ASTR-111 Section 003
Introductory Astronomy – The Solar System
Fall Semester, 2022; Mondays, 7:20-10:00pm EST
Enterprise, Room 178
Department of Physics and Astronomy
Updated August 21, 2022

ASTR 111 - Introductory Astronomy: The Solar System - Credits: 3
Course Description: Introduction to Astronomy: The Solar System. Topics include the history of astronomy, evolution of the solar system, properties of planets, scientific method, critical thinking, nature of light, principles of telescope design, formation of planets, exoplanets (outside our solar system) and the SETI (Search for Extraterrestrial Intelligence)

Important Notes:
1) Fulfills general education requirement in natural science.
2) ASTR 111 (lecture) & 112 (lab) can be used to fulfill a 4-credit lab science requirement, not for physics majors.
3) No prerequisites required for this course.

Instructor and Contact Information:
Lecturer: Michael E. Summers, Professor of Planetary Science and Astronomy
Office: Planetary Hall 235
Email msummers@gmu.edu, strongly preferred means of contact.
Online Office Hours: Tuesdays, 1:00-2:00 pm
Other times available.

My office hours are listed above. Please note that an appointment is necessary, even to schedule a time to meet during the official office hours. I am available to meet with you at other times as well, just contact me via email. You are encouraged to contact me if you are having any problems with the course, or have questions on the material, or have any questions about science in general. **Please contact me if you need help or have questions. But don't wait until it is too late!** Please schedule a time to talk in advance so that I can be sure to be available and to allow sufficient time for discussion.

- **The schedule of lectures, exams, etc. in this syllabus is tentative.**
- **The student is responsible for attending the class lectures and for reading the class announcements for updates to the course.**

Introduction: This is an introduction to the science of astronomy. The course begins with the historical development of astronomy and our understanding of the night sky, then covers the structure and content of the solar system, and then telescopic and space exploration used to study the solar system and extra-solar planets. Emphasis will be on developing a big picture view of the solar system as a context for the place of Earth in the cosmos. Finally, we will discuss the recent discoveries of numerous and diverse extra-solar planets, and the prospects for life elsewhere.

The overarching goal of this course is to provide the student with a "big-picture" view of the Earth's place in the universe. For ASTR 111 we will focus on the nature of planets in our solar system that represents our "backyard" in the vast universe. The recent discoveries of thousands of diverse exoplanets, at many different stages in their birth and evolution, have provided a wealth of new information about how planets form and evolve. Thus, this course will include very recent discoveries about exoplanets (planets outside of our solar system), and how understanding these discoveries help us understand the possibility of life elsewhere.

Mason Core General Education Course: ASTR 111 is part of the general education program at GMU and satisfies the requirements for Mason Core lecture courses:

"The general education natural sciences 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.

The central objectives of the Mason Core are to help the student:

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 relationships between the natural sciences and society, and the application of science to societal challenges (e.g., health, conservation, sustainability, energy, climate change, 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, including:
    a) Making careful and systematic observations
    b) Developing and testing a hypothesis
    c) Analyzing evidence
    d) Interpreting results

ASTR-111 shows the student how astronomers have come to know what they know about the solar system. The student will learn that this is accomplished by the study of objects in the sky mostly by the light that reaches us from these objects, and which is based upon experimental results made using the most advanced technology available. This satisfies the **Mason Core objective (1)**.

Astronomy is a type of science known as discovery science. As such it continually pushes the boundaries of what is known about the universe, and students will learn how that frontier is continually changing. That satisfies **Mason Core objective (2)**.

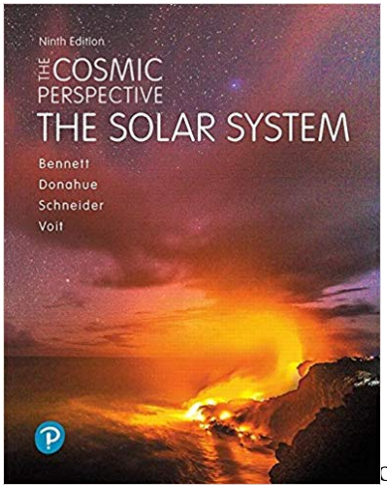
Students in ASTR-111 will also learn about the nature of the Earth, and how the state of the Earth is changing because of both natural and human-caused processes. This satisfies **Mason Core objective (3)** of the Mason Core.

And finally, students in ASTR-111 will learn about the processes by which science operates, and how the careful evaluation of observational evidence is the driver of scientific progress. The student will learn how scientists evaluate scientific evidence. ASTR 111 is designed to help students understand the scientific process and to develop their reasoning skills. This satisfies the **Mason Core Objective (4)**.

