

Syllabus Astronomy 113/114

Spring 2021

Astronomy 113/114 is an active learning version of the core natural science course on stars and galaxies. This course fulfills the requirement for a 4 credit natural science lab course.

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Learning Assistants: Alysa Aroonsakulwongse and Artem Kharko.

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Office Hours in person: Thursday 9:00 am - 10:00 pm. Additional office hours can be scheduled by appointment.

Safe Return to Campus

All students taking courses with a face-to-face component are required to take Safe Return to Campus Training prior to visiting campus. Training is available in Blackboard (<https://mymason.gmu.edu>). Students are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (www2.gmu.edu/safe-return-plan). Similarly, all students in face to face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, or Red email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

General Education Goals:

Astronomy 113/114 is part of the core natural science program. According to the GMU catalogue the purpose of the core science courses is: "to educate, liberate, and broaden the mind, and to instill a lifelong love of learning."

Core natural science courses engage students in scientific exploration; foster their curiosity; enhance their enthusiasm for science; and enable them to apply scientific knowledge and reasoning to personal, professional and public decision-making.

To achieve these goals, students will:

1. *Understand how scientific inquiry is based on investigation of evidence from the natural world, and that scientific knowledge evolves based on new evidence and differs from personal and cultural beliefs.*
2. *Recognize the scope and limits of science.*
3. *Recognize and articulate the relationship between the natural sciences and society and the application of science to societal challenges (e.g., health, conservation, sustainability, energy, natural disasters, etc.).*
4. *Evaluate scientific information (e.g., distinguish primary and secondary sources, assess credibility and validity of information).*
5. *Participate in scientific inquiry and communicate the elements of the process (for lab courses only) by: a) Making careful and systematic observations, b) Developing and testing a hypothesis, c) Analyzing evidence, d) Interpreting results.*

Course Objectives for Astronomy 113/114:

Astronomy 113/114 is a general education natural science course (lecture and lab combined) focused on *stars, galaxies, and cosmology*. It is designed to help students understand the scientific process and to develop their scientific reasoning skills in the context of astronomy. *The main emphasis of the course is investigating how astronomers have come to know what they know about stars and galaxies based on the light that reaches us.*

Course Structure and Philosophy:

The course is studio style using the “flipped” approach. ***Outside the class, students are expected to read the material, watch short videos, and do the weekly homework with deadlines on Sunday.*** During the ***class sessions on Tuesday***, students will be involved in several collaborative activities such as lecture tutorials, mini-investigations, and labs. Most of the time you will ***work in small groups*** (made of 2 members) randomly assigned. Working with others can be an effective way to learn, and importantly most jobs require some level of collaborative work. An important part of general education is becoming a lifelong learner, able to think broadly and deeply, and to communicate effectively with others. Virtual tables are randomly assigned every four weeks. To succeed it is important to ***dedicate adequate time and effort outside the class*** to study the basic concepts, which are further mastered through class activities. The level of engagement and commitment required for this class is greater than for a standard lecture; as with all things worth doing, it will require effort, attendance, and commitment.

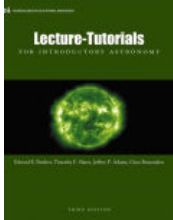
Text Books (Required):

1) *Astronomy (open educational resource)*

(<https://openstax.org/details/books/astronomy>)

2) *Lecture-Tutorials for Introductory Astronomy* (3th Edition).

Prather, Slater, Adams & Brissenden.



Blackboard & Technology requirements:

You will need a **reliable laptop** to participate in the class activities and complete your weekly homework. The course's material is delivered through Blackboard. You must be able to both upload and download documents.

You will need to download the **Respondus Lockdown Browser**, which will be used in the proctored tests in class.

You will need to **check your emails (using the GMU account) often and Blackboard at least weekly**. For detailed information about technology contact courses@gmu.edu, or the ITU Support Center at (703) 993-8870 for general help, including login or network issues.

Work Ethic & Policies:

Active learning courses require more participation and input by students than do traditional large lecture format courses. Astronomy 113/114 involves both individual and collaborative work. You are expected to contribute actively to group activities and to respect and value opinions and work of other group members.

You will need to participate fully each week by:

- 1) coming prepared to class and completing the weekly homework quiz (deadline Tuesday at 2:30 pm);
- 2) completing all class activities and labs and submitting reports in class.

There are three mandatory tests: two midterms and one comprehensive final. All tests will be taken in the proctored COS Testing Center in the basement of Planetary Hall (room 2).

