Syllabus Astronomy 113/114

Spring 2023

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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Office Hours in person: Monday, Wednesday 12:00-1:00 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.*

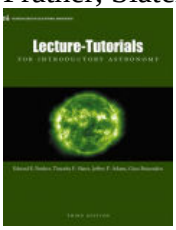
Course Structure and Philosophy:

The course is studio style using the "flipped" approach. ***Outside the class, students are expected to read the material, watch short videos, and do a quiz with deadline on Sunday***. ***On Tuesdays***, students will be involved in several collaborative activities such as lecture tutorials, mini-investigations, whereas ***Thursdays*** will be dedicated mostly to the labs.. Most of the time students 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. New 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, available on Blackboard)
(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 Sunday at 11:59 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 COS Testing Center (located in Planetary Hall room 2).

Supplies:

Each student needs the following supplies for each face to face meeting:

- Laptop (please avoid using your phone for class activities)
- Notebook with pencils/pens, and possibly some dry erase markers
- Lecture tutorial book

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: *homework quizzes (5%)*, *active participation* (5%), *in class activities (25%)*, *and labs (25%).* Adding up these assignments yields 60% of your final grade; the remaining 40% is provided by 3 mandatory 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%	***Due each Sunday at 11:59 pm*** ***No temporal extensions.***
Active Participation	5%	***Points deducted for lack of participation, texting, being late.***
In-class activities	25%	***Submission in class on Tuesday.***
Labs	25%	***Submission in class on Thursday***
Exam 1, 2, 3	40%	***In the COS testing center***

Percentage based on calculations in table above:

A+ = 97-100
A = 93-97
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, which cover the material introduced at the beginning of the week. Please, take this homework seriously, and take the quiz only after you have studied the material and 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.*

Grading rubrics

Grading rubric for class activities and labs:

Results	Presentation	Points
Correct	The reasoning is correct and explicitly explained	25-23
Mostly correct	The reasoning is mostly correct and explained	22-20
Significant errors	The reasoning is either not correct are or not shown	19-17
Mostly incorrect	There are substantial misconceptions	< 17

Grading rubric for active participation:

Participation	Points
Being present and active; genuine participation to group work; honest feedback	4-5
Coming late and/or spending class time on unrelated activities	3
Being absent one day	2
Being absent both days	0

Exams

There are three mandatory tests (taken in the COS Testing Center, located in Planetary Hall, room 2): 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 24	*Get to know the structure class and your classmates.*	**Activity:** personal introductions, clarify class misconceptions.	**Activity submission** **Lab report** **Homework Quiz**
Jan 31	*Describe our place in the Universe, Summarize the main traits of science and distinguish it from pseudoscience.*	**Math review:** scientific notation, unit conversion. **Activity + lecture tutorial** **Lab:** Universe in a tennis ball	**Activity submission** **Lab report** **Homework Quiz**
Feb 7	*Explain basic physics laws science and apply them to different contexts.*	**Math review:** graphs and charts. **Activity + lecture tutorial** **Lab:** Physics in a nutshell	**Activity submission** **Lab report** **Homework Quiz**
Feb 14	*Explain radiation properties, Illustrate different light-matter interactions.*	**Activity + lecture tutorial** **Lab:** atomic spectra	**Activity submission** **Lab report** **Homework Quiz**
Feb 21	*Describe the Sun structure and activity, Explain energy production and balance.*	**Activity + lecture tutorial** **Lab:** Solar energy	**Activity submission** **Lab report** **Homework Quiz**
Feb 27, 28	**EXAM 1 (in the COS Testing Center)**		**Units 1, 2, 3, 4**
Feb 28	*Distinguish luminosity vs. brightness (and absolute vs. apparent magnitudes), Classify stars based on their spectra, Explain methods for astronomical distances.*	**Activity + lecture tutorial** **Lab:** Stellar Classification (CLEA)	**Activity submission** **Lab report** **Homework Quiz**
Mar 7	*Explain how astronomers determine star mass and size, Describe the power of the HR diagram and explain its application to clusters.*	**Activity + lecture tutorial** **Lab:** HR diagram	**Activity submission** **Lab report** **Homework Quiz**
Mar 21	*Explain how stars form and evolve, Illustrate differences between low- and high-mass stars, Demonstrate a basic knowledge of Excel.*	**Activity + lecture tutorial** **Lab:** Photometry of Pleiades (CLEA)	**Activity submission** **Lab report** **Homework Quiz**
Mar 28	*Explain the role of degeneracy pressure in compact objects, Differentiate between WD, NS, BHs, and explain how they were discovered.*	**Activity + lecture tutorial** **Lab:** Radio astronomy of pulsars (CLEA)	**Activity submission** **Lab report** **Homework Quiz**
Apr 3-4	**EXAM 2 (in the COS Testing Center)**		**Units 5, 6, 7, 8**

Apr 4	*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.*	**Activity + lecture tutorial** **Lab:** Variable stars	**Activity submission** **Lab report** **Homework Quiz**
Apr 11	*Differentiate between galaxies based on morphology and their content,* *Explain how galaxies move and Hubble's law.*	**Activity + lecture tutorial** **Lab:** Hubble's Law (CLEA)	**Activity submission** **Lab report** **Homework Quiz**
Apr 18	*Explain how astronomers study the evolution of galaxies,* *Describe the structure of active galactic nuclei.*	**Activity + lecture tutorial** **Lab:** Citizen science: Zooniverse	**Activity submission** **Lab report** **Homework Quiz**
Apr 25	*Describe the observational evidence of the Big Bang Theory,* *Explain how astronomers inferred the existence of dark energy.*	**Activity + lecture tutorial** **Lab:** Practical lab session I	**Activity submission** **Lab report** **Homework Quiz**
May 2	*Describe the characteristics of life on Earth and the possibility of finding life beyond Earth.*	**Activity + lecture tutorial** **Lab:** Practical lab session II	**Activity submission** **Lab report** **Homework Quiz**
May 10-11	**EXAM 3 (Thursday in class, with the Respondus Lockdown Browser)**		**Comprehensive**