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# Astronomy 244/444: Advanced Astrophysics Laboratory

Prof. Kelly Douglass

Spring 2024

Astronomy 244/444 is the astronomy-only version of our Advanced Laboratory, in which challenging observing projects and analyses are carried out using the 24-inch Cassegrain telescope and its research-grade instrument suite at the C.E.K. Mees Observatory. The semester will be front-loaded with a modest number of introductory lectures on instruments, observations, and image processing. Afterwards, most of the effort will go into planning and executing observations, analyzing the data, and writing papers about the results.

**Prerequisites** ASTR 111 or ASTR 142; MATH 281, PHYS 227, and PHYS 218 completed or concurrently enrolled, and permission of the instructor.

**Instructor** Prof. Kelly Douglass

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**Phone number** 5-5549

**Office** B&L 425

**Office hours** By appointment *in advance*

## Website

The course website can be found at <http://www.pas.rochester.edu/~kdouglass/Classes/Astr244/>; this is the main reference for the course. Complete lecture presentations and observing project descriptions, as well as other helpful resources, can be found here.

## Blackboard

Grades for all reports will be posted on Blackboard throughout the semester.

## Textbooks

There is no required textbook for this class.

## Software

Largely provided for you; accessible by remote login to a server devoted to Mees observing. We will use several specialized programs such as CCDStack and SAOImage DS9, the programming environment IDL which enables programs like ATV and XStarfinder, and broadly useful commercial applications such as Photoshop. We also encourage the use of Python and the astropy module.

## Electronic communication

Via email and Slack ([astr244s24.slack.com](https://astr244s24.slack.com)). We will also use Zoom to communicate with one another during observations.

## Lectures

Tuesdays and Thursdays from 3:25–4:40PM in B&L 203H, conducted by Prof. Douglass. Our Tuesday meetings will largely be devoted to introductory lessons on telescopes and data analysis and processing, and our Thursdays will comprise of observational planning and data reduction.

## Observing

Whenever it is clear, some will observe remotely from B&L 203H. A great deal of spontaneity and schedule flexibility will be demanded to take advantage of clear nights; such is astronomical life in the cloudy Northeast. Coordination is also necessary, as ASTR 244/444 will share the telescope with the more numerous students of ASTR 142.

## Projects

Executed by pairs of students, with each student conducting two (ASTR 244) or three (ASTR 444) projects chosen from a palette which includes:

- Globular clusters, “cluster variable” stars, and stellar evolution
- Observations of transiting exoplanets
- Excitation of HII regions and planetary nebulae
- Seyfert galaxy nuclei: the retrospective discovery of black holes
- Herbig-Haro object and mass loss from protostars

It is preferable for you to have different partners for each project. Groups that choose the same project should choose different targets when possible. (There are many globular clusters, galaxies, exoplanets, etc.)

## Project reports

Each pair of students will write a complete description of each project — motivation, observations and reduction, analysis, scientific discussion, conclusions — in the style of articles in *The Astrophysical Journal*, and at approximately 15-page length. You are welcome to write the reports in L<sup>A</sup>T<sub>E</sub>X, but it is not required.

All reports are due no later than 1 month after the last observations for that project have been completed. For ASTR 244W, the first draft of your report is due no later than 3 weeks after the last observations for that project have been completed.

## Academic honesty

This class is designed to be a collaborative effort. However, all project reports must be your own work, written solely by you and your partner. According to the UR Academic Honesty Policy, cheating consists of submission of written assignments that are not your own work, submissions of assignments under someone else's name, or identical submission of your own previous work (self plagiarism). By University rules, any detected act of cheating that is not the result of a simple misunderstanding will be handed over to the Board on Academic Honesty for investigation.

## Grading

Project reports will be graded according to the quality and correctness of the planning, observations, reduction, analysis, scientific discussion, and the quality of the writing as well. Each author will share the grade with their project partner for their work in common. Grades on projects will be averaged to produce each student's final grade.

No extra credit assignments will be assigned that are not available to the entire class. Final letter grades will be assigned based on an absolute scale and not by a curve. The grading scale will be as follows:

Percentage score	$\geq 80$	$\geq 75$	$\geq 70$	$\geq 65$	$\geq 60$	$\geq 55$	$\geq 50$	$\geq 45$	$\geq 35$	$< 35$
Final grade	A	A-	B+	B	B-	C+	C	C-	D	E

## Extra help

Appointments are available, and when Prof. Douglass is in her office and not in a meeting, you are welcome to walk in. Please come in and see me. I will also answer questions via email and will often be electronically accessible late into the night. I am happy to answer any questions you have concerning the course by either means. Questions from those who find the material confusing enough that they do not know what to ask are most welcome.

## Credit hour policy

This course follows the College credit hour policy for four-credit courses. This course meets two times weekly for three academic hours per week. The course also includes observations for an average of one academic hour per week. In this course, students will plan and execute the observations and the associated activities, including data analysis and the completion of associated reports.

## Statement of inclusion

The University of Rochester, this course, and its teaching staff are committed to inclusion and welcome students of all backgrounds and abilities. Services and reasonable accommodations are available to students with temporary and permanent disabilities, to students with DACA or undocumented status, to students facing mental health issues, other personal situations, and to students with other kinds of learning needs. Please feel free to let any of us know if there are circumstances affecting your ability to participate in class or your full participation in this course. Some resources that might be of use include:

- Undocumented/DACA Student Support Contacts <https://www.rochester.edu/college/ccas/undergraduate/daca/index.html>
- University of Rochester CARE network <https://www.rochester.edu/care/>

- Office of Disability Resources (see below)

### **Disability resources**

The University of Rochester respects and welcomes students of all backgrounds and abilities. In the event that you encounter any barrier(s) to full participation in this course due to the impact of a disability, please contact the Office of Disability Resources. The access coordinators in the Office of Disability Resources can meet with you to discuss the barriers that you are experiencing and explain the eligibility process for establishing academic accommodations. You can reach the Office of Disability Resources at [disability@rochester.edu](mailto:disability@rochester.edu); (585) 276-5075; Taylor Hall; [www.rochester.edu/college/disability](http://www.rochester.edu/college/disability).

### **Mental health services**

Managing your mental and physical health while keeping up with all the academic responsibilities may be especially challenging, given the ongoing pandemic. The University offers support services in a variety of areas and has adapted to supporting students both in-person and online. We encourage you to review the services offered and reach out should you find yourself struggling. You can find a list of services, with descriptions, at <https://www.rochester.edu/college/first-year/guide/support/index.html>.