Syllabus Astronomy 115

Spring 2023

This four - credit natural science course satisfies 3 credits of lecture and one credit of laboratory for the Mason Core requirement. It is a hybrid, active learning course with four in-person hours and two hours of on-line learning materials.

Instructor: Dr. Rebecca J. Ericson

Contact Information:

Office: 201B Planetary Hall
Tel: 703-638-5417
Email: rericso1@gmu.edu
Office Hours: Tuesday 4 – 5 via Zoom by appointment

Course Purpose and goals:

Astronomy 115 is part of the core (general education) program at GMU. According to the GMU catalogue the purpose of general education courses is: "to educate, liberate, and broaden the mind, and to instill a lifelong love of learning."

General education natural sciences courses 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 115:

Astronomy 115 is a Mason Core natural science course that explores the edges of current understanding of exoplanets, planets orbiting other stars. As you come to understand how astronomers develop and test ideas you will develop a deeper understanding of the scientific

process and will develop your 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 exoplanets and how solar systems seem to form and develop based on study of our own solar system and comparison of ours to systems of planets orbiting nearby stars.

Deadlines:

On-line mini-lectures and videos in addition to readings are required to prepare for the week's work. New on-line lecture materials will be available each Tuesday and assignments for that week are due the following Monday at midnight. The assumption is that by viewing the videos and on-line materials, reading and taking quizzes and doing other assignments, you will learn what you will need to do well in the class activities for that week.

Text Books (Required):

Fraknoi, A, Morrison, D. and Wolff, S.C. (2016) **Astronomy**, OpenStax, Rice University. Availablefor free online at (https://openstax.org/details/books/astronomy)

Tasker, E. (2017). **The Planet Factory: Exoplanets and the search for a second earth**. Bloomsbury Signa.

Trefil, J. & Summers, M. (2019) **Imagined Life: A speculative scientific journey among the exoplanets in search of intelligent aliens, ice creatures, and supergravity animals**. Smithsonian Books.

The first text, **Astronomy**, is free, available in a variety of formats from OpenStax at the address above. We will use it for background astronomy readings.

The **Tasker** book is a mass market paperback, that should be available from the bookstore and is the main focus for the exoplanet information. Much of the quiz material will come from this book.

The **Imagined Life** book by two Mason Physics and Astronomy scientists is more speculative. Dr. Summers is an expert on planetary atmospheres and was one of the investigators with instruments onboard the New Horizons mission to Pluto and beyond. This book should help you imagine possible worlds within the constraints of the physics and chemistry we know.

Technology requirements:

You will need reliable computer access to participate in this course. You must be able to both upload and download documents and watch videos as well as download some selected programs to your device.

A smartphone or tablet may not be sufficient for the course, be sure you also have access to a fully featured computer.

You will need to ***check emails (use the GMU account only) and Blackboard regularly*** and will be required to submit quizzes before the due date and time each week.

For more detailed requirements about some of the necessary technology for different applications see the information below on *Blackboard* and *Collaborate*.

Blackboard:

The course is delivered through Blackboard. Please be sure you have adequate technology to access the site and do the required work. Go to My Mason, sign in and select the Courses tab, then look for the Astronomy 115. If you need help consult links on the main page as you enter Blackboard. Other sources of help:

- Contact courses@gmu.edu and include your Mason email and G#
- Contact the ITU Support Center at (703) 993-8870 for general help, including login or network issues

Getting started:

1. Before the first week of the semester be sure you can access the Blackboard site for Astronomy 115 and can navigate the tabs and course elements for the first week.

2. Go to the Blackboard menu item "Journals" to post a message and picture for the class as instructed.

3. Visit the Week 1 page to work on course materials, readings, short videos, the first graded journal assignment and the quiz. Note deadlines for each of the elements and complete work on time.

Policies:

Active learning courses require more organization and input by students than do traditional large lecture format courses. You will need to participate fully each week by:

1. Reading the materials and watching the on-line lectures and other materials
2. Completing the quiz based on the week's materials by Monday night of the following week.
3. Completing the journal or other assignments in the weekly modules and submitting them by Monday night of the following week.
4. Coming to class with questions about the material you have read and watched.
5. Contributing to class and small group discussions.
6. Carrying out laboratory exercises in small groups.

