ASTR 335: Astrophysics II

Fall 2023

Lectures: Tuesday & Thursday 9:00 – 10:15 am, Clapp Laboratory room 422

Instructor: Dr. Katie Lester, klester@mtholyoke.edu, 213 Kendade Hall

Office Hours: Thursday 1:00 – 3:00 pm or by appointment.

Course Website: Moodle contains lecture slides, homework, announcements, and all other course material.

Textbook:

- There is no required textbook for this course, and there will be no assigned readings. Here are two textbooks you can use as an additional resource:
- (optional) *Introduction to Modern Astrophysics*, 2nd edition, by Carroll & Ostlie (ISBN 9781108380980). This class corresponds to roughly chapters 8–18.
- (optional) *Astronomy: A Physical Perspective*, by Kutner (ISBN 9780511802195). This class corresponds to roughly chapters 5, 6, 9–12.

Prerequisites: Astrophysics I (ASTR 228).

Course Description: This is a course in applied physics with the ultimate goal of describing how stars work. Topics include gravitation, stellar mass determination, stellar structure, stellar atmospheres, stellar evolution, and the physics of pulsating stars. We will approach each of these topics from fundamental concepts and we will work our way to a detailed understanding. On the way we will review the structure of the atom, radiative processes, and some basic principles of thermodynamics.

MHC Learning Goals:

1. Think analytically and critically by questioning assumptions, evaluating evidence, and articulating well-reasoned arguments.
2. Acquire depth, methodological expertise, and historical understanding in a discipline.
3. Develop intellectual breadth through study across disciplines and different modes of inquiry.
4. Develop the ability to write and speak confidently and effectively.
5. Engage in artistic forms of expression.
6. Acquire quantitative and technological capabilities.
7. Develop skills in more than one language and engage with cultural communities other than their own.
8. Conduct independent or collaborative research incorporating diverse perspectives and skill sets.
9. Apply the liberal arts through experiential learning in work and community environments.
10. Learn practices of self-assessment and reflection for academic, personal, and career growth.

ASTR 335 Learning Goals:

- Demonstrate proficiency in physics, properties, & evolution of stars (MHC goal #2).
- Show a working knowledge of a broad array of physical phenomena that are based upon fundamental concepts (MHC goal #3.
- Gain familiarity with observational, computational, and database methods utilized by professional astronomers (MHC goal #6).
- Exhibit a proficiency in the methods of scientific inquiry in research projects (MHC goal #1, #2, and #6).
- Demonstrate use of critical thinking skills in well-organized, logical and scientifically sound oral and written scientific reports (MHC goals #1, #4, and #8).

Grading: Homework (60%), Activities (25%), Final project (15%). You are welcome to turn in homework after the deadline with a 20% penalty for each day late.

Letter grades:	A > 93	B+ = 87-89	C+ = 77-79	D+ = 67-69
	A- = 90-94	B = 83-86	C = 73-76	D = 63-66
		B- = 80-82	C- = 70-72	F < 60

Homework: We have homework sets due roughly every 2 weeks that will contain quantitative problems or short answer questions. These will typically have longer math problems so should be hand written (when possible) and turned in at the start of class. We'll review the homework in class afterwards.

Participation: We will spend some time in class working on hands-on activities (like group problem solving or coding labs). Participating in these activities will be a critical part of your classroom experience so they will be graded, but can be finished at home if needed.

Project: There will be a final project consisting of a paper and presentation due at the end of the semester. The topics and a grading rubric will be provided later, but this project will likely be an extension of one in-class coding activity. For example, running your code on a new data set or modifying your code to address a new problem. You'll write your results up in a 2 page paper and short class presentation, in order to practice how professional astronomers present their research and build science communication skills.

Accommodations: Please let me know if you need any accommodations from the Disability Services office (Mary Lyon Hall 3rd Floor or by email). I would like to meet with you and discuss your approved accommodations and how we can apply them to this class. (For more information on who might be eligible for accommodations and the application process please see the Disability Services website.)

Academic Integrity: I encourage you to work together on homework & activities, since science is often very collaborative. You are still expected to follow MHC's academic integrity policy. Any work that does not will be given a zero and reported to the Academic Honor Board. Each student is required to write up and submit their own work. Using artificial intelligence on assignments is prohibited; students should not have another person/entity do the writing of any portion of an assignment for them, which includes AI tools like ChatGPT.

Mount Holyoke College is a community of students, faculty, staff, and administrators committed to free inquiry and the pursuit of knowledge in the tradition of the liberal arts. The decision to join this academic

community requires acceptance of special rights and responsibilities that are essential for its effective functioning and the realization of its mission. All members of the community share the responsibility to uphold the highest standards of academic integrity. I expect all your work to abide by the MHC Honor Code: “I will honor myself, my fellow students, and Mount Holyoke College by acting responsibly, honestly, and respectfully in both my words and deeds." Any work that does not will be reported to the Academic Honor Board.

Finally, I expect everyone to treat each other with respect & compassion both inside and outside the classroom.

Tentative Course Schedule:

Week	Date	Topic
1	Sept 7	Introduction
2	Sept 12, 14	Hydrostatic Equilibrium
3	Sept 19, 21*	Ideal Gas Law
4	Sept 26, 28	Nuclear Fusion
5	Oct 3, 5	Energy Transport
6	Oct 12	Stellar Evolution
7	Oct 17, 19	Stellar Evolution
8	Oct 24, 26	Stellar Atmospheres
9	Oct 31, Nov 2	Variable Stars
10	Nov 7, 9	Physical Properties
11	Nov 14, 16	Physical Properties
12	Nov 21	Stellar Remnants
13	Nov 28, 30	Extreme Stars
14	Dec 5, 7	TBD, Presentations
15	Dec 12	Presentations

Schedule is subject to change.

If class is cancelled, then any homework due that day will be pushed to the next class period.

* Note, class will end at 10am on Sept 21 due to President Holley’s inauguration.