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ASTR 131N.01: Planetary Astronomy

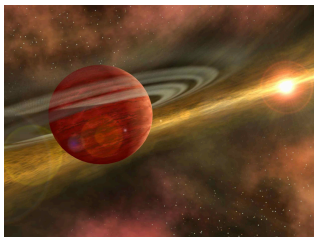
Diane P. Friend
University of Montana - Missoula, diane.friend@umontana.edu

Astronomy 131

Fall 2018

Planetary Astronomy

Observational, Historical, and Planetary Astronomy



Instructor: Diane Friend
Office: CHCB 129, 243-4299
e-mail: Diane.Friend@umontana.edu
Office Hours:
T 11-noon & 1-2, W 12:30-2, Th 2-3 in CHCB 129

Welcome! *This is a remarkable time in the field of astronomy! Fundamental discoveries are occurring at a breakneck pace and new insights keep popping up like stars coming out in a dark night sky. We will explore some of these new ideas as we examine humanity's quest to understand our place in the universe…*

Course meets: Tues. and Thurs. from 9:30-10:50 a.m. in ULH 101

Course site: Course announcements, materials, homework, links, and grades will be available through the course **Moodle** site. Check this site frequently for new announcements concerning due dates, news items, and upcoming events. It is your responsibility to keep up to date with all material on the site.

Text, articles and Interactives: I will be using FREE, online textbooks for this class along with articles from the web and the current scientific literature. These will cover everything from basic background material to current, cutting edge research. A large number of super useful interactives and videos will also be posted on the course Moodle site. Your success in the course will correlate highly with the amount of time you spend exploring these. Here are the two excellent online textbooks that I highly recommend. Use your favorite or both!

Astronomy Notes: http://www.astronomynotes.com/
Teach Astronomy: https://www.teachastronomy.com/textbook/

Homework: ***Smartwork5.***
This is an online homework system that you will be using throughout the semester. There will be NO CHARGE for using it this Fall. Follow the instructions on the ***Registering for Smartwork*** document posted on the course Moodle site under the Course Information heading. You will need to get set up with *Smartwork5* as soon as possible.

IMPORTANT: ***Smartwork5*** for this course has been set up to give you direct access through Moodle. If you access the program outside of Moodle, your grades will not be recorded!! You must always access the homework exercises from the links within the course Moodle site under the **Homework** heading.

Other materials: *Calculator*
You will need a calculator that is capable of doing scientific notation. Please bring it to class with you *every* day.
Web-enabled device
On most days (especially during the first half of the semester), we will be doing interactive activities in class that will require web access and/or the use of some freely

available astronomy apps. It will be extremely helpful (not to mention more fun) if you can bring a laptop or pad to class with you. (Many of the interactives are Flash animations. You may have to try different browsers or adjust your computer settings to be able to use these.)

Sky simulation program

For the first couple weeks of class, I would like you to have access to a sky simulation program. *Stellarium* is a great program that is free and runs on most operating systems. There are also many great observing apps and web programs for pads and phones. Links to *Stellarium* and many other programs can be found on Moodle under Week 1.

Course Description

New technologies and space-based observations have fueled a renaissance in our understanding of the solar system. Meanwhile, the discovery of thousands of planets *beyond* our solar system has shown us the incredible richness and diversity of planetary systems and is giving birth to many new ideas concerning the evolution of planetary systems in general, and our own solar system in particular. Besides surveying WHAT we know, this course will emphasize HOW we have been able to learn so much about these distant worlds- both in our own system, and beyond. By the time you finish this course, you will have had a chance to think about the many applications of astronomy- both historically and currently, see planets, stars, and nebulas through a telescope, use astronomical software to model celestial events, and ponder the possibilities of life elsewhere in the universe. You will have had a chance to think about your sense of place and scale in both distance and time. After taking this course, I hope that every time you view a dark night sky, you will be inspired to think about the richness and diversity of worlds that are out there, how much humankind has been able to learn about our universe, and how very much is still waiting to be discovered!