Students with disabilities:

Students with documented disabilities or special needs should 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:

Calendar for GMU academics Spring 2022
https://registrar.gmu.edu/calendars/spring_2022-1/

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

Classroom conduct:

Astronomy 115 is designed as a collaborative learning experience. It is important that students participate in all activities in the online environment and that they contribute actively to groups and class discussions. Discussions should be conducted with respect for each other and at a high level of discourse. Disruptive behavior will not be tolerated and may result in a student being temporarily barred from participating in activities and incurring a grade penalty. Please do not share student contributions outside of this course.

Work Ethic:

Astronomy 115 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.

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. I 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 the or the writing center.

Grading System:

Your grade will be based on both lecture and lab work. Notice that there are extra points available. This is a kind of "insurance" in case you miss an assignment, or have trouble with a quiz. You can't pass the course without completing the project and at least 9 labs, so make it your goal to do all assignments beginning with week 1 to ensure you can achieve the point value you need for the grade you are pursuing!

Activity		Possible points
Lab reports (group grades)	10 reports 10 points each	100
In-class assignments, Journals and quizzes	Up to 10 ten-point quizzes (Points for individual journals and assignments will total at least 50 points)	150
Project	Mandatory 100 points possible	100
Participation	15 points possible	15
Total	***While more points are available, the maximum counted toward your grade is 350***	***365***

Grading-points based on 300 needed (15 additional points available)

ABOVE 325	A
315 - 325	A-
304 -315	B+
290 - 304	B
280 - 290	B-
269 - 280	C+
255 - 269	C

245 - 255	C-
210 - 245	D
BELOW 210	F

Quizzes

Quizzes help you know whether you are grasping the material or not, and where to focus your effort to understand. You may take the quiz twice. Quizzes are to be your individual work but are open book and notes.

Assignments

Some assignments are designed to be completed and submitted during the synchronous meeting times. These assignments are designed to help you understand the material better and in some cases may be ungraded but submitted to help you keep track of materials you may need for your project. Out of class assignments are generally individual. Due dates help ensure that you don't reach the end of the course with an unmanageable load of work, but I don't penalize for an occasional late submission as I prefer that you do the work that will lead to learning to the best of your ability even if it means submitting a little after a deadline.

Lab reports

The heart of a laboratory science course is the laboratory experience. Astronomy is somewhat different from many of the sciences in that it is more historical than experimental. Astronomers base their hypotheses and theories on data and on experimental results from fields such as physics and chemistry but cannot recreate such things as planet formation in the laboratory. Computer simulations, spectral analysis, and studying astronomical objects in multiple wavelengths are just some of the techniques that help us understand the universe.

We will have lab activities during in-person sessions on-line. Occasionally they will involve some out of class preparation. They may also extend over the entire week for some of the longer assignments, so it is important to attend every class session. Labs will generally be done in groups of three and will receive a group grade. Each group member is responsible for all parts of the lab, though each will have a different role, leader, recorder, or checker, with additional responsibilities. Lab reports are due at the end of the Thursday synchronous session.

Participation

Attendance is key to learning in this class and is at the heart of the design of this course. In an active learning classroom, you learn from what you DO as well as what you read and hear. You learn from your individual effort, from interacting with your classmates and from your instructor. You need to contribute to the class and your group, ask thoughtful questions, and actively participate in group and individual activities. Participation is graded on the following scale:

100% - exceptional engagement and thoughtful work throughout the course
83% - satisfactory participation, some thoughtful contributions to class
70% - partial participation, some time spent off-task or disengaged
60% - significant lack of participation or engagement, frequent absence
0% - Lack of attendance, disruption of learning environment, persistent disengagement

Journals

Some weeks there will be a journal prompt designed to help you reflect on and understand the course material. You will share some of these with your classmates so assume they are shared unless they are marked "private" in which case only the instructor sees them.

Project

There will be one major project this semester, a group or individual project exploring the nature of a particular exoplanet through a creative or informative presentation. Details about these projects will be posted on Blackboard.

