

# ASTRONOMY 113

## Stars, Galaxies, and the Universe

Syllabus, Spring 2020

Instructor: Dr. Ania Wyczalkowska

READ CAREFULLY, ASK QUESTIONS IF CONFUSED.

It is your responsibility to familiarize yourself with class policies and schedule.

NASA, ESA, Hubble  
Processing: Judy Schmidt

**Course meeting:** Tue, Thu 3:00 PM - 4:15 PM, Innovation Hall 103

**Prerequisites:** none

**Contact information:**

***office:*** 327 Planetary Hall,  
***phone:*** x 34166  
***e-mail:*** [awyczalk@gmu.edu](mailto:awyczalk@gmu.edu)  
***office hours:*** Monday 5:00 PM – 6:00 PM  
 Wednesday 12:00 PM – 1:00 PM (or by appointment).

Note: my office hours may be subject to adjustment as my other obligations get scheduled at the start of the semester.

Office hours are generally conducted on a first come first serve basis. You are encouraged to come visit me if you are having any problems with the course, have questions about the material we cover or any questions about astronomy in general! If you need to see me and are not able to come during my regularly scheduled office hours, please make an appointment. Other than during my office hours, I'm not able to accept walk-ins. If, for an unexpected reason, I am not able to be there during any of the regularly scheduled office hours, I will post an announcement on Blackboard and/or leave a note on my office doors.

***contacting me:***

This is a large class and not the only one I teach this semester. So first of all, if you're mailing me please include the information that you are in my ASTR 113 class. Anything that is not of personal nature should be communicated via the discussion board. If you have course-related questions, it is likely that your classmates may want to ask the same, so please check the discussion board first for similar queries and, if your questions aren't already answered there, post them. Personal issues are best handled in person, so stop by during my office hours or make an appointment. Because of the size of the class I will not discuss individual grades, help you with your homework, discuss your test performance, or anything else that's lengthy, by e-mail. For that you'll need to come see me.

Please allow at least 72 hours for responses both to mail and the discussion board. Note that at times it is not possible for me to answer all emails, particularly if I receive a real large number of them over a short

period of time. Bottom line: while I'll do my best to be accessible to you, I need your cooperation to keep the amount of mail at a reasonable level. At the same time, if you do not get a reply from me within 72 hours, please assume that your mail got buried and re-send it. (Also, please do not use the Blackboard e-mail function. E-mails sent through Blackboard get bundled all together and sometimes do not show as new. You are more likely to get a timely answer if you do not use the Blackboard system.)

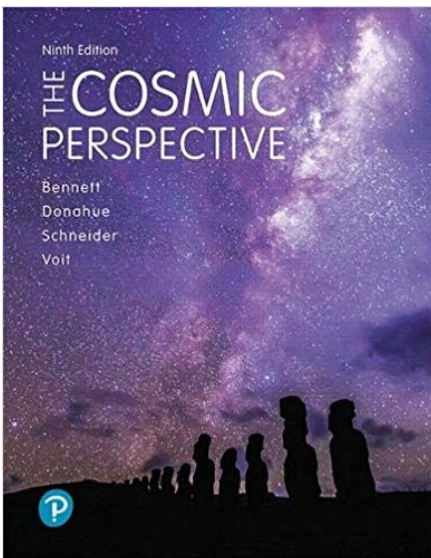
**course website:** Blackboard 9. The course is available on Blackboard with your GMU log-in name and password. Select ASTR 113.

(This is where I'll post PowerPoint slides (which are NOT a substitute for the textbook), announcements, schedule adjustments, etc. I will also post your test grades there within a few days of the last day for each test. It is your responsibility to check the website frequently for any announcements and updates).

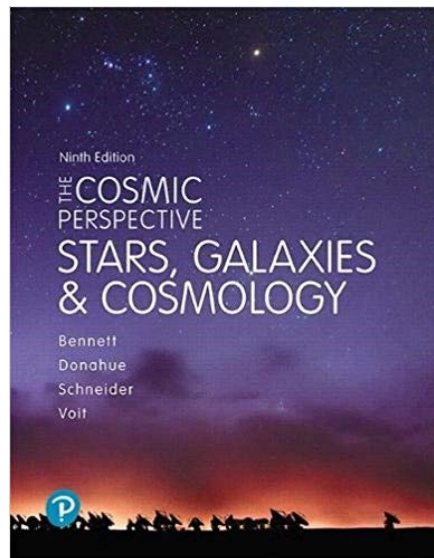
**GMU email account:** You must activate your GMU email accounts to receive important University information, including messages related to this class.

