PHY517 / AST443: Observational Techniques in Astronomy, Spring 2021

Instructor: Prof. Anja von der Linden, ESS 453, anja.vonderlinden@stonybrook.edu
Teaching Assistant: TBD
Teaching Assistant: TBD

Class Meeting Time/Place: Mondays. and Wednesdays., 4:25 pm to 7:25 pm, location: online or ESS 450
Data acquisition Lab 1: TBD with TAs, day-time
Data acquisition Lab 2: TBD with TAs and instructor, 3 nights

Class description

Astronomers explore the universe by detecting and analyzing light from all over the elecromagnetic spectrum. We concentrate on a subset of techniques for detection of photons at visible wavelengths.

This is a lab course, focused on obtaining and analyzing astronomical data with optical telescopes. Students will work in groups of two or three to conduct three distinct observational experiments. In Lab 1, students measure properties of astronomical cameras and develop a calibration scheme for optical imaging. In Lab 2, students will acquire time-series photometry of an exoplanet transit using the rooftop telescope. For Lab 3, students will write a project proposal to analyze data available in public telescope archives (such as the Hubble Space Telescope). 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. In addition, students will need to familiarize themselves with standard Linux tools (such as bash scripting), as well as one general-purpose programming language such as python. Tutorials will be provided during class-time and/or as homework.

For Lab 3, the project on archival data, the students will write project proposals and conduct a peer-review of all proposals. The proposal will emphasize the need for generating a testable hypothesis and justifying it through expected signal-to-noise or other appropriate statistical arguments. The peer evaluations will serve to assess the evaluator's ability to critically assess the quality of the other proposals.

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/anjavdl/PHY517_AST443/wiki`

Technical requirements

Students need to have access to a computer which can run zoom, and which has a microphone (required) and camera (encouraged). Students will be given a log-in for the SBU Astronomy Computing Cluster, on which all required software is installed. They are expected to access the 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, and data help sessions will take place virtually on zoom at the class time. Asynchronous communication with the instructor, the TAs, and other students will be organized on slack.

Office Hours

von der Linden: Thurs. 2:00 to 3:00 pm, on zoom
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	Feb.	1	Intro, Coordinate Systems, Time	–	1	–
2	Feb.	3	Magnitudes, Atmosphere, Telescopes	bash, LaTeX	2	1
3	Feb.	8	CCDs, FITS files, spectroscopy	python	–	–
4	Feb.	10	Statistics 1	–	–	2
5	Feb.	15	Statistics 2	astro software	3	–
6	Feb.	17	*Data Analysis Help Session*	–	–	–
7	Feb.	22	*Data Analysis Help Session*	–	4	3
8	Feb.	24	*Data Analysis Help Session*	–	–	–
9	Mar.	1	Instructions: Proposal Writing	–	–	4
10	Mar.	3	*Data Analysis Help Session*	–	–	–
11	Mar.	8	*Data Analysis Help Session*	–	–	–
12	Mar.	10	*Data Analysis Help Session*	–	–	–
	Mar.	15	3pm: proposal deadline			
13	Mar.	15	*Data Analysis Help Session*	–	–	–
14	Mar.	17	*Data Analysis Help Session*	–	–	–
15	Mar.	22	*Data Analysis Help Session*	–	–	–
16	Mar.	24	Time Allocation Committee meeting			
17	Mar.	29	*Data Analysis Help Session*	–	–	–
18	Mar.	31	*Data Analysis Help Session*	–	–	–
19	Apr.	5	*Data Analysis Help Session*	–	–	–
20	Apr.	7	*Data Analysis Help Session*	–	–	–
21	Apr.	12	*Data Analysis Help Session*	–	–	–
22	Apr.	14	*Data Analysis Help Session*	–	–	–
23	Apr.	19	Instructions: Final Presentations	–	–	–
24	Apr.	21	*Data Analysis Help Session*	–	–	–
25	Apr.	26	*Data Analysis Help Session*	–	–	–
26	Apr.	28	*Data Analysis Help Session*	–	–	–
27	May	3	Final Presentations			
28	May	5	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: 20%
- Project proposal and evaluation of peer proposals: 15%
- Homeworks: 15%
- Final Presentation: 15%

Computed this way, the overall course grade will range from 0–100. Letter grades will be based on a standard grade scale (i.e. an overall score $> 90/100$ would be an A- or better). However, if necessary, a curve will be applied to the overall course grade, considering the overall performance of the class.

Lab Report Grading

Lab reports are scored on a scale of 0 - 100. For Labs 2 and 3, the lab reports must be submitted in the style of a scientific paper, written in LaTeXusing the AASTeX package. Lab 1 is to be submitted as a jupyter notebook, including documentation (in LaTeX), code, and plots. 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, and will be assessed through zoom log, as well as directed questions. 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. 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 Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

`https://www.stonybrook.edu/commcms/studentaffairs/sasc/facstaff/syllabus.php`

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 University 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.

Religious Observances

See the policy statement regarding religious holidays at

`https://www.stonybrook.edu/commcms/provost/faculty/handbook/employment/religious_holidays_policy`

Students are expected to notify the course professors by email of their intention to take time out for religious observance. This should be done as soon as possible but definitely before the end of the 'add/drop' period. At that time they can discuss with the instructor(s) how they will be able to make up the work covered.