NAU NORTHERN ARIZONA UNIVERSITY

Department of Astronomy and Planetary Science

AST 580A TECHNIQUES OF OBSERVATIONAL ASTRONOMY LAB
FALL 2019 SYLLABUS
(PART OF A 4 CREDIT HOUR CLASS : AST580)

Course Prerequisites: Undergraduate astronomy/physics degree.

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 portion of AST580 will provide an introduction to the acquisition and reduction of modern astronomical data, emphasizing imaging, photometry, and the use of the IRAF software suite. Depending on your undergraduate institution, you may or may not have seen/used some of this material previously. This class is intended to make sure you are capable of planning/conducting a research project at an observatory: especially the Campus Observatory and the DCT (Discovery Channel Telescope).

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.

Assignments:

- AST 580A 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 mid-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 Friday of that week.

  NOTE: Labs are cumulative is design and thus cannot 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 group (2 person) 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 to 1 to 3am depending on the predicted period of your object.

- There will be 3-5 homeworks assigned during the semester: one will be a constellation quiz; another involving eyepiece observing and drawing what you see (both of these are assigned on the first day and due by the last lab class in December).

- The group term project will be written to the standards of an astronomical journal.
  - In addition to the gathering, reduction and production of a light curve for your object, you will also model the contact binary system using the BinaryMaker software suite and compare your results to previous publications in the astronomical literature. Mike Zeilnhofer will tutor you in BinaryMaker in November—this can be done during lab time on Wednesdays or at a time convenient to Mike and yourself.
  - 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.

There may be optional opportunities to visit the NURO 31-inch telescope and/or the DCT. Announcements will be made in advance.

Assessment of Student Learning Outcomes:

- **Methods of Assessment**
  - Computer Lab Assignments.
  - Homeworks.
  - Short quiz (at the beginning of lab 7).
  - The group project paper.
  - The group project presentation.

- **Timeline for Assessment:**
  - Due dates for homework will be announced in class; and labs will be due by 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 5.

Grading System:

The lab portion of AST580 counts for 40% of your AST580 grade.
Of that, Computer Labs, Homework, and Quiz will accumulate to 50%
Final Project Paper will count for 40%
Final Project Presentation will count for 10%

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:

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 at BBLearn:

- 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 (optional)
- Stetson, P. Basic Principles of Stellar Photometry (optional)

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/university-policy-library/wp-content/uploads/sites/26/Syllabus-Policy-Statements.pdf