**Computer support:** **Computer and/or Web support is not my responsibility.** You can find help as well as available workstations at the Johnson Center.

### Textbook:



The 9<sup>th</sup> edition full text.  
**ISBN-13:** 978-0134874364  
**or ISBN-10:** 0134874366



The 9<sup>th</sup> edition split text.  
**ISBN-13:** 978-0134990781  
**or ISBN-10:** 0134990781

We will use **Bennett, Donahue, Schneider, and Voit: "The Cosmic Perspective: Stars, Galaxies and Cosmology"** (9<sup>th</sup> edition). The publisher is Addison-Wesley.

You can purchase the book in GMU bookstore or elsewhere, but be aware that there are many, many different versions of this textbook and some do not contain all of the material we'll study. Particularly, **avoid anything with the word "essential" or "fundamentals" in the title.** Make sure you get the "Stars, Galaxies & Cosmology" part.

And be aware that this textbook often comes bundled with an online homework system called Mastering Astronomy, with tutorials, with stargazing software or with iclickers. You won't need those. Just get the book.

For our class, you'll need the split book, but some options described below only offer the full text, so I listed both. Many retailers, including amazon, offer rentals, so check those. Other good options, and substantially less expensive than a paper copy, is e-text. You can either get an access card from GMU bookstore, the publisher, or any retailer, or directly from the publisher. Here is the link:

<https://www.pearson.com/store/p/cosmic-perspective-the/P100001120237/9780135161753>  
**(ISBN-13: 9780135161753)**

## Purpose:

Astronomy 113 is part of the 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. In conjunction with each student’s major program of study and other electives, minors, or certificates, this program seeks to produce graduates with intellectual vision, creative abilities, and moral sensibility as well as skills to ensure a well-rounded and usable education.

General Education courses will ensure that all undergraduates develop skills in information gathering, written and oral communication, and analytical and quantitative reasoning; expose students to the development of knowledge by emphasizing major domains of thought and methods of inquiry; enable students to attain a breadth of knowledge that supports their specializations and contributes to their education in personal and professional ways; and encourage students to make important connections across boundaries—for example, among disciplines, between the university and the external world, and between the United States and other countries.”

## Overview:

Astronomy 113 is a general education natural science course designed to help students understand the scientific process and to develop their scientific reasoning skills in the context of astronomy. This 3 credit lecture is usually taken with Astronomy 114 lab to fill the requirement for a 4 credit natural science lab course.

Astronomy 113 is designed to familiarize you with the universe in which we live and with the principles of scientific inquiry that have enabled us to explore and understand that universe. We are part of the universe and thus can learn about our origins by studying it. The study of the universe is possible through evidence based scientific inquiry that anyone can understand.

Astronomy 113 has for its subject matter stars, galaxies and cosmology. The first part of the course will concentrate on the history and fundamentals of astronomy, including the night sky as seen from the Earth, the historical development of astronomy, and the nature of light and matter and how they interact. The remainder of the course will focus on stars and galaxies, how they form, evolve and die. We’ll also discuss selected topics from cosmology.

To achieve these goals you will:

- ✚ Understand how scientific inquiry is based on investigation of evidence from the natural world, and that scientific knowledge and understanding is not a body of facts but rather a process through which we seek to understand the world around us and so it continuously evolves based on new evidence differs from personal and cultural beliefs
- ✚ Recognize the scope and limits of science
- ✚ Recognize and articulate the relationship between the natural sciences and society and the application of science to societal challenges (e.g., health, conversation, sustainability, energy, natural disasters, etc.)
- ✚ Evaluate scientific information (e.g. assess credibility and validity of information)
- ✚ Participate in scientific inquiry and communicate the elements of the process, including:
  - ★ Making careful and systematic observations
  - ★ Developing and testing a hypothesis
  - ★ Analyzing evidence

### ★ Interpreting results

Perhaps most importantly, in line with the general education goals, this class should stimulate your curiosity about the universe, and encourage you to continue to read and think about astronomy and other areas of science long after your college education is complete.

The class will focus on concepts, and the expression of these concepts in colloquial, graphical, and schematic descriptions. You will be asked to show your understanding in all these ways on the exams. By the end of this term, you should have a strong conceptual understanding of the primary topics, and be able to interpret data to support that understanding.

