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Spring 2022

PHYS 322-102: Observational Astronomy

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Spring 2022: PHYS 322

Time: Tuesday. 6:00 - 8:50 pm (or other clear nights. After Day Light Savings begins, 7:00 - 9:50 pm)
Room: 107 Tiernan Hall (lecture) and Faculty Memorial Hall Rooftop Observatory
Office Hour: Tuesdays, 4:00 - 5:00 pm

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).

ORGANIZATION

Readings: Read over the lab assignment before the corresponding class period. Some basics are described in the file "Phys322_Basics_2021Spring.pdf" located in Files. For further information, read Lecture 1 and Lecture 2 of Phys 321.
Observing Sessions: Attendance is required every Tuesday night (the weekly lecture/ demonstration and observing session, cloudy or clear). Missing, without a doctor's excuse, a Tuesday night on which observing is possible will result in a 5% drop in your grade. All observing sessions are at the observatory on the roof of Faculty Memory Hall. Keep in mind that we may have to move the observing night to a different night due to weather.
Lab Report Due Dates: The due dates for the assignments are shown below. You are expected to complete the labs on these dates (by 11:59 pm Eastern Time). 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 exam" will consist of a final imaging project to be done at

UACNJ (uacnj.org), Jenny Jump State Forest. The final project will count as two labs. The observations will be done in an overnight session some time during finals week (or just before). -- *TBD due to the concerns related to COVID-19*
Data Repository: NJIT Google Team Drive will be used to share data.

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 (required!): You must keep a lab notebook containing your notes while you take and analyze your data. This will also be graded.
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 (Sample lab report). Neatness and thoroughness counts! Read Tips for Writing Lab Reports.
Computer and Software: A personal computer is necessary for data analysis. It is recommended to install Aladin, an interactive sky atlas (see Lab 1 below) before the first class. A programming language to read astronomical data (*.fits) should be installed on your computer. Python is highly recommended.
Bundle up!: Most class time will be spent in our observatory using the telescope. It can be cold outside. Prepare warm clothes.
Special Instruction Related to the Pandemic: If the class size is big, students will be assigned into a smaller group to avoid crowdedness in the dome as it is not spacious enough to accommodate more than 4-5 people. The remaining group not participating in observation in the dome will stay in the classroom to work on data processing, reports and to do group discussions.

GRADES

The course grade will be based on your lab reports (70%), attendance and class participation (30%). 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

NJIT has an honor code (see University Code on Academic Integrity) that you are all expected to apply rigorously to your conduct in this course. All work that you submit must be your own. All written words and ideas must be your own, unless cited (and using quotes where appropriate). All books, web materials, or other sources that you consult must be included in a bibliography at the end of your report. Any violations will be reported to the Dean of Students. This is a lab-based course where each student is expected to use the telescope and obtain data. No bystanders allowed!

SCHEDULE FOR SPRING 2022

Date (New Date)	
Week 1 (01/18) ***Virtual***	**LAB 1:** Learning the System • Learn *Aladin* web interface • Learn to point the telescope (*Cartes du Ciel*) • Learn to operate the camera (*MaxIm DL*) and focus (*Focusmax*) • Learn basics of astrometry (*astrometry.net*): Astrometry.net uncertainties
Week 2 (01/25) ***Virtual***	
Week 3 (02/01)	**LAB 1 DUE (02/01)** **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 (02/08)	
Week 5 (02/15)	**LAB 2 DUE (02/15)** **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*. • Create minor planet center report
Week 6 (02/22)	
Week 7 (03/01)	
Week 8 (03/08)	**LAB 3 DUE (03/08)**

Week X (03/15) (Spring Recess) Week 9 (03/22)	**LAB 4:** Eclipsing Binary Stars (due 04/11) • Planning observations • Precision photometry • Obtaining light curves • Epoch fitting • Binary star analysis
Week 10 (03/29) Week 11 (04/05)	**LAB 4 DUE (03/29)** **LAB 5:** Spectroscopy (TBD) • Basics of spectroscopy • Laboratory measurement and calibration of spectral data • Taking astronomical spectra • Stellar classification, physical properties
Week 12 (04/12) Week 13 (04/19)	**LAB 5 DUE (04/12)** **LAB 6:** Solar H-alpha Imaging, Lunar Imaging, Planetary Imaging, Star Color Photometry (*Student Choice Lab, choose one* • Planning observations • Learning new software • Taking appropriate images for the purpose • Calibration, combining, enhancement of images • Quantitative analysis of data
Week 14 (04/26)	**LAB 6 DUE (04/26)** **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. 2006 Student Images 2008 Student Images
Week X (05/03)	**No class (Friday classes meet)**
05/12	**Final project due**