ASTR-111 Section 003
Introductory Astronomy – The Solar System
Mondays, 7:20-10:00pm EST
Online Synchronous Lectures (recorded)
Instructor: Michael E. Summers (msummers@gmu.edu)
Backup Instructor: Ms. Brooke Vaughn (bvaughn4@gmu.edu),
Dept. of Physics and Astronomy
Updated August 24, 2020
TENTATIVE SYLLABUS

ASTR 111 - Introductory Astronomy: The Solar System - Credits: 3
Catalog Description: Topics include history of astronomy, evolution of the solar system, properties of planets, scientific method, critical thinking, nature of light, and principles of telescope design, origin of planets, planets around other stars, the search for life elsewhere.

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.
4) Hours of lecture per week: 3

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

My online 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, or ask for a Skype appointment. 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. **Seriously, please contact me if you need help or have questions.** Please be sure to 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 online class lectures and for reading the class announcements for updates (of any nature) 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.

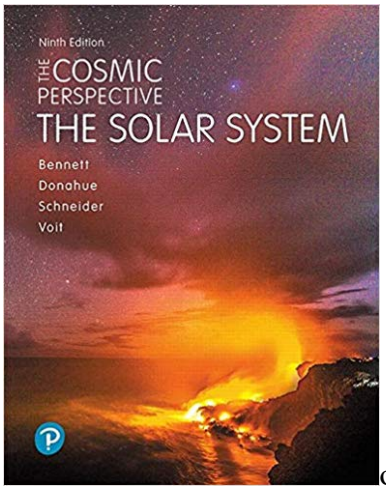
The central objectives of the Mason Core are to help the student:

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 as a result of both natural and human-caused processes. This satisfies objective (3) of the Mason Core. And finally, students in ASTR-111 will learn about the processes by which

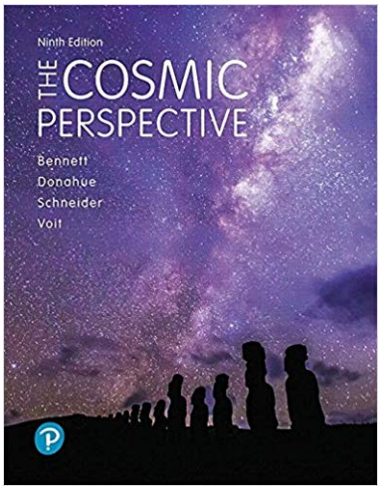
science operates, and in particular how the careful evaluation of observational evidence is driver of scientific progress. The student will learn how scientists evaluate scientific evidence. ASTR 111 is designed to help students understand the scientific process and to develop their reasoning skills. This satisfies the Mason Core (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.



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 watch out: these books often come in package deals with a lot of stuff you won't need, so don't buy anything but the book (unless you want it.

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

<u>The Cosmic Perspective, 9th Edition, chapters have the following learning structure:</u>

- **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 in order 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 of 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.

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 that contain that each day's presentation. **Lectures will be recorded so you can view later. However, I have had some difficulty with previous class recordings – the video is not clear and the audio is not great. So please try to attend the class in person if at all possible.**

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) Quizzes over the assigned readings
(3) Discussion questions in class
(4) Two in-semester exams
(5) Final Exam

Tentative Course Schedule
Lecture week numbers correspond to chapters in The Cosmic Perspective:

Week 1: August 24
Introduction and Overview of the Course
Chapter 1: A Modern View of the Universe
Week 2: August 31
Chapter 2: Discovering the Universe for Yourself; Chapter 3: Science of Astronomy
September 7 – No classes on Monday the 31st /Labor Day Holiday
Week 3: September 14
Chapter 4: Making Sense of the Universe; Motion, Energy & Gravity
Week 4: September 21
Chapter 4: Making Sense of the Universe; Begin Chapter 5 – Light and Matter
Week 5: September 28
Chapter 5: Light and Matter – finish; Chapter 6: Telescopes
Week 6: October 5
Chapter 6: Telescopes; **Review for Exam #1**
Week 7: October 12
Chapter 7: Our Planetary System; **Exam #1**

Week 8: October 19,
Chapter 8: Formation of the Solar System
Week 9: October 26
Chapter 9: Planetary Geology; Earth & Terrestrial Worlds
Week 10: November 2
Chapter 10: Planetary Atmospheres
Week 11: November 9
Chapter 11: Jovian Planetary Systems
Week 12: November 16
Chapter 12: Asteroids, Comets, Moons and Dwarf Planets, **Review for Exam #2**
Week 13: November 23, Exam #2
Chapter 13: Other Planetary Systems
Week 12: December 2
Chapter 24: Life in the Universe

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:
First lecture: Monday, August 24, 7:20-10:00pm EST
Exam #1 - Tuesday, October 13
Exam #2 - Monday, November 23
Final exam: Monday, December 14, 2020: 7:30-10:15pm

Final Exam:
- **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.

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.**

Students with Disabilities:
If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Resources at 703/993-2474. All academic accommodations must be arranged through that office.

George Mason University Honor Code:
GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely.

What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form.

Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind), please ask for guidance and clarification.

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.

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. Also, the case will be forwarded to the GMU Honor Council.***
- ***If in doubt about what constitutes plagiarism, please contact me.***

http://www.gmu.edu/departments/unilife/pages/honorcode.html