Students will understand:

- ✚ the scientific method and how we apply it to investigate the universe
- ✚ that universe is comprehensible through scientific principles that anyone can understand
- ✚ the size and scale of the solar system, galaxies, and the universe
- ✚ how the motions of the Earth affect our view of the sky
- ✚ the basic physical laws that govern the motion of objects
- ✚ what light is, how it works, and how we use it to study distant objects
- ✚ how light and matter interact
- ✚ what stars are and how they differ from other astronomical objects
- ✚ how the stars are born, evolve over time and die
- ✚ what types of galaxies we observe and what do we know about their structure, formation and evolution
- ✚ what structure our universe, how it began and what is its current state
- ✚ when and how life arose on Earth, and the possibilities for finding life elsewhere
- ✚ how astronomers have come to know these things
- ✚ how astronomy affects each of us personally with the new perspectives it offers
- ✚ what are the current issues, what is the focus of research in astronomy today, and what big questions remain unanswered.

As the instructor in this course, I am the guide through the territory of astronomy. I will not be pouring facts into your head. **You must do the thinking and the learning: I can only assist and provide guidance and clarity.**

### General course policies:

In order to facilitate the optimum learning environment for your fellow students, the following behavior is expected:

- ✚ Class will start on time. Come on time, and be prepared to start working.
- ✚ My class policy is: **NO LATE COMERS AND NO LEAVING IN THE MIDDLE OF THE CLASS.** Entering and leaving in the middle of the class is extremely distracting and discourteous to your fellow students as well as to me.
- ✚ Be respectful of yourself and others in the class. Don't talk during class about things that aren't class related; when working in groups, keep voices to a low level so all can communicate; don't denigrate others' work or ideas. Give everyone a chance to speak and contribute.
- ✚ Except during in-class activities **no electronic devices are to be used in class.** It has been my experience that laptops, notebooks, and cellphones are more often than not used for web surfing, e-mail, or other class unrelated purposes. Not only is this detrimental to your own progress, it is also distracting to students sitting next or behind you. In addition, recent studies indicate that much better retention is achieved by students

who take notes by hand rather than typing them. Thus, unless you can demonstrate to me a special need for such device, its use will not be allowed. And, please, mute your cell phone ringer before you enter the classroom (unless there is a potential emergency involved, in which case you should inform me that such disruption may occur and sit yourself in a location where your exit will be least disruptive to your classmates). Anyone whose electronics disturbs the class will be penalized 1% of the overall course grade each time it happens.

## Class components:

### Lectures

The lectures will follow the subjects as shown in the Course Schedule at the end of this document. **Attendance is vital to your success.** The textbook does not cover everything that I discuss in class. Likewise, I will not be talking about everything covered in the textbook, only the things I think are particularly important, or confusing, or pertain to the more recent discoveries and ongoing investigations. **You need to read the textbook, go over PowerPoint lecture slides and, in general, follow the Learning Modules provided on Blackboard.** You are expected to spend at least twice as much time studying as you spend in class, that is if you study efficiently. If you don't, it can be a lot longer than that.

In this class you will be encouraged to make your own observations, ask and wonder why, and arrive at your own conclusions. So observe, participate, and question. Be on time and come prepared to start working. Arriving late or leaving early will not be tolerated. You are responsible for any materials distributed during the class and any oral announcements made in class which are binding. If you miss a class, it is your responsibility find out what went on that day.

### Homework **All assignments must be submitted on time, assignments submitted late will not receive credit.**

Homework is vital to reinforce the material you study. For each portion of material there will be assignments composed of reading, video, and other materials, followed by questions that will allow you to test your understanding. All of the homework is contained in the Learning Modules on Blackboard and I strongly recommend that you read the information and follow the instructions in the Modules before attempting homework. Most weekly homework assignments are cut-up into smaller pieces that follow the lessons contained in the Learning Modules. You will have unlimited number of attempts at each portion of the homework until the due date, with the highest score counting. The answers will be available after the due date. For that reason, extensions beyond the due date are not possible. You should make it a habit go over the answers once they are available and learning from your mistakes.

### Activities **All assignments must be submitted on time, assignments submitted late will not receive credit.**

There will be many in and out of class activities throughout the semester. There will also be several observing activities to be done on your own. The activities will be accompanied by quizzes that allow me to assess that you did, in fact, do the activity.

