



Astronomy 114

Spring 2022

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Course Description

This is the laboratory that goes along with the introductory course Astronomy 113. The purpose of this course is to help students understand the process of science through astronomy investigations and the use of realistic simulations. An important learning goal is to help students understand and practice the rudiments of scientific reasoning as a model for investigations in other disciplines.

Blackboard Login Instructions

Access to My Mason and GMU email are required to participate successfully in this course. Please make sure to update your computer and prepare yourself to begin using the online format before the first day of class. Go to <https://mymasonportal.gmu.edu/ultra/institution-page> and log in with your Mason credentials. You should see this course listed under “Courses” in the menu bar. All materials and drop boxes are located in this Astronomy 114 course for your section.

Required Textbooks

There are no required textbooks for this course. All materials will be found in the course on Blackboard. If you are currently enrolled in Astronomy 113 the assigned textbook will be useful for background information for Astronomy 114 as well. In addition, the course has a link to the text, *Astronomy*, a free, open education resource from OpenStax which will be valuable for those taking the lab as a stand-alone without the lecture portion.

Course Learning Outcomes

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1. Understand how scientific inquiry is based on investigation of evidence from the natural world, and that scientific knowledge and understanding:
 - a. evolves based on new evidence
 - b. differs from personal and cultural beliefs
2. Recognize the scope and limits of science.
3. Recognize and articulate the relationship between natural science and society and the application of science to societal challenges
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, including:
 - a. Making careful and systematic observations
 - b. Developing and testing a hypothesis
 - c. Analyzing evidence
 - d. Interpreting results

Technology Requirements

There is no need for special hardware or software unless you are doing a make-up lab at home since the lab computers have the necessary software. In the case of doing a make-up lab via distance or if you are enrolled in a distance section you will need the following.

Hardware: You will need access to a Windows or Macintosh computer with at least 2 GB of RAM and access to a fast and reliable broadband internet connection (e.g., cable, DSL). A larger screen is recommended for better visibility of course material. You will need speakers or headphones to hear recorded content. A headset with a microphone is recommended for the best experience. A web cam will be valuable, though not absolutely required. For the amount of Hard Disk Space required taking a distance education course, consider and allow for:

- the storage amount needed to install any additional software and
- space to store work that you will do for the course.

If you consider the purchase of a new computer, please go to Patriot Tech to see recommendations.

Software: You will need a browser and operating system that are listed compatible or certified with the Blackboard version available on the the [myMason Portal](#). See [supported browsers and operating systems](#). Log in to [myMason](#) to access this course. Labs may use [Acrobat Reader](#), and [Windows Media Player](#), [QuickTime](#) and/or [Real Media Player](#).. Your computer should be capable of running current versions of those applications. Also, make sure your computer is protected from viruses, see some possibilities here: [Mason IT suggested antivirus software](#).

Students owning Macs or Linux should be aware that some courses may use software that only runs on Windows. You can set up a Mac computer with Boot Camp or virtualization software so

Windows will also run on it. Watch [this video](#) about using Windows on a Mac. Computers running Linux can also be configured with virtualization software or configured to dual boot with Windows.

Note: If you are using an employer-provided computer or corporate office for class attendance, please verify with your systems administrators that you will be able to install the necessary applications and that system or corporate firewalls do not block access to any sites or media types.

Course-specific Hardware/Software

Free software that you can download on a home computer and install will be used for some labs. This is all available in the lab room where you will work in groups of 2 or 3. For a distance version of the course you will need to download the following.

Stellarium: a planetarium type program. A web based version is also available though it has a slightly different navigation system and more limited possibilities. Access at:

<http://stellarium.org/>

NAAP labs native apps installation. These are on the lab computers and can be installed on your own computer. Instructions for the download are on the website.

<https://astro.unl.edu/nativeapps/>

You will also need the spreadsheet program Excel which can be downloaded from the your GMU Office 365 email account (be sure to install the ap on your computer as well).

Schedule for in-person classes only

Assignments week of	Lab Topic (subject to change)	Overview
January 24	Introduction to the lab Star wheel or Sun Spotters	Orientation to lab procedures. Introductory star wheel activity Or introduction to Sun spotters outdoor activity if weather is conducive
Dates will vary by section	1 – Observatory tour - the dates will be announced near the start of the semester	Visit GMU’s observatory for a tour of the facility. This may be in-person or virtual. You will be asked to select one tour from several possibilities offered for your section.
January 31	2-Lenses and mirrors lab Optics equipment light box, mirrors lenses etc.	The behavior of light and an introduction to optics. This is relevant to the observatory tour where students should see how it applies to data collecting with a telescope
February 7	3-Atomic Spectra Diffraction grating glasses, gas tubes, spectrometers	Basics of atomic structure and the origin of emission lines and how they serve as “fingerprints” for the chemical elements
February 14	4-Stellar classification CLEA	Investigate differences in stellar spectra and understand how stars are classified by spectral type
February 21	5-HR Diagram CLEA	Learn how a fundamental graphic in stellar astronomy is constructed and its power in understanding how stars change over their lifetimes.
February 28	6-Photoelectric Photometry of the Pleiades CLEA	Another rung on the distance ladder using clusters of stars that form at close to the same time and same distance from the sun.
March 7	7-The Sun lab – Sun Spotters with data collection outside if weather permits – CLEA alternative if sun is not shining during your section meeting.	Using sunspots to measure solar rotation rates – on-going investigation in real time using Sunspotters or CLEA lab depending on weather.
March 14	Spring break – no classes	
March 21	8- Variable Stars	Explore how certain classes of very bright stars in their giant phase can provide another measure of distance.