As a class, you will have an assigned temporal window to go to the Testing Center and complete each exam.

Students with disabilities:

Students with documented disabilities or special needs need to contact the instructor during the first week of class so that we can accommodate your needs throughout the course.

Students who suspect they have disabilities that need accommodation should contact the Office of Disability Services at George Mason as soon as possible in order to get proper documentation.

Student resources:

[Academic advising center](#) – 703-993-2470

[Campus counseling center](#) – 703-993-2380

[Office of Disability Services](#) – 703-993-2474

[Writing center](#) – 703-993-1200

[Math tutoring center](#) – 703-993-1460

[Office of Diversity, Inclusion, and Multicultural Education](#)

[Religious Holiday Calendar](#)

Honor Code:

George Mason’s Honor code states that “Student members of the George Mason University pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.” If you have questions about the meaning of these terms, please ask. We expect you to hold to this standard by carefully citing sources used in your work and by doing your own work on tests and individual assignments.

In an environment where group work is highly valued it can be difficult to sort out what policies apply. At a minimum follow these guidelines:

- Work identified as individual should be strictly your own.
- Cheating on exams or presenting another’s work as your own (plagiarism) will result in a zero grade for the assignment.
- Students are expected to actively collaborate on assignments identified as group, but it is important that only students who actively participate are given credit. The group is responsible for ensuring that all members take part and assume responsibility for group assignments.
- Material that is drawn from written or electronic sources must be appropriately cited. For on-line discussion it is usually enough to simply reference a text page or web site. In a more formal paper a bibliography and appropriate in-text citations are mandatory. If in doubt about how to do this contact an instructor.

Grading System:

Graded assignments include both at-home and in class activities. The grade is computed as follows: 1) *homework quizzes* (5%), 2) *active participation* (5%), 3) *in class activities* (25%), and 4) *labs* (25%). Adding up these assignments yields 60% of your final grade. The remaining 40% is provided by three mandatory exams. There is extra credit in some of the class activities and in all the exams. During the semester, no more than 3 missed activities or labs can be made up out of class. ***If you miss 5 activities or 5 labs, you will get a zero in that category*** (and likely fail the class). *Partial credit* can be earned for late work (not for the quizzes): *up to 80% within one week*, 0% after one week. Late arrivals, texting, use of computers unrelated to class activities will result in systematic point deduction.

| Type of Assignment | Percentage of grade | Method of calculating |
|-------------------------|---------------------|--|
| Homework quizzes (home) | 5% | <i>Due each Sunday at 11:59 pm <u>No temporal extensions.</u></i> |
| Active Participation | 5% | <i>Points deducted for lack of participation, texting, being late.</i> |
| In-class activities | 30% | <i>Submission in class. Full credit for honest participation and demonstrating comprehension</i> |
| At home activities | 20% | <i>Submission due Sunday 11:59pm</i> |
| Exam 1, 2, 3 | 40% | <i>Done in class with Respondus</i> |

Percentage based on calculations in table above:

A = 93-100

A- = 90-93

B+ = 87-90

B = 83-87

B- = 80-83

C+ = 77-80

C = 73-77

C- = 70-73

D = 60-70

F = 0-60

Homework Quiz

Each week you must complete one quiz, made of multiple choice, multiple-answer, and ranking questions, that covers the material studied the previous week and the lab that you are about to do that week. Please, take this homework seriously, and take the quiz only after you have studied the material and (possibly) without external help. Some questions in the tests are very similar to those in the homework quiz. To encourage you to study on weekly basis (which is necessary for a deeper understanding of the subject) and get prepared for the weekly lab, no temporal extensions are allowed for the quiz submission.

At home collaborative activities grading system

A variety of activities (which comprise lecture tutorials, mini-experiments, crosswords, visualization activities, video and audio analysis, etc.) will be performed in class to help you master the most important concepts of the course. Overall, the activities are worth 25% of your grade. At the end of the class period, you will submit the daily assignment, which will be graded according to the 3-2-1-0 High Performance System:

- Score 2: Work is essentially correct and free of most major errors. Work meets my expectations. Contact me if you are not sure about what is correct and what is not.
- Score 1: Your work is missing some important components or has some important errors that need to be resolved before you can progress. Please meet me or an LA as soon as possible.
- Score 0: Your work was not submitted according to the directions or no meaningful attempt is evident in your work. Please meet with me or an LA as soon as possible.
- Score 3: Your work is exemplary and goes beyond my expectations for this particular assignment. This score is rarely assigned and you should be very proud of your efforts.
- Note: Strive to earn a "2" on every assignment. A consistent "2" will earn an A for this portion of the grade. Typically, in a 25-point assignment, 3 means 25, 2 means a grade between 20 and 24, 1 means a grade between 10 and 15, 0 means 0.