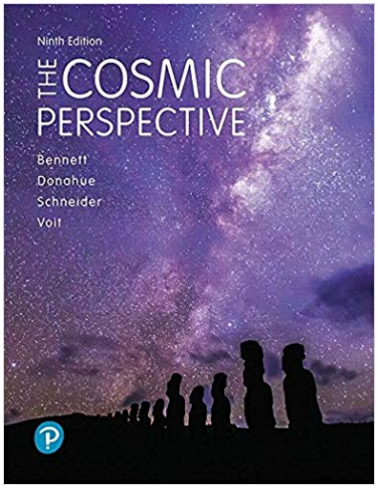
Participation in the scientific process and presentation of the results, as the student will cover in the separate ASTR-112 laboratory, satisfies Mason Core (5).

Text (required): We will be using Bennett, Donahue, Schneider & Voit. 2019. "***The Cosmic Perspective: The Solar System"*** (9th edition). The publisher is Addison-Wesley.

- **YOU MUST HAVE THE 9TH EDITION OF THE TEXTBOOK! OLDER EDITIONS HAVE DIFFERENT INFORMATION AND THE MATERIAL IS IN A DIFFERENT ORDER.**



9th edition (ASTR 111 only)



or 9th edition (ASTR 111 & ASTR 113)

The recent edition is updated with exoplanet discoveries. Supplemental material will also be provided on Blackboard. Unless you want the full book to take ASTR 111 & ASTR 113, I recommend getting the split first half of the book in either the paper or e-book version. Also be careful: these books often come in package deals with a lot of stuff you won't need, so don't buy anything but the book for this course (unless you want it.)

The ISBN information is: ***The Solar System: The Cosmic Perspective***, 9th edition (2019), **ISBN-10:** 0134874366, **ISBN-13:** 978-0134874364

The Cosmic Perspective, 9th Edition, chapters have the following learning structure:

- **Major content (Be sure to read everything!)**
- **The Big Picture (Very important!)**
- **Summary of Key Concepts (excellent for review)**
- **Visual Skills Check**
- **Exercises and Problems**
  - *Review Questions*
  - *Test Your Understanding*
  - *Process of Science*
  - *Group Work Exercise*
  - *Investigate Further*

This course is designed in this manner to familiarize you with the universe in which we live, as well as the principles of scientific inquiry that have enabled us to explore and understand that universe.

"The Cosmic Perspective" textbook is built around these five themes:

1) **We are part of the universe and thus can learn about our origins by studying the universe.**
2) **The universe is comprehensible through scientific principles that anyone can understand.**
3) **Science is not a body of facts but rather a process through which we seek to understand the world around us.**
4) **A course in Astronomy is the beginning of a life-long learning experience.**
5) **Astronomy affects each of us personally with the new perspectives it offers.**

The first part of the course will concentrate on developing a scientific perspective on the universe. We will discuss the history and fundamentals of astronomy, including the night sky as seen from the Earth, the apparent motions of celestial objects, lunar and solar eclipses, phases of the moon, the historical development of astronomy, and the nature of light and matter and how they interact.

The second part of the course is focused on understanding key concepts of astronomy, such as motion, energy, gravity and light. The use of telescopes will be covered as essential to collecting and studying light from distant objects.

The third part of the course (and the largest portion of the course) will cover the origin, evolution and current characteristics of our Solar System, Extrasolar Planets, and the Prospects for Life Elsewhere (the new science of Astrobiology). We will learn how planets and stars form, about the properties of the individual planets and their moons, as well about planets beyond our solar system – exoplanets.

ASTR-111 Learning Outcomes: By the end of the course the students are expected to understand:

- **The scientific method and how we apply it to investigate the universe.**
- **The size and scale of the solar system, galaxies, and the universe.**
- **How the motions of the Earth affect our view of the sky over days, months, and years including lunar and solar eclipses.**
- **The causes of the seasons.**
- **The basic physical laws that govern the motion of objects, including the planets.**
- **What light is, how it works, and how we use it to study distant objects.**
- **How light and matter interact.**
- **How the solar system was formed and has evolved over time.**
- **The properties of the three major classes of planets in our solar system and how and why they are different.**

- **The physical characteristics of the individual planets, including their compositions, atmospheres, and the physical processes that dictate these properties.**
- **When and how life arose on Earth, and the possibilities for finding life elsewhere.**

Lectures: The lectures will follow the chapters of the text as shown in the Course Schedule below; additional materials that represent recent discoveries in astronomy will also be presented in class.

