ASTRONOMY 4880 / PHYSICS 5880

Astrophysical Measurements Laboratory

Syllabus Fall 2009 Version 2

Time: M/W 7:20–8:35 PM, T 3:30-4:45 PM
Instructor: Dr. N. D. Morrison
Hours: T 5:00–6:30 PM, W 4–6 PM
2:00–3:00, 5:00–6:00
Room: MH 4012 or RO 501
Office: Ritter Observatory 205
Contact info: 530-2659, ndm@astro.utoledo.edu
URL: http://astrol.planet.utoledo.edu/~ndm/4880f09.html
MyUT may also be used.

Corequisite: ASTR 4810 / PHYS 5810 or equivalent preparation

Text and software

- Required: Steve B. Howell, *Handbook of CCD Astronomy* 2nd ed. (Cambridge, 2006); most material in chapters 1–4 and 6 will be covered
- Required: planetarium software such as *Starry Night* (any version) ([http://www.starrynight.com](http://www.starrynight.com)) or *Stellarium* ([http://www.stellarium.org](http://www.stellarium.org)) will be needed for topic no. 8 late in the semester.

Format: one 75-minute lecture plus three hours laboratory per week. Laboratory classes are supposed to encompass two contact hours per credit hour.

- Daytime meeting: one 75-minute class lecture period, Tuesdays 3:30–4:45 PM
- Evening meetings: half the class will attend Monday and half Wednesday evening from 7:20 to 9:40 PM. When the weather is suitable for observing, students will learn to acquire scientific data with the 1-meter telescope. On other evenings, hands-on practice with use of IRAF for data reduction and analysis will be provided in a computer lab. Work on assigned labs (see below) may also be done during those periods. Students will choose Monday or Wednesday for the entire semester; switching nights will not normally be allowed.

Objective: On completing the course, students should: understand the scientific principles underlying the operation of an observatory; and be able to take research-grade stellar spectra, with little or no supervision and with understanding of the main features of what they have obtained.

Requirements

- Assignments will be expected to take 2 to 3 hours per week outside of class. Periodically, one or the other of the following will be assigned. Percentages give weights to be used in computing final grade.
Short problem assignments, called “Homework,” may be provided, for practice in applying concepts developed in class. (Up to 20%)

Longer projects, called “Labs,” in which students will practice the research techniques they have learned in class. Students will have some responsibility for developing the procedure to be used in carrying out the lab. Data reduction practice with the data analysis package IRAF, running on the Unix machine astro1, will be included. Accounts on astro1 will be arranged for students who do not already have them, and access to client computers will be provided. Full-length lab writeups will be required. (At least 35%)

For students taking the class for Writing Across the Curriculum, lab reports will be graded for English grammar, usage, and organization. Revisions will be required as needed. Homework problem solutions will be graded for layout, clarity, and organization, and revisions may be required.

- Because of the importance of hands-on demonstrations, class attendance is required (except in the case of medical absence). (10%)

- Because of the significant conceptual content of this class, there will be a short final examination beginning at 7:30 PM on Wednesday, December 16 and lasting about an hour. (35%)

- The grading standard for students taking the course for graduate credit will be higher.

- Students are required to be aware of any changes to this syllabus that may be announced.

Strongly recommended supplies

- Small flashlight
- Clipboard for taking notes in the dome
- Dress that is appropriate for outdoor activities

Lecture Topics

1. The charge-coupled device (CCD)
2. Introduction to image processing; IRAF
3. Signal and noise; introduction to statistics
4. Spectrographs
5. Spectroscopic data reduction
6. Optical fibers
7. Astronomical telescopes
8. Celestial coordinates: practical aspects, observation planning
9. Star names; stellar spectra (brief introduction)
10. Measured quantities: radial velocities, equivalent widths, line profiles