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 these announcements.

Text: You do NOT need to purchase a text for this course. Lots of interesting and very useful readings, interactives, and videos will be posted on the course Moodle site. Your success in the course will correlate highly with the amount of time you spend exploring these. Many students greatly benefit from the type of background reading a textbook can provide. To that end, there are two (FREE) online textbooks that I highly recommend. Make use of these as needed!
http://www.astronomynotes.com/
https://www.teachastronomy.com/textbook/

Homework: Smartwork5 access
You will need to purchase access to the online homework system Smartwork5 ($30). Homework will comprise 30% of your grade.

Smartwork5 Registration instructions:
Once Homework 1 is available in Moodle, click on that assignment. This will take you to a registration page. You may then be asked to enter your name and e-mail address. Be sure to use your name as it appears on UM records and your official UM email.

Important: DO NOT register online outside of Moodle! 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 within the course Moodle site.

Class Participation: In addition to the many interactive activities and discussions we will be engaging in during class, I will also be using Packback this semester to encourage meaningful class participation by all. Interaction via Packback will comprise 10% of your grade.

Packback Registration instructions:
1. Go to https://Packback.co.questions and click “Register as a new student”.

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
(If you already have an account on Packback, you can login with your credentials.)

2. When queried, enter your official UM email address and your name as it appears on official UM records.

3. Enter the class community access code into the “Join a new Community” module on your dashboard.

   Community access code: 708439E0-D904-0907-F2A5-EB5CF0EC05AD

4. Follow the instructions on your screen to finish your registration.

For a brief introduction to Packback Questions and why we are using it in class, watch this video: vimeo.com/packback/Welcome-to-Packback-Questions

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.

- **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.

This course relies heavily on technology. You will need to sign in to **Smartwork5, Packback**, and get set up with a 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 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. Keeping up with these will improve your comprehension and enjoyment of the lectures and help you to ask well-informed questions. The interactives are extremely useful and fun. 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!

**Packback (10%):** To encourage dialogue beyond the confines of the lecture hall, you will also be required to participate in Packback. Packback provides an online curiosity community where you can be fearlessly curious and ask BIG questions about how what we’re studying relates to life and the real world. It will enable me to hear from those of you who are less comfortable about talking in class as well as help me stay tuned in to both class interests and confusions. I’ve attached a Packback registration and posting information sheet at the end of this syllabus.

**Homework (30%):** 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.

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<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Packback Questions/Responses</td>
<td>10%</td>
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<tr>
<td>Homework</td>
<td>30%</td>
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<td>Midterm 1</td>
<td>20%</td>
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<td>Midterm 2</td>
<td>20%</td>
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<tr>
<td>Final (comprehensive)</td>
<td>20%</td>
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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.

Blue Mountain Observatory

Astronomical Observing at the Blue Mountain Observatory
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 one or two early evening star talks 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**

**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/vpesa/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:** The last day to add/drop on Cyber Bear is Thursday, Sept. 21. The **last day to drop** with your instructor's and advisor's signature, is Thursday, Nov. 2. 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 2017

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topic</th>
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| 1    | Aug. 31 | Introduction to the course  
A sense of scale and place |
| 2    | Sept. 5 | Observing, modeling, and predicting the motions of the Sun, planets, and stars  
The Sun, Earth, Moon system: Seasons |
| 3    | 12     | The Sun, Earth, Moon system: Phases of the Moon; Eclipses  
Astronomy through the ages |
| 4    | 19     | Explaining motion  
Gravity |
| 5    | 26     | Some cool applications  
Light and matter - the universe we know |
| 6    | Oct. 3 | EXAM 1  
Interation of matter and radiation - reading the stories told by light |
| 7    | 10     | Doppler shift  
Thermal radiation laws |
| 8    | 12     | Ways of seeing: Simple Optics ... to Next Gen Telescopes |
| 9    | 17     | Physical Characteristics of Planets  
Order from chaos: Looking for basic patterns and trends in our own solar system |
| 10   | 24     | Solar nebular theory: How do planetary systems form?  
Insights from exoplanet discoveries |
| 11   | 31     | Determining Age: Sorting out evolutionary timelines  
Putting it all together - predicting basic properties of planets |
| 12   | 7      | EXAM 2  
Putting it all together - predicting basic properties of planets |
| 13   | 14     | Terrestrial Planet Atmospheres  
The terrestrial planets: Observations and discoveries: Part I |
| 14   | 16     | The terrestrial planets: Observations and discoveries: Part II |
| 15   | 23     | Thanksgiving Holiday  
Thanksgiving Holiday |
| 16   | 28     | Giant Planets  
Giant Planet Moons |
| 17   | 7      | Dwarf planets, comets, asteroids, and meteorites |
| 18   | 12     | The search for habitable planets - discoveries and questions  
Are we alone? |
| 19   | Dec. 15 | Friday **FINAL** 10:10 am – 12:10 pm in ULH 101 |
Active participation is a requirement for this course, and the Packback Questions platform will be used for online discussion about class topics. This is the first time I have used Packback, so as we progress through the semester, I welcome your feedback and/or suggestions (please communicate these via email or personal conversation, not via Packback questions).

**To start posting on Packback Questions**

Navigate to [https://Packback.co/questions](https://Packback.co/questions) and click “Register as a new student”. Make sure to register with your UM email address and official first name and last name.

Enter our class community’s access code into the “Join a new Community” module on your dashboard. **Our Community access code: 708439E0-D904-0907-F2A5-EB5CF0EC05AD**

Follow the instructions on your screen to finish your registration.

For a brief introduction to Packback Questions and why we are using it in class, **watch this video:** [vimeo.com/packback/Welcome-to-Packback-Questions](https://vimeo.com/packback/Welcome-to-Packback-Questions)

Your participation on Packback will count towards 10% percent of your final grade.

In order to receive your points each week, you must post 1 Question and 2 Answers per week relevant to our class subject matter that week.

Before you start posting, be sure to read the **Community Guidelines** found in the tutorial on Packback-accessible through a link on the right hand side of the site once you have registered and logged in.

If your post doesn’t follow the Packback Community Guidelines, there is a chance it will be removed and you won’t receive points for that post.

There will be a **Sunday 11:59 PM deadline** for submissions in your community each week.

Each week, we will spend time in class highlighting some of the Packback discussions, encouraging feedback and addressing some of the most relevant and engaging posts.