- **You are responsible for all the material covered in lectures, in addition to that in the text.**
- **You should read the assigned chapters BEFORE they are discussed in class; this will enable you to ask questions in class if you do not understand some aspect(s) of the chapters.**
- **Quizzes will be based on the assigned readings.**
- **You are expected to spend at least as much time reading the text and studying on your own as you spend in the classroom.**

Lectures and Presentations: I will post the lecture PowerPoint slides on Blackboard after each day's presentation.

Attendance: Because you are responsible for all materials and announcements (including exam information, and e.g., important date change), attending the online class lecture is very important.

- **After the mid-terms I always get students wanting to know how to improve their grades. The best way to get good grades is to read the chapters before the lecture and then to attend the lectures. There is no better advice that I can offer.**
- **Oral announcements made in class are binding and it is your responsibility to find out what was announced in any class you might miss.**

Course format:

(1) Lectures covering material in the "The Cosmic Perspective"
(2) Weekly quizzes over assigned readings
(3) Two in-semester exams
(4) Final Exam

Tentative Course Schedule

Week 1: August 22
Introduction and Overview of the Course
Chapter 1: A Modern View of the Universe
Week 2: August 29
Chapter 2: Discovering the Universe for Yourself; Chapter 3: Science of Astronomy
Week 3: September 5 – No classes on Monday the 6th /Labor Day Holiday
Week4: September 12
Chapter 4: Making Sense of the Universe; Motion, Energy & Gravity

Week 5: September 19
Chapter 4: Making Sense of the Universe; Begin Chapter 5 – Light and Matter
Week 6: September 26
Chapter 5: Light and Matter – finish; Chapter 6: Telescopes
Week 7: October 3
Chapter 6: Telescopes; Chapter 7: Our Planetary System
Week 8: October 10
GMU Closed Monday, Oct. 10; Monday Classes meet Tuesday, Oct. 11
Oct. 11: Exam #1 (Chapters 1-7, inclusive)
Week 9: October 17
Chapter 8: Formation of the Solar System
Week 10: October 24
Chapter 9: Planetary Geology; Earth & Terrestrial Worlds
Week 11: October 31
Chapter 10: Planetary Atmospheres
Week 12: November 7
Chapter 11: Jovian Planetary Systems
Week 13: November 14
Chapter 12: Asteroids, Comets, Moons and Dwarf Planets
Week 14: November 21, Exam #2 (Chapters 8-12, inclusive)
Chapter 13: Other Planetary Systems
Week 15: November 28
Chapter 24: Life in the Universe

Final Exam: TBD
The Final Exam is Comprehensive – covering all material covered in the course

- **You are responsible for all material from text and any additional assigned readings.**
- **This will be a fast-paced course! It will be very important to keep up with the chapter readings.**

Course Policy and Grading:

Quizzes:	10%
Two exams:	50%
Final Exam:	40%

Numerical Grade Ranges:
A: 94-100%
A-: 90-93%
B+: 87-89
B: 83-86%
B-: 80-82%
C+: 77-79
C: 73-76%
C-: 70-72%
D: 60-69%

F: Below 60%

IMPORTANT DATES – TENTATIVE
First lecture: Monday, August 22, 7:20-10:00pm EST
Exam #1 – October 11
Exam #2 – November 21
Final exam: TBD

Final Exam TBD

- **The final exam will be comprehensive.**
- **The exams are closed book, closed notes, and you are not allowed to use outside materials of any kind. Uses outside materials constitutes cheating.**

Exam Makeup Policy: Late exams will be permitted only if an acceptable explanation is provided and if the makeup is performed within one week of the original exam.

- **Make-up exams must be scheduled IN ADVANCE with instructor permission.**
- **There are no make-ups for missed quizzes. I drop your lowest quiz score at the end of the semester.**

Technology in the Classroom:
Cell phones and other communicative devices are not to be used during class. Please keep them stowed away and out of sight. Laptops or tablets may be permitted for the purpose of taking notes only. Engaging in activities not related to the course (e.g., gaming, email, chat, etc.) will result in a significant reduction in your participation grade.

Safe Return to Campus:
Students are required to follow Mason's current policy about facemask-wearing. As of August 11, 2022, facemasks are NOT required. If this policy changes, you will be informed; however, students who prefer to wear masks either temporarily or consistently will always be welcome in the classroom.

Campus Closure:
If the campus closes, or if a class meeting needs to be canceled or adjusted due to weather or other concern, students should check Blackboard [or other instruction as appropriate] for updates on how to continue learning and for information about any changes to events or assignments.