### Exams **All tests are to be taken within allotted time window. There are no make-up tests.**

Exams will include questions similar to those in the homework assignments. Anything covered in class, in homework, in the textbook, and in the assigned supplementary sources (including websites, applets, visualizations, and videos), may appear on the tests.

**Exam Schedule:**

There will be three unit tests and a comprehensive final. All of the tests will be administered via Blackboard at the College of Science Testing Center in room 2 of the Planetary Hall. No, you cannot take any of them at home. Each test will be delivered for a period of 4 days. Please plan carefully and make sure to take the test within the allotted window: I will not grant any extensions, except in most dire circumstances.

Test	Dates
Midterm 1	Wednesday, Feb. 19 <sup>th</sup> – Saturday, Feb. 22 <sup>nd</sup>
Midterm 2	Wednesday, March 25 <sup>th</sup> – Saturday, March 28 <sup>th</sup>
Midterm 3	Wednesday, April 29 <sup>th</sup> – Saturday, May 2 <sup>nd</sup>
Final	Wednesday, May 6 <sup>th</sup> – Saturday, May 9 <sup>th</sup> <b>The final test is comprehensive.</b>

Due to the large size of this class, I recommend that you take the test as early as possible. If you take the test on the last day, there is always a possibility that you might not get a seat if the Center is busy. If you miss a test, that will be your lowest test score, a zero. Tests are limited to an hour and a half. That means you must start the test with at least that much time before the scheduled closing time for the Testing Center. You need to allow plenty of time in case the Center is busy and you have to wait for an available seat. The Center will close on time, and you will have to leave even if you have not completed the test.

*Please see the Testing and Tutoring website for rules and hours of operation at: <http://ttc.gmu.edu/info.htm>*

**Grades:****Letter grade based on the percentage score:**

Letter Grade	Percent
A+	97-100
A	93-96.99
A-	90-92.99
B+	87-89.99
B	83-86.99
B-	80-82.99
C+	75-79.99
C	70-74.99
C-	67-69.99
D	60-66.99
F	below 60

In this course, you will get exactly the grade you deserve by a mathematically weighted average. It is **YOUR** responsibility, not mine, to make sure you study hard enough to get the grade you want.

Type of Assignment	Percent
Homework	30 %
Activities	10 %
Best 3 out of 4 exams	total 60 %
each	20 %

Your final grade in this class will be based on homework, activities, and tests. I will **NOT** answer questions about individual grades at any time in class or by mail. If you have a question about your grades, you need to come to my office hours and see me individually.

Final grades will be assigned by me at the end of the semester. Your final grade in this class will not be changed under any circumstances at any time.

**There will be no so called “extra credit project”**- that’s a cop out and I’d rather you spend your time studying. So don’t count on improving your grade that way. There are, however, going to be opportunities to earn extra credit in homework, activities, and during the tests.

Any individual agreements that involves adjustment to requirements, schedule and/or grades due to documented prolonged illness or other documented serious and unforeseen circumstances, need to be negotiated with me and made in writing. You are responsible of reminding me of such agreements before the time of the finals.

**Student resources:** For complete information and links to student support resources on campus, visit <http://ctfe.gmu.edu/teaching/student-support-resources-on-campus/>

A few of the resources available are listed below.

- **Counseling and Psychological Services** offers psychological services, a variety of learning services, multicultural services, and educational programs that support students' educational goals.
- **The English Language Institute** holds workshops for students whose first language is not English.
- **Mathematics Tutoring Center** offers tutoring on a walk-in basis for all George Mason students enrolled in math courses up to MATH 290
- **Office of Alcohol, Drug, and Health Education Services** provide health-related information, education and training, and resources for the Mason community.
- **Office of Disability Services** implements and coordinates reasonable accommodations and disability-related services that afford students with special needs equal access to university programs and activities.
- **Office of Diversity Programs and Services** serves students, cultural organizations, and the Mason community by promoting an environment that fosters and values human understanding and diversity. The office seeks to provide services and programs that will instill university-wide appreciation for diverse perspectives and ensure equal levels of inclusion, participation, and retention of underrepresented student groups in their quest for a quality education.
- **Sexual Assault Services** provides direct services for survivors of sexual assault and sexual assault education and information to the university community. All services are available to survivors, and to their families, significant others, and friends at no cost.
- **Student Health Services** provides high quality health care, counseling, education and prevention services in support of student learning and retention.

