ASTRONOMY 4880 / PHYSICS 5880

Astrophysical Measurements Laboratory

Syllabus Fall 2008

Time: MW 7:20–8:35 PM
Rooms: RO 27 & 501
Instructor: Dr. N. D. Morrison
Office: Ritter Observatory 205
Hours: TW 4–6 PM, or by appointment
Contact info: 530-2659, `ndm@astro.utoledo.edu`

URL: `http://astro1.panet.utoledo.edu/~ndm/4880f08.html`

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: Hale Bradt, *Astronomy Methods* (Cambridge, 2004)
- Required: planetarium software such as *Starry Night* (any version) (`http://www.starrynight.com`) or *Stellarium* (`http://www.stellarium.org`) will be needed for topic no. 9 late in the semester.

Format: three to six hours lecture / laboratory per week

- When conditions are suitable for observing, telescope operation and data acquisition will be demonstrated and practiced. On some cloudy nights, class will include demonstration of data reduction software, and/or computer laboratory sessions. Students should expect to spend three hours (150 minutes) in class on those occasions.
- At other times, class sessions will include lecture-style presentation of the topic of the day. Lecture sessions will last 75 minutes.

Objective: On completing the course, students should understand the operating principles of an observatory and should 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 17** and lasting about an hour. (35%)
- Students taking the course for graduate credit will carry out an additional project. Their work will also be graded according to higher standards.
- 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. CCD Calibration
5. Spectrographs
6. Spectroscopic data reduction
7. Optical fibers
8. Astronomical telescopes
9. Celestial coordinates: practical aspects, observation planning
10. Stellar spectra (brief introduction)
11. Measured quantities: radial velocities, equivalent widths, line profiles