ASTR 592 Syllabus
Spring 2022
Professor Mills

Galactic and Extragalactic Astronomy
3:00- 3:50 MWF
Mallott 2005

Office Hours:

- **TBD**

Class Google Drive

Anonymous Feedback Form:

https://forms.gle/RNN7jRBy3q2DHcxM9

Topics:

In this course we will study the Milky Way and other galaxies, focusing on developing the tools needed to answer the following questions:

- What are galaxies made of, and what physics govern and organize these components?
- What processes and conditions lead to the diversity of observed galaxy types?
- How do galaxies change over time?

The course will consist of two main parts. First, we will investigate the processes that occur inside of individual galaxies like the Milky Way, with a particular emphasis on the interstellar medium (the gas, dust, and plasma between the stars). We will then use this as a foundation for the second part of the class, in which we will explore how the 'microphysics' of the gas inside of galaxies can help us understand observed galaxy properties and their evolution.

Course Goals:

As an instructor:

- Maintain a supportive and welcoming classroom environment where students are comfortable asking questions, discussing topics, and solving problems
- Foster a community of learning in which students and professor support each other and challenge each other to listen, grow and succeed
- Listen to student needs and provide resources, guidance, and feedback that helps each student achieve their individual goals

For students:

- Recognize when a challenging problem or concept has you stuck, and respond by finding and utilizing resources like textbooks, course notes, your classmates, the professor, and the internet to get unstuck.
- Apply the methods and topics covered in this class to new problems and scenarios. This course is intentionally structured so that we will revisit topics multiple times in order to facilitate the development of problem-solving tools and approaches.
- Improve your academic resilience by identifying topics that are challenging to you, applying new out-of-class study practice to these areas, and evaluating your performance to look for evidence of improvement.

Textbooks:

(1) J E Dyson & D A Williams, 'The Physics of the Interstellar Medium', Second Edition. (***DW***)
(2) L S Sparke & J S Gallagher, 'Galaxies in the Universe: An Introduction'. (***SG***)

Both textbooks are required. ***DW*** will be used for the first half of the course, prior to the midterm. ***SG*** will be used for the second half of the course, after the midterm. Please consult the class Google drive, and also note there are many ways to obtain physical copies of these books, including the campus bookstore and used book vendors online. Please contact me if you encounter difficulties or barriers to obtaining or using these books!

Course Webpage:

Class materials, including problem sets and solutions, as well as copies of the supplemental readings, will be available in a shared Google drive. Please contact me if you have any difficulty accessing these materials.

Classroom Environment:

Learning is not a competition, but rather a mutual endeavor where we all work to succeed together. Everyone in this classroom, including myself as a professor, is here to learn. Ignorance is a natural part of this process. During the semester we will all encounter situations that make us feel confused or lost. We may initially fail at something. We can support each other by asking questions, sharing our own understanding, respecting each other when we struggle with a new idea or concept, and celebrating when we eventually 'get it'. Listening to each other is key to learning, and as a professor I will regularly solicit student opinions and feedback about the course, in addition to the anonymous feedback form.

If you have any concerns about the class that you feel are not being addressed, please contact me by e-mail or in person. I will set up regular office hours, based on student availability, when you can talk to me about any topic (grades, homework, class structure, issues outside of the classroom, research, etc). Additionally, if you ever feel that you have been subjected to sexual harassment (or any other kind of bullying) in this class and do not wish to discuss it with me directly, please talk to the Depatment Chair (Dr. Feldman) as soon as possible.

Preparation for Class:

This class will be highly interactive with limited lecturing, so I expect you to familiarize yourself with the assigned reading before coming to class. At the end of each class, I will also give you a question which you should be prepared to discuss (or be quizzed on) the next time we meet!

