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ASTR 131N.01: Planetary Astronomy

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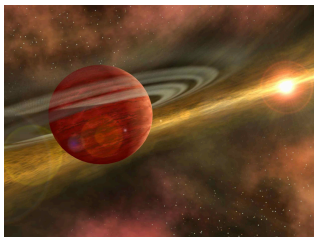
Astronomy 131

Fall 2016

Planetary Astronomy

Observational, Historical, and Planetary Astronomy



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T 11-noon & 1-2, W 12:30-1:30, Th 2-3 in CHCB 129

Welcome! *This is a remarkable time in the field of astronomy! Fundamental discoveries are being made almost daily and new insights are 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: All 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 these announcements.

Required text: ***21st Century Astronomy: The Solar System,*** Kay, Palen, and Blumenthal, 5th edition
You can purchase this as either a paper book (loose leaf is reasonably priced) or e-book (cheapest alternative). The paper text also comes with e-book access. Online homework has many links to the e-book. You can make your purchase through the UC Bookstore, or online at https://digital.wwnorton.com/astro5sw5 for the ebook, or http://books.wwnorton.com/books/webad-detail-editions.aspx?id=4294991939 for the paper book. Make sure that you get the ***Solar System*** text rather than the more expensive, full edition.

Homework: ***Smartwork5*** access
This is FREE with the access code that comes with your textbook. (If you already have a used textbook, you can still get Smartwork5 for free this semester, but it will not have the link-to-text functionality.

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.

Stellarium
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. For pads and laptops, there are many great star apps and web programs that can do a variety of things. Links to *Stellarium* and many other programs can be found on Moodle under Week 1.

This course relies heavily on technology. You will need to sign in to ***Smartwork5****,* acquire the text, and get set up with *Stellarium* (or another sky simulation program) as soon as possible.

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.

Course Requirements

Readings: In the Course Schedule you will find a "Readings" column that lists the relevant material from the textbook that you should read **BEFORE** coming to class that day. Keeping up with the reading will improve your comprehension and enjoyment of the lectures, give you a better opportunity to ask informed questions about the material, and improve your performance on homework and exam questions. Additionally, look under each week's tab in Moodle for interesting and very helpful articles and interactives. The interactives are fun, and spending a little time with them will give you a much deeper understanding of course material and may pay big dividends on homework and exam scores!

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 (comprehensive)	20%

I will curve course grades at the end of the semester. If you want to track your process through the semester, you can go by the traditional grading scale (A for 90% and up, B for 80-89%, C for 70-79%, etc.). Final grade boundaries will not be higher than this, *but may be lower*.

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 two early evening star talks in UM's beautiful Digistar planetarium (room 13 in the basement of PFNAC). Dates are Wednesday, Sept. 7 from 4-5 pm and Friday, Sept. 9, from 6-7 pm. Sign-up on Moodle is required as space is limited.

Personal Obligations

Student courtesy: Texting, talking, game playing, and internet browsing unrelated to the course are activities that DO NOT belong in this class. All students are expected to contribute to a positive learning environment. PLEASE BE COURTEOUS.

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/vpsa/policies/student_conduct.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: The last day to add/drop on Cyber Bear is Monday, Sept. 19. The last day to drop with your instructor's and advisor's signature, is Monday, Oct. 31. A drop, or change of grading option after Monday, Oct. 31 requires the signature of the Dean and written documentation of exceptional circumstances. Doing poorly in the class does not constitute adequate reason to drop the class at the end of the semester!

Astr. 131: Course Schedule Outline- Fall 2016

Week	Dates	Topic	Readings in Text
1	Aug. 30	Introduction to the course A sense of scale and place	Ch. 1: Section 1.1
	Sep. 1	Observing, modeling, and predicting the motions of the Sun, planets, and stars	Ch. 1: Section 1.2-1.3
2	6	The Sun, Earth, Moon system- Seasons	Ch. 2: Section 2.1-2.2
	8	The Sun, Earth, Moon system- Phases of the Moon; Eclipses	Ch. 2: Section 2.3-2.5
3	13	Astronomy through the ages	Ch. 3: Section 3.1-3.3
	15	Explaining motion	Ch. 3: Section 3.4-end of ch.
4	20	Gravity	Ch. 4
	22	Some cool applications	Supplemental readings and interactives on Moodle
5	27	**EXAM 1**	
	29	Light and matter- the universe we know Interaction of matter and radiation- reading the stories told by light	Ch. 5: Section 5.1-5.2
6	Oct. 4	Doppler shift Thermal radiation laws	Ch. 5: Section 5.3-end of ch.
	6	Ways of seeing: Simple Optics … to Next Gen Telescopes	Ch. 6
7	11	Physical Characteristics of Planets	
	13	Order from chaos: Looking for basic patterns and trends in our own solar system	
8	18	Solar nebular theory: How do planetary systems form?	Ch. 7
	20	Insights from exoplanet discoveries	Supplemental readings on Moodle
9	25	Determining Age: Sorting out evolutionary timelines	Ch. 8: 8.1-8.2
	27	Geology of Terrestrial Planets	Ch. 8: 8.3- end of ch.
10	Nov. 1	**EXAM 2**	
	3	Putting it all together- predicting basic properties of planets	
11	8	***Election Day – go vote!!***	
	10	Terrestrial Planet Atmospheres	Ch. 9
12	15	The terrestrial planets: Observations and discoveries: Part I	Supplemental readings on Moodle
	17	The terrestrial planets: Observations and discoveries: Part II	
13	22	Giant Planets	Ch. 10
	24	***Thanksgiving Holiday***	
14	29	Giant Planet Moons	Ch. 11: Section 11.1-11.2
	Dec. 1	Planetary Rings	Ch. 11: Section 11.3- end of ch.
15	6	Dwarf planets, comets, asteroids, and meteorites	Ch. 12
	8	The search for habitable planets- discoveries and questions Are we alone?	Supplemental readings on Moodle
16	Dec. 19	**FINAL EXAM Monday, Dec. 19 from 10:10 a.m. – 12:10 p.m. in ULH 101**	