Assignments week of	Lab Topic (subject to change)	Overview
March 28	9-Galaxy Analysis	Sorting galaxies by observed physical characteristics.
April 4	10- Hubble Redshift	Measuring galactic redshifts to calculate the expansion rate of the universe using real data.
April 11	Make-up lab: Radio Astronomy of Pulsars CLEA	Understand how radio waves can be a powerful tool in astronomy with yet another possible way to measure distance.
April 18	<i>Possible make-up day in case schedule needs to change due to weather delays or instructor illness</i>	
April 25	<i>Possible make-up day in case schedule needs to change due to weather delays or instructor illness</i>	
May 2	<i>Possible make-up day in case schedule needs to change due to weather delays or instructor illness</i>	
May 11-18	<i>No final exams for Astronomy 114 labs</i>	

Course Policies: Labs will be in-person but due to Covid-19 and possible variants, please notify the instructor if you feel ill or need to stay home to quarantine. There are make-up possibilities that you can complete the same week. These will be individual labs and may differ somewhat from the in-person labs, but are designed to meet the same educational goals. Because there is great value in working with a team please plan to attend all classes if possible.

Instructor-Student Communication: Your instructor may opt for online office hours. In any case the instructor will respond to your emails involving class policies, procedures and lab content as quickly as possible. Before sending an email, please check the following (available on your Blackboard course menu) unless the email is of a personal nature:

1. Syllabus
2. Ask the Professor on the discussion board for questions of interest to class members.
3. On-demand Blackboard videos on how to use Blackboard features, and Technical Requirements if you must do a lab on-line.

Feel free to respond to other students in the Ask the Professor forum if you know the answer.

Grading Scale

Your grade is based on the points from 10 lab exercises. Each lab has a possible 100 points which includes a possible 10 points for each quiz and 90 points for the lab itself. The one exception is the Observatory tour lab which has a 10 point prelab exercise in the report rather than a quiz. The observatory report itself is worth up to 90 points for a total of 100 points for the

lab. 1000 points total for ten labs is the maximum possible for the semester. Converted to letter grades the scale is as shown in the table below.

Points	Letter grade
930 - 1000	A
900 -929	A-
870 - 899	B+
830 -86	B
800 -829	B-
750 -799	C+
700 -749	C
670 -699	C-
600 -669	D
Below 60	F

Semester important dates

First Day of Spring Classes:	Mon. Jan 24
Last Day to Submit Domicile Reclassification Application	Mon. Jan 24
Last Day to Add: All Individual Sections Forms Due	Mon. Jan 31
Last Day to Drop: With 100% Tuition Refund	Mon. Feb 7
Last Day to Drop: With 50% Tuition Refund	Mon. Feb 14
Unrestricted Withdrawal Period: 100% Tuition Liability	Tues. Feb 15 - Tues. Mar 1
Spring Recess (no classes)	Mon. Mar 14 - Sun. Mar 20
Mid-term Evaluation Period: 100-200 level classes - Grades Available via PatriotWeb	Mon. Feb 21- Fri. Mar 25
<u>Selective Withdrawal Period</u> - Undergraduate Students Only (100% Tuition Liability)	Wed. Mar 2 - Mon. Apr 11
Incomplete Work from Fall 2021 Due to Instructor	March 25, 2022
Last Day of Class	Sat. May 7

Examination Period

No exams for
astronomy labs

For more dates and information go to

https://registrar.gmu.edu/calendars/spring_2022-1/

University Policies and Resources

- a. Academic Honesty: You are expected to be familiar with and abide by the University's Honor Code. The Code can be found [here](#). It is your responsibility to see me if you have questions about these policies. George Mason University has an honor code that states the following:
To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this:
- b. Students must follow the university policy for [Responsible Use of Computing](#).
- c. Student services: The University provides range of services to help you succeed academically and you should make use of these if you think they could benefit you. I also invite you to speak to me (the earlier the better).
- d. Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- e. [The George Mason University Counseling and Psychological Services \(CAPS\)](#) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance. Counseling Center: Student Union I, Room 364, 703-993-2380.
- f. Students with disabilities who seek accommodations in a course must be registered with the [George Mason University Office of Disability Services \(ODS\)](#) and inform their instructor, in writing, at the beginning of the semester. All academic accommodations must be arranged through that office. Please note that accommodations MUST BE MADE BEFORE assignments or exams are due. I cannot adjust your grade after the fact.
- g. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- h. [The George Mason University Writing Center](#) staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. University Writing Center: Robinson Hall Room A114, 703-993-1200. The writing center includes assistance for students for whom English is a second language.
- i. Diversity: George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.