PHYS 322: Observational Astronomy (Spring 2024)

DATE/TIME
Tuesdays 6:00 - 8:50 pm (or other clear nights. After Day Light Savings begins, 7:00 - 9:50 pm or later due to sunlight). However, due to the nature of night-time observation, be prepared to spend additional hours occasionally.

LOCATION
407 Faculty Memorial Hall (lecture) and Faculty Memorial Hall Rooftop Observatory

OFFICE HOUR
Tuesdays, 4:00 - 5:00 pm (other times by appointment)

INSTRUCTOR
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DESCRIPTION
The emphasis of this course is observations of celestial objects using a telescope system. This is largely a lab-based, hands-on course in which students learn to use a telescope and camera system to obtain, present and analyze astronomical data using computational tools such as Python, IDL and Matlab. Prerequisite: PHYS320 (Astronomy and Astrophysics I, with grade of C or better).

LEARNING OUTCOMES
- Learn about optical telescope and imaging systems for astronomical observations.
- Analysis of acquired data from the telescope system to measure physical properties of the celestial objects using programming languages (e.g., MATLAB, Python, etc.).

ORGANIZATION
- Readings: Read over the lab assignment before the corresponding class period.
- Observing sessions: Attendance is required every Tuesday night (the weekly lecture/demonstration and observing session, cloudy or clear). Students will meet in Room 407 in Faculty Memorial Hall before staring observing session. All observing sessions are at the observatory on the roof of Faculty Memory Hall. If the weather is not good and there is no further lecture material, the entire class may be postponed (the students will be informed by the instructor prior to the class).
- Missing, without a doctor's excuse, a Tuesday night on which observing is possible will result in a 5% drop in your grade.
- There are no exams. Only lab reports should be submitted.
- Lab reports: Lab reports, written in Word or some similar word processor, are the final product of each lab assignment, and must be prepared as a separate document, well-illustrated and explained. Neatness and thoroughness counts! See the sample report and “Tips for Writing Lab Reports” (shared via “Files” on Canvas). The lab reports will be graded by the instructor.
- Lab report due dates: The due dates for the assignments are shown in the schedule below (by 11:59pm on Fridays in the following week after each lab assignment is complete). If you have a legitimate excuse for not getting the lab done on time (i.e. equipment or weather not cooperating or due to sickness), seek permission to turn it in late from the instructor. Otherwise, you will receive 5% reduction in credit per day for a late lab report. Bad weather is NOT an excuse if it is clear on Tuesday. In the case of a run of bad weather, you will be supplied with data taken previously, so that lab due dates need not be missed.
- Final project: The final project consists of an imaging project to be done at the United Astronomy Clubs of New Jersey (UACNJ) Observatory (uacnj.org), Jenny Jump State Forest, Hope, NJ. Since it may be

difficult to find a good weather AND a good schedule for the observatory, we will try to visit the observatory well before the final exam period (possibly, in April).
- Weather consideration: Most class time will be spent in our observatory using the telescope. It can be cold outside. Prepare warm clothes when necessary. A flashlight is also helpful.
- Use of Canvas: Lab assignments and reading materials will be shared on Canvas ("Files"). Some contents (e.g., schedule, in particular) are subject to change due to uncertainties related to the weather, class size, etc.
- Mode of delivery: It is expected that the students attend the class IN PERSON. There will be NO virtual mode of delivery (unless otherwise announced).
- Food and drink are allowed in the classroom (407 FHM) but NOT in the observatory.

TEXT AND REQUIRED SUPPLIES
- Textbook (desired but not required in class): Observational Astronomy 2nd Edition, D. Scott Birney, Guillermo Gonzalez, and David Oesper, Cambridge University Press 2006.
- Lab Notebooks: It is highly recommended to have a lab notebook containing your notes while you take and analyze your data.
- Computer and Software: A personal computer is necessary for data analysis. It is recommended to install necessary software (free). A programming language to read astronomical data (e.g., *.fits) should be installed on your computer. Python is highly recommended.

SPECIAL INSTRUCTION

If the class size is bigger than 5-6 students, students will be assigned into a smaller group to avoid crowdedness in the dome as it is not spacious enough to accommodate more than 5-6 people. The remaining group not participating in observations in the dome will stay in the classroom to work on data processing, reports and to do group discussions. Some labs can be done relatively quickly. In such a case, all the groups will conduct the labs by taking turns so everyone can experience the assigned observations. If observations cannot be done by multiple groups at a given day/time, one group conducts the assigned observations and share the acquired data for the rest of the students. The bottom line is that students should understand the uncertainties associated with the observation activities (class size, time it takes, weather, etc). Therefore, there will be some "play it by ear" approaches.

GRADING

The course grade will be based on lab reports (80%), attendance and class participation (20%). The grading breakdown is as follows:
- 85-100% A
- 80-84% B+
- 70-79% B
- 65-69% C+
- 55-64% C
- 50-54% D
- 0-49% F

ACADEMIC INTEGRITY

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: NJIT Academic Integrity Code. Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu

CLASS SCHEDULE FOR SPRING 2024*

Date	Activity

Week 1 (01/16)	LAB 1: Learning the System Learn Aladin web interface Learn to point the telescope (Cartes du Ciel) Learn to operate the camera and focus Learn basics of astrometry (astrometry.net): Astrometry.net uncertainties
Week 2 (01/23)	
Week 3 (01/30)	LAB 1 DUE (02/02) LAB 2: CCD Digital Imaging Learn about CCD cameras Learn calibration procedures (bias and dark frames) Learn Python image analysis (Python Tutorial) Learn about signal to noise ratio and photon statistics
Week 4 (02/06)	
Week 5 (02/13)	LAB 2 DUE (02/16) LAB 3: Imaging Asteroids Precision astrometry and photometry of moving objects Learn to obtain minor planet center information Calibration (including flats), combining, and aligning of CCD images Finding moving objects with Astrometrica.
Week 6 (02/20)	
Week 7 (02/27)	
Week 8 (03/05)	LAB 3 DUE (03/08) LAB 4: Eclipsing Binary Stars Planning observations Precision photometry Obtaining light curves Epoch fitting Binary star analysis
Week X (03/12) (Spring Recess)	
Week 9 (03/19)	
Week 10 (03/26)	LAB 4 DUE (03/29) LAB 5: Analysis of space weather data, lunar imaging or solar imaging (TBD)
Week 11 (04/02)	
Week X (04/08)	Solar Eclipse
Week 12 (04/09)	LAB 5 DUE (04/12) LAB 6 (FINAL PROJECT): Make a true-color deep sky image Observe from a dark sky site (http://uacnj.org) Choose your own object to image Take images in multiple color filters Learn to combine LRGB filters to a single color image.
Week 13 (04/16)	
Week 14 (04/23)	
Week X (04/30)	No class (Friday classes meet)
05/03	LAB 6 (Final Project) due

*May be subject to change (e.g., due to weather).