PHY517 / AST443: Observational Techniques in Astronomy, Spring 2026

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Class Meeting Time/Place: Mondays. and Wednesdays., 3:30 - 6:20 pm, location: ESS 450
Data acquisition Lab 1: TBD with TAs, evening-time
Data acquisition Lab 2: TBD with TAs and instructor, night-time
Data acquisition Lab 3: TBD with TAs and instructor, night-time

Class description

Most discoveries in Astrophysics and Cosmology were and are driven by observations. Astronomers explore the universe by detecting and analyzing light from all over the electromagnetic spectrum. This class concentrates on obtaining and analyzing astronomical data of photons at visible wavelengths with optical telescopes. Students will work in groups of two or three to conduct observational experiments.

In Lab 1, students measure properties of astronomical CCD cameras, take images of several astronomical objects, and develop a calibration scheme for optical imaging. In Lab 2.1, students will acquire time-series photometry of an exoplanet transit using the rooftop telescope. For Lab 2.2, students will aquire optical spectra of stars to characterize stellar types. For Lab 3, students will write a telescope proposal for a project of their own choosing with the rooftop telescope; each group will then conduct their highest-ranked project. Students can choose either Lab 2.1 or 2.2 (photometry or spectroscopy). Lab 3 has to use the opposite observational method.

The students will be responsible for setting up and calibrating the telescope equipment, obtaining their own data, analyzing the data, and reporting their work in lab reports written in the style of scientific papers.

The lecture component is intimately intertwined with the experimental aspects of the course. The students will learn the basics of practical observational astronomy, such as determining the observability of select targets, telescope and detector technology, the use of photometric and spectroscopic techniques, and methods of error, statistical, and time-series analysis. A limited number of homework sets will be assigned to facilitate comprehension of the lecture material.

Data analysis will be performed using standard astronomy software packages, as well as with the general-purpose programming language Python. In addition, students will need to familiarize themselves with standard Linux tools (such as bash scripting). Tutorials will be provided during class-time and/or as homework.

Towards the end of the course, the students will prepare a final oral or poster presentation on one of the projects.

Prerequisites (or equivalents for graduate students)

AST 203 (Astronomy): Students must be familiar with a broad range of astronomy topics.
PHY 277 (Computation for Physics and Astronomy): Students must be familiar with Linux and bash, and have basic programming experience in a language of their choice. Example code will be provided in python.
WRT 102 (Intermediate Writing Workshop): Students must be able to write scientific texts.

Course Website / Syllabus

All course materials will be available on the class webpage:

`https://github.com/sibirrer/PHY517_AST443/wiki`

Technical requirements

Students will be given a log-in for the SBU Astronomy Computing Cluster, on which all required software is installed. They can use these log-ins to work on one of the machines in the Astronomy Computing Center during normal business hours. Alternatively, they can access the Computing Cluster remotely through ssh with window forwarding. On Linux and Mac systems, the latter is straightforward. On Windows, ssh with window forwarding can in principle be done with the programs putty and Xming, but often fails. Students with Windows computers are encouraged to create a Linux partition on their system before the start of classes.

Communication tools

Lectures, tutorials, data help sessions, office hours, and observing sessions will take place in person. Asynchronous communication with the instructor, the TAs, and other students will be organized on slack.

Office Hours

Birrer: TBD
TA1 TBD: TBD
TA2 TBD: TBD
Additional appointments may be arranged by e-mail or slack.

Textbook

There is no required textbook. Suggested texts are:

- Measuring the Universe, G. Rieke (Cambridge University Press, 2012)
- Data Reduction and Error Analysis for the Physical Sciences, P.R. Bevington & D. K. Robinson (McGraw-Hill Higher Education, 2003)
- Practical Statistics for Astronomers, J.V. Wall & C.R. Jenkins (Cambridge University Press, 2008)

Preliminary Course Schedule

#	Month	Day	Topic	Tutorial	HW assigned	HW due
1	Jan	26	Intro, Coordinate Systems	–	1	–
2	Jan	28	Time, Magnitudes, Atmosphere, Telescopes	bash, LaTeX	2	1
3	Feb	02	CCDs, FITS files	python	–	–
4	Feb	04	Spectroscopy	–	–	2
5	Feb	09	Statistics 1	image processing	3	–
6	Feb	11	Statistics 2	Source Extractor	4	–
7	Feb	16	*Data Analysis Help Session*	–	–	3
8	Feb	18	*Data Analysis Help Session*	–	–	4
9	Feb	23	Instructions: Proposal Writing	–	–	–
10	Feb	25	*Data Analysis Help Session*	–	–	–
11	Mar	02	*Data Analysis Help Session*	–	–	–
12	Mar	04	*Data Analysis Help Session*	–	–	–
13	Mar	09	Midterm	–	–	–
14	Mar	11	*Data Analysis Help Session*	–	–	–
-	Mar	16	No class	–	–	–
-	Mar	18	No class	–	–	–
15	Mar	23	Time Allocation Committee	–	–	–
16	Mar	25	*Data Analysis Help Session*	–	–	–
17	Mar	30	*Data Analysis Help Session*	–	–	–
18	Apr	01	*Data Analysis Help Session*	–	–	–
19	Apr	06	*Data Analysis Help Session*	–	–	–
20	apr	08	*Data Analysis Help Session*	–	–	–
21	Apr	13	*Data Analysis Help Session*	–	–	–
22	Apr	15	Instructions: Final Presentations	–	–	–
23	Apr	20	*Data Analysis Help Session*	–	–	–
24	Apr	22	*Data Analysis Help Session*	–	–	–
25	Apr	27	*Data Analysis Help Session*	–	–	–
26	Apr	29	*Data Analysis Help Session*	–	–	–
27	May	04	Final Presentations	–	–	–
28	May	06	Final Presentations	–	–	–

Course Grade

The final grade will be based on the homeworks, midterms, and final exam using the following weighting:

- Lab 1 report: 15%
- Lab 2 report: 20%
- Lab 3 report: 25%
- Midterm exam: 10%
- Project proposal and evaluation of peer proposals: 10%
- Homeworks: 10%
- Final Presentation: 10%

Computed this way, the overall course grade will range from 0–100. A curve will be applied to assign letter grades, based on student grades both this semester and past semesters. Historically, a combined score of 80 or above will earn a grade of A- or better.

Lab Report Grading

Lab reports are scored on a scale of 0 - 100. All Lab reports must include a jupyter notebook, including documentation (in LaTeX), code, and plots. The lab reports must additionally be submitted in the style of a scientific paper, written in LaTeX using the AASTeX package. Each lab comes with weekly deadlines to complete parts of the analysis and the lab report. For every day that a data analysis check-in / the lab report is late, the finaly grade is multiplied by 0.95. Example: if the initial grade of a report was 80, but it was submitted 2 days late, the corrected grade will be 72.

Attendance

Attendance is mandatory, unless a student is feeling sick or is in isolation / quarantine. In this case, the student MUST inform the instructor ahead of time, so that attendance / recording through zoom can be arranged. Students who are feeling sick are expected to take a Covid test. Unexcused absences result in 1 grade point penalty on the final grade. Up to 2 non-consecutive data analysis sessions can be missed without penalty, provided the instructor is informed ahead of time. Absence from the Time Allocation Committee or Final Presentation day results in forfeit of participation points of these components. Unexcused absences on scheduled observing nights results in a 50% penalty on the lab report grade.

Disability Support Services

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: `https://ehs.stonybrook.edu//programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities` and search Fire Safety and Evacuation and Disabilities.

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at:

`http://www.stonybrook.edu/commcms/academic_integrity/index.html`

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.