Academic Advising Center – 703-993-2470

Office of Disability Services – 703-993-2474

Math Tutoring Center – 703-993-1460

Writing Center: A114 Robinson Hall; (703) 993-1200; <http://writingcenter.gmu.edu>

University Library: “Ask a Librarian” <http://library.gmu.edu/mudge/IM/IMRef.html>

Counseling and Psychological Services (CAPS): (703) 993-2380; <http://caps.gmu.edu>

University Policies: The University Catalog, <http://catalog.gmu.edu>, is the central resource for university policies affecting student, faculty and staff conduct in university affairs.

**Getting help:** In addition to your instructor, a **Learning Assistant** will be available to help you with the course material. Detailed information will be announced in class and posted on Blackboard. Help is also available from **Physics and Astronomy tutor:** Planetary Hall room 2A. See <http://mason.gmu.edu/~sfisher2> for hours. If you have any problems, seek help right away. Do not wait until the last minute before the test.

**Students with disabilities:** Please contact The Office of Disability Services (SUB I, Room 222, Phone 703-993-2474) if you have a learning or physical disability that will require accommodation in this class. You must obtain the proper paperwork as soon as possible and contact me during the first week of classes so that I can accommodate your needs throughout the course.

**Safety and security:** The provost’s office has set up a system for notifying students and staff of emergencies. You can sign up for emergency messages to your cell phone by going to <https://alert.gmu.edu>. Call 911 in case of life-threatening emergencies in the classroom.

**Withdrawal:** If you need to withdraw from this course you must do it within the University established time frame.

**Honor code:** You are expected to adhere to the George Mason University student honor code:

"George Mason University shares in the tradition of an honor system that has existed in Virginia since 1842. The Honor Code is an integral part of university life. On the application for admission, students sign a statement agreeing to conform to and uphold the Honor Code. Therefore, students are responsible for understanding the provisions of the code. In the spirit of the code, a student's word is a declaration of good faith acceptable as truth in all academic matters. Therefore, cheating and attempted cheating, plagiarism, lying, and stealing of academic work and related materials constitute Honor Code violations. To maintain an academic community according to these standards, students and faculty must report all alleged violations of the Honor Code to the Honor Committee. Any student who has knowledge of, but does not report, an Honor Code violation may be accused of lying under the Honor Code."

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:

- ✚ During **all tests** you must work alone.
- ✚ Work identified as individual should be strictly your own. Submitting work of another student as your work is considered cheating.
- ✚ Students are encouraged to form study groups to work on homework assignments and study the course material together. The group is responsible for ensuring that all members take part, learn the material, and understand how to do the assignments.
- ✚ Material that is drawn from written or electronic sources must be appropriately cited. Cut and paste from web sources without citation is considered plagiarism.

If you have questions about the meaning of any of these terms or if you are doubt about what the above policies mean in regard to a specific assignments, ask me for clarification. If you are caught cheating, you will be brought before the Academic Honor Council which may result in a failing grade in this course, a permanent mark on your transcript, suspension, or expulsion.



## Tentative Course Schedule for ASTR 113, Spring 2020

(subject to verification by real life)

Week	Lectures	Dates	Chapters from textbook
1	1, 2	Jan 21, 23	Chapter 1 A modern view of the Universe
2	3, 4	Jan 28, 30	Chapter 2 Discovering the Universe for yourself Chapter 3 The science of astronomy
3	5, 6	Feb 4, 6	Chapter 3 The science of astronomy Chapter 4 Making sense of the Universe
4	7, 8	Feb 11, 13	Chapter 4 Making sense of the Universe Chapter 5 Light and matter
5	9, 10	Feb 18, 20	Chapter 5 Light and matter Chapter 6 Telescopes: portals of discovery
6	11, 12	Feb 25, 27	Chapter 14 Our Star
7	13, 14	March 3, 5	Chapter 15 Surveying the Stars
8		March 10, 12	Spring break, no classes
9	15, 16	March 17, 19	Chapter 16 Star Birth
10	17, 18	March 24, 26	Chapter 17 Star Stuff
11	19, 20	March 31, April 2	Chapter 18 Bizarre Stellar Graveyard
12	21, 22	April 7, 9	Chapter 19 Our Galaxy
13	23, 24	April 14, 16	Chapter 20 Galaxies and the Foundation of Modern Cosmology
14	25, 26	April 21, 23	Chapter 21 Galaxy Evolution Chapter 22 The Birth of the Universe
15	27, 28	April 28, 30	Chapter 22 The Birth of the Universe Chapter 23 Dark Matter, Dark Energy, and the Fate of the Universe