

Syllabus Astronomy 113/114

Spring 2020

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.

Instructor: Dr. Mario Gliozzi

Learning Assistants: Alysa Aroonsakulwongse and Charlotte Conant.

Contact Information:

Office: 201C Planetary Hall

Tel: 703-993-4479

Email: mgliozzi@gmu.edu

Office Hours in person: Monday 10:00 am - 12:00 pm. Additional office hours can be scheduled by appointment.

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 and watch short videos on weekly basis.*** New material will be released on Wednesday. On Thursday, students will be involved in several activities such as lecture tutorials, mini-investigations, which will introduce the most important concepts and highlight common misconceptions. Finally, the following Tuesday will be dedicated to labs to go deeper and reinforce the main learning goals.

Most of the time you will ***work in small groups*** (made of 2 or 3 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. Tables are randomly assigned every four weeks. In these four weeks you will work in pairs and groups of three that change on weekly basis.

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.

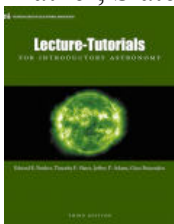
Text Books (Required):

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 reliable computer access to participate in this course. Most of the course’s material is delivered through Blackboard. You must be able to both upload and download documents. 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. Texting, use of computers unrelated to class activities will result in systematic point deduction. There will be a 20% deduction for late arrivals within 15 minutes, 40% deduction within 30 minutes; beyond 30 minutes you will be marked absent.

Type of Assignment	Percentage of grade	Method of calculating
Homework quizzes (home)	5%	<i>Due each Tuesday at 2:30 pm</i> <i>No temporal extensions.</i>
Active Participation	5%	<i>Points deducted for lack of participation, texting, being late.</i>
In-class activities	25%	<i>Submission in class.</i> <i>Full credit for honest participation and demonstrating comprehension</i>
Labs	25%	<i>Submission in class.</i>

Percentage based on calculations in table above:

A = 93-100	C+ = 77-80
A- = 90-93	C = 73-77
B+ = 87-90	C- = 70-73
B = 83-87	D = 60-70
B- = 80-83	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.

In class 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.

Labs

Weekly pre-lab quizzes are to be completed out of class before the beginning of the Tuesday class, when we do a formal lab. Pre-lab material, lab instructions and report templates are located on the Blackboard site. The labs are done entirely in class and the reports are submitted in class in the weekly lab Dropbox on Blackboard. The vast majority of the labs are done in groups of 2 (more rarely in groups of 3). At the end of the semester, there will be an individual practical lab, where you will have to use observational techniques and skills learned in previous labs..

Observatory Visit

A visit to the GMU observatory counts as one lab. You will need to go to the observatory (located in the Research I building), and gather at the elevators where a guide will meet you and take you to the telescope on the top floor. The observatory report is due the week following your visit. You will need to prepare in advance by reading materials on the GMU observatory Blackboard

site.

See one of the observatory web sites for more information about the telescope and procedures for visiting. A good place to start is

<https://sites.google.com/view/georgemasonobservatory/home>.

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. The three mandatory exams will be taken in the testing center in the basement of Planetary Hall (<http://ttc.gmu.edu>).

You will have a specific temporal *window* for each exam and there will be no extensions.

Schedule (subject to change)

Week	Weekly Learning Goals	Learning Support Tasks	Assessments
Jan 22	<i>Get to know the class and your neighbors, Describe our place in the Universe, Summarize the main traits of science.</i>	Math review: scientific notation, unit conversion. Activity: personal introductions, clarify class misconceptions. Lab: Universe in a tennis ball	Activity submission Lab report Homework Quiz
Jan 29	<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 5	<i>Explain radiation properties, Illustrate different light-matter interactions.</i>	Activity + lecture tutorial Lab: Atomic spectra	Activity submission Lab report Homework Quiz
Feb 12	<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
Feb 19-20	EXAM 1 (first midterm, in the COS Testing Center)		Weeks 1, 2, 3, 4
Feb 19	<i>Distinguish luminosity vs. brightness (and absolute vs. apparent magnitudes), Classify stars based on their spectra, Explain methods for astronomical distances.</i>	Math review: logarithms Activity + lecture tutorial Lab: Stellar classification (CLEA)	Activity submission Lab report Homework Quiz

Feb 26	<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 4	<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 (CLEA)	Activity submission Lab report Homework Quiz
Mar 9-22	SPRING BREAK		
Mar 25	<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 (CLEA)	Activity submission Lab report Homework Quiz
Apr 1	EXAM 2 (second midterm, with Respondus Lockdown Browser + Webcam)		Weeks 5, 6, 7, 8
Apr 1	<i>Describe the structure of the Galaxy and the interstellar medium, Explain how astronomers inferred the existence of dark matter, Distinguish between intrinsic and extrinsic variable stars.</i>	Activity + lecture tutorial Lab: Variable stars	Activity submission Lab report Homework Quiz
Apr 8	<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 (CLEA)	Activity submission Lab report Homework Quiz
Apr 15	<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 22	<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 Homework Quiz
Apr 29	<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 6	EXAM 3 (with Respondus Lockdown Browser + Webcam)		Comprehensive