Assignment Schedule

This schedule is subject to change as I continue to restructure for on-line presentation. Videos will be available on Blackboard and there may be additional short readings as new information emerges in this very volatile field of study. A quiz and journal writing are due each Monday at midnight.

Observatory tour. Tours will be scheduled for our class – individual sign up with choice of in-person or virtual tour.		**Lab 0: Out of class lab tour of GMU Observatory – sign up when schedule is announced.**	**Tour pre-lab assignment is on Blackboard during first week.**	(Report is due one week after completing tour)
Week	**Topic – the "big picture" idea for the week**	**Lab (usually on Thursday some preparatory material on Tuesday**	**Readings and foundational material – may vary somewhat as the semester goes on.**	**Assignments and quiz due on Monday of this week at midnight.**
Jan 24 and 26	Introduction: Overview of the universe	**Preparation for out of class lab**	**Astronomy Ch. 1 and 7.1, 7.2, 7.4** **The Planet Factory Preface and Introduction**	
Jan 31 and Feb 2	Stars and planets –	**Lab 1: Comparative planetology**	**Astronomy Ch. 5** **Imagined Life Ch. 1 and 2**	(Due Jan 30 at midnight)

	What is the difference?		**Trappist 1 What is it? Graphic Short story** **http://www.trappist.one/#stories**	Quiz 1 (Planet Factory and Astronomy ch.1 readings) Class introduction
Feb 7 and 9	Learning with light	**Lab 2: Learning with light**	**Astronomy Ch. 18** **The Planet Factory Ch. 2 and 3**	(Due Feb 6 at midnight)_ Quiz 2 Journal entry 1: Value of ignorance
Feb 14 and 16	Candidate stars	**Lab 3: Herzsprung-Russell Diagram**	**The Planet Factory Ch. 4 and 5 The Terminator Short Story** **https://www.nature.com/articles/542512a**	(Due Feb 13 midnight) Quiz 3 Journal or assignment
Feb 21 and 23	Planet search techniques	**Lab 4: Radial velocity technique**	**Astronomy ch. 21- Birth of stars** **The Planet Factory Ch. 6 and 7** **Imagined Life Ch.6**	(Due Feb 20 midnight) Quiz 4 Journal or assignment
Feb 28 and March 2	Planet search techniques II	**Lab 5: Transiting planet**	**The Planet Factory Ch. 7 and 8** **Imagined Life Ch. 7 and 8**	(Due Feb 27 midnight) Quiz 5 Journal or assignment
Mar 7 and 9	Solar system formation	**Lab 6: Reading scientific writing**	**The Planet Factory Ch. 9, 10, and 11** **Imagined Life Ch.9**	(Due Mar 6 midnight) Quiz 6 Journal or assignment
March 13-19	**Spring break – no class this week**			
Mar 21 and 23	Weird Worlds	**Lab 7: Exoplanet database graphing lab**	**The Planet Factory Ch. 12, 13 and 14** **Imagined Life Ch.10**	(Due Mar 20 midnight) Quiz 7 Journal or assignment
Mar 28 and 30	Exploring your Exoplanet	**Lab 8: Habitable zone lab**	**The Planet Factory Ch. 15 and 16** **Imagined Life Ch.11**	(Due Mar 27 midnight) Quiz 8 Mandatory Journal: Post topic and presentation method for project
April 4 and 6 *	Farthest Voyage in Space		**Astronomy Ch. 30 Life in the Universe** **The Planet factory Ch. 17**	(Due April 3 midnight) Quiz 9 Journal or assignment

Apr 11 and 13	Habitable planets	**Lab 9: Drake equation lab**	**Imagined Life Ch. 3,4 and 5**	(Due Apr 10 midnight) Quiz 10 Farthest Voyage in Space assignment
Apr 18 and 20	Life in the Universe	**Lab 10: Cosmic distance ladder**	**Imagined Life Ch. 12, 14,15**	(Due Apr 17 midnight) Journal or assignment (Due April 20 midnight) Project paper and creative project
Apr 25 and 27	**In-class presentations of projects**			
May 2 and 4	Finding ET?	**Role play: ET found?**	**Imagined Life Ch.16, 17**	(Due May 1 at midnight) Journal: ET found
No Final exams for Astronomy 115 – have a wonderful summer!				