Course Learning Objectives

After taking this course you will:

- have become familiar with the common celestial objects visible to the naked eye- the constellations, Sun, Moon, and planets, understand how and why these objects move and/or change their appearance in the sky over time, and be able to use this knowledge to explain and predict the appearance and movement of these objects at any point in time.
- be proficient in the use of resources that allow you to locate, identify, and model the motions of celestial objects.
- have used physical and computer models to understand and explain personal observations.
- have some familiarity with how astronomical ideas have evolved over time and why astronomy has been important in the lives of people throughout history and across cultures.
- have a working knowledge of basic physical laws of light, motion, and force and have both conceptual and quantitative experience with how this knowledge can be used to help us discover more about the universe.
- have a basic understanding of many of the methods astronomers use to study the solar system.
- have an understanding of the origin and evolution of our solar system and the factors that control the properties of the objects in it. You will be able to apply this knowledge to explain how planets in our solar system have evolved over time and to predict the properties of planets being discovered *beyond* our solar system.
- have a working knowledge of the techniques used to discover planets beyond the solar system, a general knowledge of what has been discovered, and an understanding of how these discoveries have spurred theories concerning the evolution and make-up of our own planetary system.
- have become familiar with some of the important research topics in planetary science today.
- have thought critically about the future of planetary exploration- what fundamental questions remain, what resources we will need to answer them, and what we might be willing and/or able to invest.

Course Philosophy

Scientists learn by DOING- making observations, taking measurements, making and testing models. This course is designed to encourage active learning. Be advised! This course will require you to think critically, conceptually, and quantitatively. It is my intention to bring as much observation, measurement, and modeling into this course as is practical. If you are looking for a course where you can just copy down lectures and spit them back verbatim on tests, this will not be the best course for you! A good grade in this course will require a

sense of curiosity, critical thinking skills, and active participation. Please come prepared to be involved! You will be asked to perform observations and simple experiments as well as discuss concepts and problems in group settings during lecture. Class response, homework and exam questions will draw from these experiences and have a significant effect on your grade.

Classroom Note: Urey 101 is a completely inappropriate classroom for this course (way too large, fixed desks, etc.) Since there are no other options this semester, we will have to make do as best we can. This means:

- EVERYONE MUST sit in the front half of the lecture hall. NO exceptions!
- Everyone- please feel free to move around during the discussion periods.
- NO extraneous web browsing, social media, or other non-course related tech activities during class. This will really annoy some of your fellow students and impinge on their right to a classroom environment conducive to learning. If you feel the need, please avail yourself of the many lovely public locations nearby.

Course Requirements

Readings and Interactives: It is very important in this course for you to read, explore, and play with the many weekly links that I will post on Moodle. It is essential that you keep current with these! Keeping up with the reading and spending some *quality* time experimenting with the simulations will improve your comprehension and enjoyment of the lectures, give you a better opportunity to ask informed questions about the material, and greatly improve your performance on exams.

Class Response Questions: I will use personal response questions in class to initiate discussion and probe misconceptions. These questions help you think more critically about course topics, stay current with the course material, and give both you and I good feedback on your current understanding. The free, low-tech color answer sheets can be found under the **Course Information** tab on Moodle. Please make sure that you have these with you every class meeting. You have nothing to lose and everything to gain by ACTIVELY participating in these discussion questions!

Homework (40%): Science is a problem-solving discipline. Thinking through homework problems will deepen your knowledge and appreciation of topics covered in the course and exercise your critical thinking skills. There will be frequent ***Smartwork5*** homework assignments. To do well in this course, you will need to spend some quality time on these assignments. Do not put these off until the last minute! These assignments can only be accessed through your own, individual ***Smartwork5*** account. Due dates for these will be listed in ***Smartwork5*** and on Moodle and are absolute. No exceptions unless you have official written documentation of a bona fide emergency!

Exams (60%): There will be two midterms and one final. All exams have equal weight. Each exam is comprehensive since many topics will build on each other throughout the semester, but each exam will concentrate on material not previously tested. Exam questions will be multiple choice, but largely based on conceptual and quantitative understanding, NOT memorization! I will hold an optional review session before each exam (time to be determined). **NOTE**: Absolutely NO make-ups will be given for midterms or the final. If you experience an unexpected emergency for which you have official documentation, come see me and we can talk. Note that "emergency" implies the threat of significant peril, not just an "unexpected" occurrence. NO exam scores will be dropped.

Grading

Homework	40%
Midterm 1	20%
Midterm 2	20%
Final	20%

Course Grades: Plan on grade boundaries of 85-100% an A, 70-84% a B, and 55-69% a C. I will decide on the D/F boundary at the end of term, depending on the attendance and effort of any students on that part of the grade distribution. Please note that there are NO extra credit possibilities for this course!

