# Astronomy 465: Galactic Structure

Prof. Kelly Douglass

Fall 2022

Galaxies are among the most spectacular objects in the night sky. These huge collections of stars, gas, dust, and dark matter trace out the structure of the universe on the largest scales, and each represents a complex and dynamic ecosystem in which stars form, evolve, and interact with their environment. Astronomy 465 will present an overview of extragalactic astrophysics that describes the processes responsible for the formation and evolution of galaxies. We will study the details of extragalactic astronomy, the properties of galaxies and galactic nuclei, stellar and gas dynamics, clusters of galaxies, and the large scale distribution of galaxies and galaxy clusters. We will develop analytical and numerical tools to help us understand the properties of these objects. For the most part, these tools will be based on familiar concepts in classical mechanics, thermodynamics, and quantum mechanics.

**Instructor** Prof. Kelly Douglass

**Email** kellyadouglass@rochester.edu

**Phone number** 5-5549

**Office** B&L 425

**Office hours** In-person or on Zoom by appointment *in advance*

## Website

The course website can be found at http://www.pas.rochester.edu/~kdouglass/Classes/Astr465/; this is the main reference for the course. Lecture presentations, problem sets, and other helpful resources can be found here.

## Blackboard

Our Blackboard page is a secondary reference for this course. Lecture recordings and our Zoom link can be found here.

## Textbooks

Required: *Galaxy Formation and Evolution* by Houjun Mo, Frank van den Bosch, and Simon White.

Here is a list of supplemental recommended texts for your reference. They will sometimes be referenced during the lectures. You should not feel compelled to buy any of these.

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| L.S. Sparke & J.S. Gallagher, III | *Galaxies in the Universe, An Introduction*, 2nd edition |
| J. Binney & S. Tremaine | *Galactic Dynamics*, 2nd edition |
| P. Schneider | *Extragalactic Astronomy and Cosmology* |
| J. Binney & M. Merrifield | *Galactic Astronomy* |

  

## Lectures

Highly interactive and discussion based, conducted by Prof. Douglass on Tuesdays and Thursdays from 2–3:15PM in ~~Morey 205~~ B&L 480 (the Chart Room). Any material used during lecture will be available to you on the class website.

## Homework assignments

Problem sets will be due most every other week on Tuesdays (see schedule) at the beginning of lecture, submitted in person. These assignments will be graded for completeness, not accuracy, and will comprise 20% of your final grade.

You are welcome, and encouraged, to work together with your fellow classmates on the problem sets. The solutions you submit, however, must be your own thought and expressed in your own words, in accordance with the University's academic honesty policies.

## Exams

There are no exams in this class.

## Semester project

In lieu of a final exam, you will work on a research-based project throughout the semester. Project topics are to be selected and approved by Prof. Douglass by the end of September. Your project topic must be related to galaxies, but can be anything of interest to you. You will present your project to the class at the end of the semester. A write-up of the project, in your favorite astronomy/astrophysics journal format, will be due by the end of the day on Tuesday, December 13.

## Academic honesty

You are welcome and encouraged to collaborate during the set-up of homework problems and your term project. However, all solutions to the problem sets and your written report and presentation must be your own work, written solely by you. According to the UR Academic Honesty Policy, cheating consists of submission of homework or exam solutions that are not your own work, or submissions of solutions under someone else's name. 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

As outlined above, your grade for this course will be calculated as follows:

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| Project presentation | 30% |
| Project report | 30% |
| Class participation | 20% |
| Homework | 20% |

The course will be graded based on an absolute scale and not by a curve. The grading scale will be as follows:

  

| Percentage score | $\geq 90$ | $\geq 85$ | $\geq 80$ | $\geq 75$ | $\geq 70$ | $\geq 65$ | $\geq 60$ | $\geq 55$ | $\geq 50$ | $< 50$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Final grade | A | A- | B+ | B | B- | C+ | C | C- | D | E |

## 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. This class also includes an independent out-of-class assignment for an average of one academic hour per week. In this course, students will complete independent study using readings and other course materials. These activities include researching and preparing a presentation on a course-related topic of the student's choice.

## Extra help

Office hours are available by appointment. Office hours will be conducted either in-person or via Zoom, as preferred by you. Please dial in and talk to me. I will also answer questions via email and will often be electronically accessible late into the night when problem set due dates approach. I am happy to answer any questions you have concerning the course by any of these means. Questions from those who find the material confusing enough that they do not know what to ask are most welcome.

## 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; (585) 276-5075; Taylor Hall; 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.

### COVID-19 classroom safety

The University is committed to protecting the health and safety of the entire community — students, faculty, and staff. For this reason, it is mandatory that everyone adhere to the daily masking guidelines in University buildings and observe appropriate social distancing, including classrooms. Masks have been provided to students, faculty, and staff. **If the daily COVID-19 risk is High, you must wear a mask appropriately (e.g. over nose and mouth) if you are meeting with me in person, and you must do this for every in-person interaction and for the entire duration of each in-person interaction.** If you fail to do this, you will be politely reminded of the requirement and then asked to leave if you do not comply.

Students who refuse to adhere to the requirement for mask wearing or social distancing during the course will be in violation of the COVID-19 Community Commitment and will be referred to the Student Conduct system through a COVID-19 Concern Report. Such referrals will lead to student conduct hearings and may result in disciplinary action.

Students who feel unable to wear a mask may contact the Office of Disability Resources to explore options for accommodations. Students requiring accommodations may be asked to participate in the course through synchronous learning as part of this accommodation.

  