Exams

There are three mandatory tests: two midterms and one comprehensive final. If the grade of the final test is better than one of the midterm tests, the lowest midterm grade will be dropped and the grade of the final will be counted twice. Exams are to be done completely individually and I expect full adherence to the honor code with no collaboration, no outside notes. Your responses should come exclusively from your well-prepared and thoughtful brain.

Schedule (subject to change)

| Week | Weekly Learning Goals | Learning Support Tasks | Assessments |
|--------------|---|--|---|
| Jan 26 | <i>Get to know the structure class and your classmates.</i> | Activity: personal introductions, clarify class misconceptions. | Activity submission Lab report Homework Quiz |
| Feb 2 | <i>Describe our place in the Universe, Summarize the main traits of science and distinguish it from pseudoscience.</i> | Math review: scientific notation, unit conversion. Activity + lecture tutorial Lab: Universe in a tennis ball | Activity submission Lab report Homework Quiz |
| Feb 9 | <i>Explain basic physics laws science and apply them to different contexts.</i> | Math review: graphs and charts. Activity + lecture tutorial Lab: Physics in a nutshell | Activity submission Lab report Homework Quiz |
| Feb 16 | <i>Explain radiation properties, Illustrate different light-matter interactions.</i> | Activity + lecture tutorial Activity: light & info from spectra | Activity submission Lab report Homework Quiz |
| Feb 23 | <i>Describe the Sun structure and activity, Explain energy production and balance.</i> | Activity + lecture tutorial Lab: Solar energy | Activity submission Lab report Homework Quiz |
| Mar 2 | <i>Distinguish luminosity vs. brightness (and absolute vs. apparent magnitudes), Classify stars based on their spectra, Explain methods for astronomical distances.</i> | Activity + lecture tutorial Lab: Parallax distance | Activity submission Lab report Homework Quiz |
| Mar 4 | EXAM 1 (Thursday in class, with the Respondus Lockdown Browser) | | Weeks 1, 2, 3, 4 |
| Mar 9 | <i>Explain how astronomers determine star mass and size, Describe the power of the HR diagram and explain its application to clusters.</i> | Activity + lecture tutorial Lab: HR diagram | Activity submission Lab report Homework Quiz |
| Mar 16 | <i>Explain how stars form and evolve, Illustrate differences between low- and high-mass stars, Demonstrate a basic knowledge of Excel.</i> | Activity + lecture tutorial Lab: Photometry of Pleiades | Activity submission Lab report Homework Quiz |
| Mar 23 | <i>Explain the role of degeneracy pressure in compact objects, Differentiate between WD, NS, BHs, and explain how they were discovered.</i> | Activity + lecture tutorial Lab: Radio astronomy of pulsars | Activity submission Lab report Homework Quiz |
| Mar 30 | <i>Describe the structure of the Galaxy and the interstellar medium, Explain how astronomers inferred the</i> | Activity + lecture tutorial Lab: Variable stars | Activity submission Lab report |

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|---------------|---|---|---|
| | <i>existence of dark matter, Distinguish between intrinsic and extrinsic variable stars.</i> | | Homework Quiz |
| Apr 1 | EXAM 2 (Thursday in class, with the Respondus Lockdown Browser) | | Weeks 5, 6, 7, 8 |
| Apr 6 | <i>Differentiate between galaxies based on morphology and their content, Explain how galaxies move and Hubble's law.</i> | Activity + lecture tutorial Lab: Hubble's Law | Activity submission Lab report Homework Quiz |
| Apr 13 | <i>Explain how astronomers study the evolution of galaxies, Describe the structure of active galactic nuclei.</i> | Activity + lecture tutorial Lab: Citizen science: Zooniverse | Activity submission Lab report Homework Quiz |
| Apr 20 | <i>Describe the observational evidence of the Big Bang Theory, Explain how astronomers inferred the existence of dark energy.</i> | Activity + lecture tutorial | Activity submission Lab report Homework Quiz |
| Apr 27 | <i>Describe the characteristics of life on Earth and the possibility of finding life beyond Earth.</i> | Activity + lecture tutorial | Activity submission Homework Quiz |
| May 4 | EXAM 3 (Thursday in class, with the Respondus Lockdown Browser) | | Comprehensive |