Astronomical Observing at the Blue Mountain Observatory

Blue Mountain Observatory
Photo by David Podrasky

If weather permits, I will try to host a special observing night for Astronomy 131/134 students at the **Blue Mountain Observatory**. You can find detailed directions and general information about the observatory on the Blue Mountain Observatory website:

http://cas.umt.edu/physics/Blue_Mountain_Observatory.

Blue Mountain is a beautiful place to spend a clear, late summer evening! We'll point out constellations, tell star stories, and tour as much as we can of what's up in the sky- planets, star clusters, nebula, and distant galaxies. This is a great opportunity for you to use a telescope at a dark sky site and see first-hand many of the things that we will talk about during the course. More information on possible dates will be discussed in class.

Visit UM's Star Gazing Room

I will host an early evening star talk in UM's beautiful Digistar planetarium (room 13 in the basement of PFNAC) for students who would like to come but may not be in the accompanying Astronomy 134 lab. Dates to be determined. Sign-up on Moodle will be required as space is limited.

Personal Obligations

Academic integrity: All students taking this course must adhere to the University of Montana's academic dishonesty policy as presented in the Student Conduct Code: (http://www.umt.edu/student-affairs/dean-of-students/default.php). Any actions that include, but are not limited to, copying another student's exam, allowing another student to copy from your exam, sharing information with another student during exams, cheating on homework- all are reasons for pursuing academic and university sanctions. Students will be subject to a charge of academic dishonesty for any breach of these standards. This will result in a grade of zero on the particular assignment and a distinct possibility of a failing grade in the course as well as the possibility of expulsion from the university.

Course accessibility: If you are a student with a disability who will require reasonable program modifications in this course, please meet with your instructor and Disability Services for Students in Lommasson 154 for assistance in developing a plan to address any reasonable program modifications. If you are already working with Disability Services, please make an appointment to meet with me to discuss how we can maximize your enjoyment of this course as well as your success in it. For more information, visit the Disability Services website at http://www.umt.edu/dss/.

ADD/DROPS: Detailed student information on add/drop procedures can be found at: https://www.umt.edu/registrar/PDF/PaperlessDropsAddsChangesforStudents.pdf.

Astr. 131: Course Schedule- Fall 2018 !

Week	Dates	Topic
1	Aug. 28	Introduction to the course; A sense of scale and place
	30	Getting acquainted with the night sky; sky simulation software Astronomical coordinate systems
2	Sept. 4	Observing, modeling, and predicting the motions of the Sun, planets, and stars
	6	Modeling the Sun, Earth, Moon system- Phases of the Moon; Eclipses
3	11	Modeling the Sun, Earth, Moon system- Seasons
	13	Astronomy through the ages; Kepler's Laws
4	18	Energy, force, and motion
	20	Gravity
5	25	Interaction of matter and radiation; thermal radiation laws
	27	**EXAM 1**
6	Oct. 2	Reading the stories told by light; Simple Optics … to Next Gen Telescopes
	4	Doppler shift; Putting it all together Some really cool applications
7	9	Searching for alien worlds- the detection of exoplanets
	11	Determining Physical Characteristics of Planets; Comparative Planetology
8	16	Order from chaos: Looking for basic patterns and trends in our own solar system
	18	Solar nebular theory: How do planetary systems form?
9	23	Insights from exoplanet discoveries
	25	Determining Age: Sorting out evolutionary timelines
10	30	Terrestrial Planets: Origin and evolution of surfaces
	Nov. 1	**EXAM 2**
11	6	***Election Day Holiday***
	8	Terrestrial Planets: Origin and evolution of atmospheres
12	13	Terrestrial planets: Observations and discoveries: Moon, Mercury, and Venus
	15	Terrestrial planets: Observations and discoveries: Mars
13	20	Gas and Ice Giants
	22	***Thanksgiving Holiday***
14	27	Planetary Rings
	29	Giant Planet Moons
15	Dec. 4	Dwarf planets, comets, asteroids, and meteorites
	6	The search for habitable planets- discoveries and questions Are we alone?
16	Dec. 13	**FINAL** is 10:10 am – 12:10 pm on Thursday, December 13 in ULH 101