VANDERBILT UNIVERSITY
College of Arts *and* Science

ASTR 8060 Syllabus
Observational Astronomy

Instructor: Prof. Jessie Runnoe
Lecture: TR 09:30-10:45
Classroom: 17th & Horton A1009
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Course Information

Description: The purpose of this course is to train advanced students in astrophysics in the observational tools of the professional astronomer. The idea is that by the end of this semester you will be able to perform every step needed to acquire and interpret astronomical data: planning the observation, deciding the telescope and instrument combination to be used, performing the observations and collecting calibration data, calculating the signal-to-noise ratios expected, reducing the data to eliminate instrumental artifacts, and extracting photometric and spectroscopic measurements in the units astronomers use.

The class will consist of weekly homework assignments which include traditional analytical written homework assignments, data analysis assignments utilizing photometric and spectroscopic datasets, and programming using the Python language. My intent is to teach you the things that I have found most useful as an observational astronomer. Of course, this cannot be done in one semester, but we will start with the basics and I expect you will pick up the rest in the course of conducting research.

The high-level overview of this course is to learn to plan observations and carefully reduce one imaging and one spectroscopic dataset:

- Telescope operation and observing planning
- CCD photometry
- CCD spectroscopy

We will only briefly touch on observations and data at X-ray, infrared, and radio wavelengths. Some of the analysis techniques that we'll learn from optical data will carryover to these other wavelength regimes, but any specialized methods are beyond the scope of this course.

Format: This course will be fully in person for Spring 2026. We will meet on campus for both lecture and office hours. Content material from lecture will be posted after class meetings but it is supplementary and not a substitute for attending lecture. Asynchronous announcements will

be made via email or Slack, so you should check your VU email and Slack regularly for updates.

Lecture Schedule: The schedule of lectures and other information will appear on the class Github repository. It is essential for you to be able to regularly access that link. Homework problems and lecture outlines will be posted there, as well as useful reading and links for each lecture.

Textbook and Required Materials: The following texts will be useful resources for this course:

To Measure the Sky, by F. Chromey (recommended; available electronically)
Handbook of CCD Astronomy, by S. Howell (recommended; available electronically)
Data Reduction and Error Analysis, by Bevington (or other stats reference)
Astronomical Optics, 2nd edition, by Schroeder (available electronically)

These are also linked in Brighspace and I have put the hardcopies for these books on reserve for the semester at the VU Science and Engineering Library.

Specific Course and Grading Requirements

Your course grade will be based on the following work:

Homeworks: I will set several traditional problem set assignments. They will be concentrated at the beginning of the semester.

Data reduction: I will also set computing homework assignments. You will get specific homework questions to guide hands-on computing to reduce real data sets.

Final project: There will be no exams, but your final project will be to write an observing proposal. I will assign progress check deadlines throughout the semester. The final project will be due on Wednesday, April 15 at 11:59pm and we will hold a proposal review during our last class meeting. The proposal review is scheduled for 9:30-10:45am on Thursday, April 16, 2026.

Course Grade Components: Your grade will be computed as follows:

Rubric
homework assignments **(35%)**
data reduction **(40%)**
final project **(25%)**
A+ $\geq$ 97%; A= 93 – 96%; A– = 90 – 92%;
B+ = 86 – 89%; B= 83 – 85%; B– = 80 – 83%;
C+ = 72 – 79%; C= 68 – 71%; C– = 65 – 67%;
D+ = 60 – 64%; D= 55 – 59%; D– = 50 – 54%;
F< 50%

Average grades will be rounded to the nearest whole number (that is, 89.5 is 90% and an A–,

89.4 is 89% and a B+). I may relax the grade boundaries but only in your favor (i.e., it might be possible that the A grade boundary ends up being 90% instead of 93%).

Submitting work: You will submit your work by committing it to the class Git repository. Git is a public collaboration tool...all students' work (but *not the grade that it achieved*) will always be available to all other students in the class Git repository. If you are worried about other students copying your homework (and other) submissions, note that logging via "git diff", will make it obvious to me if another student has directly copied your submission. In fact, frequently uploading your code to the Git repository as you write and develop it will make it far harder for your work to be copied than uploading it in a single submission.

You may consider previous submission by your classmates with appropriate citation *after they are graded*. My hope is that you will learn collaboratively from each other's approaches. Science is a collaborative endeavor: This statement is fair warning that your work will be freely available to all other students in the class. Sharing knowledge and expertise in this way is intended in the spirit of scientific collaboration among your classmates.

Late Submissions: You will have the opportunity to earn credit for any in-class tasks and the final exam that are submitted on time. Late submissions are possible with special arrangements made in advance of the due date. Late submissions for homeworks are eligible for the following credit: up to 1 day late 75%, 2 days late 50%, 3 days late 25%, more than 3 days late is not eligible for credit.

Class Policies

General: This course will follow all policies outlined by the Honor System.

There Will be No Extra Credit: I will not be offering extra credit. This syllabus sets up the rules of the game for ASTR 8060. Read it, and carefully note how you will be assessed. I will not be changing the rules halfway through the course by offering extra credit. It would be unfair to the majority of the class who expect to be assessed as detailed in this syllabus if I offer an individual student extra credit after the course has started.

Absences: If you have any symptoms of COVID or other illness, please do not attend lecture. Missing a few lectures should not adversely affect your grade, particularly if you review the course resources and attend office hours to go over the missed material.

The opportunity to make-up missed work will be offered if the student has a genuine university conflict. Advance notice and documentation are required for approved school events (e.g., on an athletic team), religious observances, and other planned absences; the Dean's office must also be contacted in the case of unforeseen circumstances (e.g., death in the family) and an Official Absence requested.

Personal Accommodations: To ensure that I can help support you from the beginning, if you have a physical, learning, or psychological consideration or disability and require ac-

commodations, please let me know as soon as possible. You must register with, and provide documentation of your disability to Student Access Services.

Academic Integrity: Discussing course material with your classmates is in general a good idea, but each student is expected to do their own work. Any instance of academic dishonesty (including plagiarism) will be dealt with according to university regulations. It is your responsibility to avoid complaints or appearances of impropriety. I encourage you to freely discuss any or all content of the course with your peers.....but please, do your own work.

Vanderbilt University is built upon a strong foundation of integrity, respect and trust. All members of the university community have a responsibility to be honest and the right to expect honesty from others. Any form of academic dishonesty is unacceptable to our community and will not be tolerated. Students should report any suspected violation of proper academic behavior to me. I will report suspected violations of standards of academic honesty to my Department Head, and/or the Dean. Complete regulations regarding academic dishonesty are here.

Generative Artificial Intelligence: Artificial intelligence (AI) language models, such as ChatGPT, have become readily available. However, they are not a replacement for your own thinking and comprehension. You will not master the concepts and skills in this course by relying on tools like ChatGPT to give you the answers.

The use of ChatGPT or other AI chatbots to give complete answers for any assignments in this course is prohibited. However, you may treat it like an expert colleague to help resolve misunderstandings, provide additional examples or explanations, or other things that supplement the learning process. In these cases, you must provide an appropriate citation for the tools that you have used. If you have any doubt as to whether you are using an online learning support platform appropriately in this course, I encourage you to discuss your situation with me.

As a final word of caution, remember that these tools can be wrong (and often in subtle ways)! Engage with the feedback that they give you so that you weight it appropriately.