Blackboard:
Activities and assignments in this course will regularly use the Blackboard learning system, available at https://mymason.gmu.edu. Students are required to have regular, reliable access to a computer with an updated operating system (recommended: Windows 10 or Mac OSX 10.13 or higher) and a stable broadband Internet connection (cable modem, DSL, satellite broadband, etc., with a consistent 1.5 Mbps [megabits per second] download speed or higher. You can check your speed settings using the speed test on this website.)

Academic Integrity:
The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that:

(1) all work submitted be your own;
(2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and
(3) if you are uncertain about the ground rules on a particular assignment, ask for clarification.

No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using the appropriate format for this class. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting.

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:

Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

If you have questions about the meaning of the honor code please ask me. I expect you to hold to this standard by doing your own work on tests and assignments.

Classroom conduct:
Discussions, whether face-to-face or electronic, should be conducted with respect for each other and at a high level of civil discourse. Disruptive behavior may result in a student being asked to leave the virtual classroom or be temporarily barred from participating in online activities.

In order to comply with student privacy laws, faculty and students need to use their GMU email accounts when corresponding with each other and the instructor.

Religious Holidays and Observations:
http://ulife.gmu.edu/calendar/religious-holiday-calendar/ is available to help minimize difficulties for students of different faiths. It is the student's responsibility to speak to the instructor in advance should their religious observances impact their participation in class activities and assignments.

Resources for Students:

Students with Disabilities:

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit http://ds.gmu.edu/ for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500.
Email:ods@gmu.edu | Phone: (703) 993-2474

Diversity and Inclusion:
The College of Science seeks to create a learning environment that fosters respect for people across identities. We welcome and value individuals and their differences, including gender expression and identity, race, economic status, sex, sexuality, ethnicity, national origin, first language, religion, age and ability. We encourage all members of the learning environment to engage with the material personally, but to also be open to exploring and learning from experiences different than their own.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence:
Notice of mandatory reporting of sexual or interpersonal misconduct: As a faculty member, I am designated as a "Non-Confidential Employee," and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, stalking, sexual exploitation, complicity, and retaliation to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-993-3686 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

Privacy:
Students must use their Mason email account to receive important University information, including communications related to this class. I will not respond to messages sent from or send messages to a non-Mason email address.

Student Use of Classroom Materials:
Some kinds of participation in online study sites violate the Mason Honor code: these include accessing exam or quiz questions for this class; accessing exam, quiz, or assignment answers for this class; uploading of any of the instructor's materials or exams; and uploading any of your own answers or finished work. Always consult your syllabus and your professor before using these sites.

Counseling and Psychological Services:
Offers faculty and staff consultation about how to help students that experience difficulties that impact their learning, including how to respond to students in crisis. In particular, the Mason Cares, faculty referral guide, and students of concern are primary resources for faculty and

staff. Students can take advantage of psychological services, a variety of learning services, multicultural services, and educational programs that support students' educational goals.

Mason Student Services Center:
Provides one-stop, integrated information and referrals regarding admissions, registrar, student accounts, and financial aid.

Office of Academic Integrity:
Provides information on the honor code and resources for students and faculty.

Student Health Services:
Provides high quality health care, counseling, education, and prevention services in support of student learning and retention.

University Life:
Enhances students' in- and out-of-class experiences, in addition to facilitating interactions among faculty, staff, and other students. These resources help students achieve academically, stay healthy, get involved with campus life, find jobs, and identify resources to enrich their learning.

REMINDERS Enhances students' in- and out-of-class experiences, in addition to facilitating interactions among faculty, staff, and other students. These resources help students achieve academically, stay healthy, get involved with campus life, find jobs, and identify resources to enrich their learning.

- **THERE ARE NO MAKEUPS ON QUIZZES**
- **MAKEUPS ON EXAMS MUST BE SCHEDULED IN ADVANCE**
- **PLEASE SIGN IN YOUR EMAILS TO ME**
- **THIS SYLLABUS IS TENTATIVE**
- **YOU ARE RESPONSIBLE FOR ATTENDING CLASS AND KNOWING IF CLASS OR SCHEDULE CHANGES ARE ANNOUNCED.**
- **OFFICE MEETINGS MUST BE SCHEDULED IN ADVANCE**
- **YOU SHOULD EXPECT A QUIZ EVERY WEEK ON THE ASSIGNED READING**

- **YOU ARE RESPONSIBLE FOR ALL OF THE MATERIAL IN THE ASSIGNED READINGS**
- **YOU MUST BUY THE 9TH EDITION OF THE TEXTBOOK**