In-class work:

Significant lecture time will be devoted to solving problems in class– either as groups or individually. I hope that students will be able to attend class regularly in order to fully participate in all these activities, however students who need to be absent from class for a period of time will be able to access the in-class problems online. **For full credit, In-class problem sets must be turned in the following class day (when solutions will be made available).**
Note that individual grades for in-class problem sets will be based on effort, participation, and completeness, **NOT correctness.**

Homework:

There will be 5 problem sets assigned over the course of the semester. You are encouraged to work together, however each student must turn in their own version of solutions. Unless otherwise stated, all homework assignments must be typed. Unless otherwise specified in class, ***homework is due at the start of class on the date shown in the lecture schedule.*** Solutions

will be posted the Monday after the problem set is due, and any late work received after this time will be accepted for 50% credit. **The class period before each problem set is due will be structured as office hours, where students can ask questions and work together.**

Quizzes:

Each ***Monday*** there will be a short quiz on the lecture and reading material from the previous week. These should be viewed as a way to assess your progress and understanding, and as practice for the problem sets and midterm. Note that grades for quizzes will be based on effort (attempting the problem, showing your calculations, and explaining your thought process) **NOT** the correctness of your final answer! Solutions to the weekly quizzes will be made available the following class day.

Exams:

There will be one midterm exam halfway through the semester. ***The exam will be open-book and open-notes.*** The exams will consist primarily of worked problems similar to those done in-class and for homework. ***The exam will take place over 2 days, to give you time to reflect on the problems, consult with peers or other sources, and correct your work!***

The final exam will be project-based, and will be submitted on the last day of class. You will be asked to both write and solve a 4-problem exam, with 2 problems on topics from before the midterm, and 2 problems covering topics from after the midterm. You will be graded on the creativity, uniqueness, and topical appropriateness of your questions, and the completeness and correctness of your solutions. You may consult with other students to design and solve these questions, but the exam you submit must be unique.

Retake Policy:

In this class, I want to emphasize that an initial failure is not a stopping point-- it is a part of a process that leads to eventual success. Every student will have an opportunity to revisit the missed parts of **any problem set** at any time before the last day of class to receive **half of the missed points.** To receive this credit, you must identify any errors you made in your original solution as well as provide an updated solution.

Grades and Assessment:

Your performance in this course will be assessed using multiple methods.

Formative Assessment: Roughly one third of the course grade (35%) will be determined purely from the ***completion*** of work, including in-class problem sets and quizzes. This is low-stakes work that will not be graded on correctness, but the effort you have put in. Solutions will be provided promptly, and you should use these along with written feedback on these assignments to check your understanding and prepare for higher-stakes activities like homework and exams.

Hybrid assessment: Slightly more than one third of the course grade (40%) will be determined from the homework and midterm exam, for which you will have the opportunity to revisit and correct your work.

Summative assessment: The remaining 25% of your grade will be a **project-based final exam**, and while you may consult with other sources including other students in the class while preparing your project, there will be no opportunities to revisit or correct this work.

The detailed weighting scheme for final grades is:

In-class work	25%
Problem sets	25%
Midterm	15%
Weekly Quizzes	10%
Final Exam	25%

Final grades in the class will be assigned based on percentages, as follows (Yes I know KU does not give A+ grades, but you will still have an A+ in my heart if you do well!):

A+	97% and above	**B+**	87% - 89.9%	**C+**	77% - 79.9%	**D+**	67% - 69.9%
A	92% - 96.9%	**B**	82% - 86.9%	**C**	72% - 76.9%	**D**	62% - 66.9%
A-	90% - 91.9%	**B-**	80% - 81.9%	**C-**	70% - 71.9 %	**D-**	60% - 61.9%

How to Succeed in this Class:

A successful student in this class looks like you! I have high expectations about what we can learn and accomplish this semester, and I believe each of you has the ability to meet these expectations and succeed.

Some tips on how to spend your time in & out of class:

- Take notes in lecture, and spend some time outside of class summarizing them (daily or weekly). Try to make connections in your notes to topics from other lectures (have we discussed anything similar already in this class?)
- Do the class reading, and write regular summaries (being familiar with the textbook and having a shortcut to finding important points will be an extremely valuable resource for problem sets and exams!)
- Ask questions. I highly recommend writing down at least 1 or 2 questions you come up with as you do the reading. If you don't want to ask them in the lecture, submit them anonymously through the google form, or send me an e-mail!
- Take advantage of your classmates: we can all learn from each other, and sharing our questions and ideas will make all of us better problem solvers.
- **Don't leave problems blank on homework or exams**-- always try something and write a description of your thought process (if you think you are doing something wrong or have the wrong answer, tell me why!! Reflecting on problems is valuable and will be rewarded!)
- If something isn't working for you, let me know! I value your perspective and feedback, and while I can't fix or change everything, I will be working to improve the class over the course of the semester.