZONA UNIVERSITY

Department of Astronomy and Planetary Science

AST 580A TECHNIQUES OF OBSERVATIONAL ASTRONOMY LAB
FALL 2023 SYLLABUS

Course Credits: **PART OF A 4 CREDIT HOUR CLASS : AST580**
Pre/Co-requisites: Undergraduate astronomy/physics degree.
Mode of Instruction: In-Person

Mode of Instruction:

- Meets W 2:20-4:50pm in 019-232 and W 7:00-9:30pm at the Campus Observatory.
- **Instructor**: Ed Anderson, Ed.Anderson@nau.edu, **Phone**: 523-7096. **Office**: 019-211.
- Office hours: knock on Ed's door anytime, or by appointment.

Course Purpose :
This lab course will provide an introduction to the acquisition and reduction of modern astronomical data, emphasizing imaging, photometry, and the use of the IRAF software suite.

Course Student Learning Outcomes :
By the end of the class and laboratory, you will have a firm understanding of the skills necessary to plan, execute, reduce and analyze data from a research-grade telescope and imaging system.
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Assignments:

- AST 580A/B consists of one 2.5-hour daytime computer laboratory per week (in PS232). These labs will lead you through the use of IRAF (Image Reduction and Analysis Facility) such that by early-November, you will be able to reduce and analyze your observing project data. These labs are designed to be completed during the Wednesday afternoon class; but it is important that you complete them properly and so all **labs will be due by 5pm on the Friday of that week**.

  NOTE: Labs are cumulative is design and thus must not be skipped—*i.e.,* they must be done in order.

- Students must make astronomical observations with the 0.5-meter Barry Lutz telescope during the semester as part of a 2-person team term project to produce a light curve of a WU Ma class contact binary star. The telescope is reserved for this purpose on Wednesday nights but you will not be observing every week, and observing on other nights might be necessitated by weather.

  On your project night, observing will start 1-hour before sunset and continue until done, which usually means somewhere between 1 and 3am, depending on the predicted period of your object.

- There will be 3-5 homeworks assigned during the semester aside from our regular lab exercises.

- Your team's project paper written to the standards of an astronomical journal.

- In addition to the gathering, reduction and production of a light curve for your object, your group will also model the contact binary system using the **BinaryMaker** software suite and compare your results to previous publications in the astronomical literature.

- Your group will also give a 10-minute presentation to the entire class (AST401/AST580) during the last couple of class meetings in December. This is good preparation for future presentations you will do at astronomical conferences.

Assessment of Student Learning Outcomes:

- **Methods of Assessment**
  - Computer Lab Assignments.
  - Homeworks.
  - Short quiz.
  - Group Project.

- **Timeline for Assessment:**
  - Due dates for homework will be announced in class.
  - Computer Labs are due by the following Friday at 5pm.
  - There will be a short (10-minute) quiz at the beginning of Lab 7.
  - The term paper will be due by 5pm on **Wednesday, December 6**.

Grading System:

Your **Lab grade** will be calculated as follows:

Computer Labs, Homework, Quiz will accumulate to 50%
Final Project Paper will count for 50%

Your **final grade** will be calculated as a 60%-class, 40%-lab split.

A letter grade will be fixed at the end of the semester. An approximate grade scale is as follows:

A >= 90%
80% =< B < 90%
70% =< C < 80%
60% =< D < 70%
F < 60%

Reading and Material:

Suggested Textbook: Birney, Gonzalez, Oesper; *Observational Astronomy*, Second Edition. A copy has been placed on 4-hr reserve in the Cline Library.

Supplementary materials: All of the following can be found on-line on NAU/Canvas:

- Thorstensen, J. (2011). Coordinates, time, and the sky.
- Massey, P, & Jacoby, G. H. (1991). CCD Data: The Good, the Bad, and the Ugly.
- Supplemental material relating to the guest lectures.
- Massey, P., & Hanson, M. M. Astronomical Spectroscopy
- Stetson, P. Basic Principles of Stellar Photometry

Lab Outline (subject to change):

- Lab 1: Introduction to Linux
- Lab 2: Introduction to IRAF
- Lab 3: More IRAF
- Lab 4: Bias and Dark Corrections
- Lab 5: Flat Field Corrections
- Lab 6: CCDProc
- Lab 7: Aperture Photometry
- Lab 8: Extinction Corrections
- Lab 9: Aperture Corrections
- Lab 10: Image alignment and Making Pretty Pictures
- Lab 11: Final Project Term Paper Assigned.
- Lab 12-15: Open lab to work on final project and learning to model the light curve using BinaryMaker.

Class Policies:

- **Late Work**
  Computer lab work should be done in the lab period, but you may turn it in without penalty by the following Friday at 5pm.

  Some of you may be off observing at other telescopes with your supervisors during some of this semester. Please have your supervisor email me with the dates you will be away, and then we can work out how best to complete your labs. Unless I have that email from your supervisor, or you have an institutional excuse, late homework and labs will receive a maximum grade of 80% of the original grade. Answers to labs will be posted the following Monday at 5pm --- after that Labs not turned in will receive a grade of 0.

- **Attendance**
  Attendance is not figured in your grade; however, since the labs are cumulative, poor attendance will most definitely result in a poor grade.

- **Cell Phone Use**
  Please exit the lab to make/take calls.

University Policies:

You are responsible for understanding the University Policies. Please see:
https://nau.edu/wp-content/uploads/sites/26/Syllabus-Policy-Statements.pdf