ASTR 230: Spring 2016 Syllabus

Time: Tuesday 7pm - 8pm (lecture time may change); HBH 254;

Instructor: Dr. Patrick Hartigan, hartigan@sparky.rice.edu, HBH 350, X2245

TA: No TA assigned as of now

Undergrad zeno lab: HBH 347

Office Hrs:
PMH: after class and by appt. W afternoon after the AU seminar is a good bet if I am not traveling. Monday evening will often work

Text: None required. Useful texts for the first half of the class include *Peterson Field Guides: Stars and Planets, 4th ed*. (be sure to get one that goes through 2017 - not all of the 4th ed volumes do) or *Nightwatch: A Practical Guide to Observing the Universe* by Terrence Dickenson. Other materials needed for observing such as a small flashlight are described in the lab writeups.

Additional Information: The course website has information about observing such as scheduling information, weather links, previous final projects, and the most updated lecture schedule.

Topic Schedule:

DATE TOPIC ASSIGNMENT Jan 12
Initial Orientation Begin work on Lab I Jan 19
Telescope/Celestial Sphere Intro First Observing Week Jan 26 Star Names, Conventions Continue Observing Feb 2 Telescope Essentials Continue Observing; Start LAB II Feb 9
Adv. Telescopes & Instruments Continue Observing
Dark Sky Field Trips Feb 16 CCDs & Observing Techniques
Meeting w/ Prof re Projects
Finish up LAB I Start
Short Projects Dark Sky
Field Trips Feb 23 Introduction to UNIX/IRAF **LAB I DUE**
Short Project Data Acquisition Mar 1 **SPRING BREAK** Mar 8
IRAF Image Arithmetic & Display Short Project Data Acquisition Mar 15 Spectrographs IRAF Practice, Spectra;
Project Observing Mar 22 IRAF topics
IRAF/IDL Practice, Final Project Observing Mar 29 Lab I Grades **LAB II DUE** Interferometry Final Project Observing Apr 5 Project Description **Short Project DUE** Error Analysis Techniques Presentation to class
Final Project Observing Apr 12 Errors and Noise
Final Project Observing Apr 11-15 Exam on Lecture material
Lecture Exams, individual times TBA Apr 19 Statistics, Problem

Resolution Data Analysis for Project Apr 27
Final Oral Presentations 3pm (Wednesday)
Final Web Pages Due

Course Description:

This course is designed to give students hands-on experience operating telescopes, obtaining and analyzing data for a special project of the student's choosing, and presenting the results of the project both orally and as a Web page. The course lectures will introduce students to the motions of stars and planets in the night sky, describe the coordinate systems, telescopes and instruments that astronomers use, and show how such data are analyzed. Two main labs, a short quiz on lecture material, a short observing project and a more detailed final observing project comprise the grades for the class.

The first lab introduces students to the basics of telescope operation, while the second lab involves analyzing images and spectra with the IRAF software packages devised by the National Observatories and the Space Telescope Science Institute on machines that run unix. Special projects combine the skills learned in the first two labs, and make use of the on-campus observatory. Typical projects involve imaging and/or spectroscopy of astronomical objects chosen by the student, followed by data reduction and analysis.

There may be trips to locations that have dark skies, including the professor's house in Manvel south of Houston.

Course Outcomes:

Students who complete this course gain many skills that are useful both in astronomical careers and elsewhere, including

- *Speaking skills:* Students present the results of their final projects to the class in a formal setting similar to a scientific conference. In addition to the instructor, typically one or more faculty in the Departments will be present for these talks. Students should acquire increased confidence and experience from the presentations.
- *Writing skills:* Both labs require written reports. Students should be able to write up a clear scientific report from this exercise.
- *Web Page Design:* Students learn to create and design their own web pages as a means to publicize their work.
- *Oral exam and pedagogical skills:* The short tests on lecture material require students to think on their feet and to explain concepts at the blackboard. This experience will help improve the ability of students to perform better in similar circumstances, such as in qualifying Ph.D.

candidacy exams, or simply when speaking with professionals at poster papers at scientific meetings

- *Instrumentation skills:* Students learn how optical telescopes, spectrographs, and CCD detectors work, and will gain hands-on experience operating acquiring data and finding objects. Students who have taken ASTR 230 should be able to run their own `public night' where they can find interesting objects for the general public.
- *Data analysis:* Both photometric and spectroscopic data are analyzed and interpreted in the labs. Students will be able to assess reliability of conclusions based on these data by applying modern statistical methods of error analysis.
- *Computational Skills:* Students will learn the basics of UNIX operating systems, and will be able to use IRAF and IDL to analyze astronomical data.
- *Stellar Motions:* Students will be able to use a planetarium program like Stellarium to understand what the sky looks like at any time in the past or future, and at any location on the Earth.
- *Stars, Planets, Constellations:* Graduates of this class will be able to identify at least a dozen stars and constellations by name, be able to distinguish stars from planets in the sky, and identify north, south, east, and west any time the sky is clear.
- *History and Culture:* Students will understand and appreciate how star names and groupings have come down to us through multiple civilizations over the last 6000 years.

ASTR 230 Grades, Exams, and Papers:

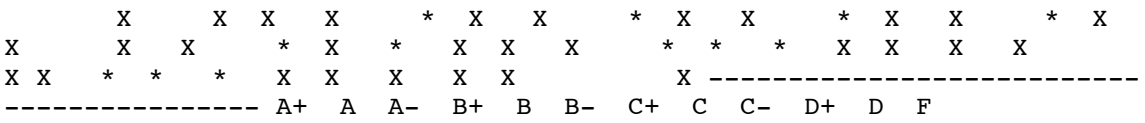
Grades will be based on

- Lab 1: Observational Astronomy (20%)
- Lab 2: Data Reduction and Analysis (20%)
- Short imaging and spectroscopy project (5%)
- Exam on lecture material (10%)
- Final project presentation to the class (20%)
- Final project Web page (15%)
- Preparation (10%)

The following lists the grade distribution I have given out the last eight times I have taught this class (going back to 1998). These may not reflect the totals compiled by the Registrar because some students may have taken the course pass/fail, but professors do not know this when assigning grades. The

compilation does not reflect grades of students who dropped before the add/drop date, or those who were in another section of the class from what I taught.

Asterisks indicate students who later applied to and were accepted into graduate school in astronomy. Note the strong correlation between doing well in this class and continuing on to a career in astronomy.



The median of this distribution is a B+ and the mean GPA is 3.11.

Absences, Preparation:

Class preparation includes being on time for scheduled observing sessions and being prepared in class and at the telescope. Students are responsible for getting their projects and assignments done whenever the weather is clear. There are no makeups if the students postpone the work to the last minute and it happens to be cloudy. Obviously, students that do not attend lectures tend to not do as well on the exam on the lecture material.

Honor Code:

Unlike many other PHYS and ASTR classes, this one has no problem sets and the oral exams are individually scheduled with the professor. For the latter, no notes or outside aid of any kind is allowed. For the observation lab, you must report only your own observations, and must do so honestly and accurately. For the computation lab you must create and store all your own files. Each student should create their own web pages for the final project. A general description of the honor code is avilable on-line.

Disability Accomodation:
If you have a documented disability that will impact your work in this class, please contact me to discuss your needs. Additionally, you will need to register with the Disability Support Services Office in the Ley Student Center.