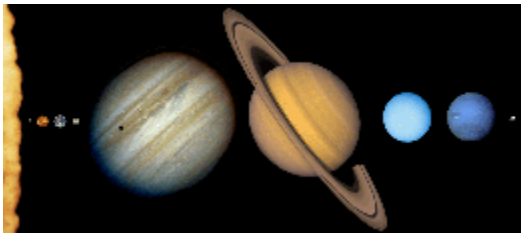
ASTR430:
The Solar System, Spring 2026



Prof: Doug Hamilton
Phone: (301) 405-1548
Email: Please use the ELMS messaging system
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Office Hours: After class or by appointment.

Textbook: Fundamental Planetary Science by J.J. Lissauer and I de Pater
Webpage: *http://www.astro.umd.edu/~hamilton/ASTR430*

ASTR430 Course Description

I have two main objectives in teaching ASTR430. First, I want you all to gain a basic knowledge of the Solar System: its origin, the interesting and diverse worlds that orbit within it, and the remnant debris left over from its creation. We will learn about the history of Planetary Science as it grew from one practitioner in the 1940s to over 1500 active scientists worldwide today and its meteoritic rise due primarily to the spectacular results of the U.S. and Soviet space programs. We will see the results of titanic collisions and mammoth volcanoes, peer through the murky atmospheres of worlds whose surfaces we can barely see, and speculate on Solar System niches where extraterrestrial life may exist. Scientists working in Planetary Science come from many fields including geology, chemistry, physics, astronomy, mathematics, fluid dynamics, and biology. Similarly, the class textbook, Fundamental Planetary Science, utilizes results from a wide diversity of different sciences. One of my primary goals in ASTR430 is that you thoroughly read and understand all of the chapters from this excellent textbook. We will cover about a chapter per week and, to help motivate you to keep up the reading pace, there will occasionally be short quizzes on the reading. We will also spend at least 15 minutes per lecture discussing the reading. This will work best if you all bring questions and comments on the reading to class so that you can contribute to the discussion.

My second main objective in ASTR430 is to help you develop your problem solving skills. I assume that you all have had at least one year of college Physics, and have some familiarity with differential equations. Having the necessary prerequisites for this class, however, does not necessarily make you a good problem solver. There are a number of excellent techniques that you can and should use to improve ou ability at problem solving (see Hints for Problem Solving). These techniques are powerful and general, and can be used in your other classes as well as this one. We will spend the semester working on your problem solving skills, which you will have a chance to practice on homework assignments, and to perfect on the midterms and the final exam. Depending on student interest, we may also have informal problem solving sessions prior to homework deadlines.

Assignments and Grading

There are several types of assignments in ASTR430 listed below.

- **Homeworks:** The homework assignments are meant to help you improve your problem solving skills. The problems will cover aspects of planetary physics and will emphasize using the basic conservation laws of Physics (Energy, Momentum, and Angular Momentum).
- **Midterms:** The two midterms will emphasize problem solving and will also include questions relating to the reading, lectures, and class discussions. Problems will be similar to, but easier than, those on the homework assignments.
- **Final:** The two-hour final exam will be similar in format to the midterm. It will be cumulative, covering the whole course, but with emphasis on the material after the last midterm.
- **Presentation:** You'll each have an opportunity to read and present to the class material from one of the book chapters. Public speaking can be scary, but is an extremely important life skill. The idea here is to practice this skill in a safe non-threatening space.
- **Participation:** Between 15 minutes and 1/2 hour of each class will be devoted to a class discussion of the assigned reading. These discussions are more fun, more interesting, and more relevant if you take an active role in contributing to them. Maximum participation scores will be awarded to students who keep up with the reading, regularly post interesting topics and questions to Reading Log, and actively help to shape classroom discussions. In addition, there will occasionally be quizzes on the assigned reading.

I grade on a point scale with different assignments weighted as shown in this table.

ASSIGNMENT	Homework	Midterms	Final	Presentation	Participation	Total
POINTS	150	150	150	75	125	650

The number of points required to get a given grade will depend on the class average. In addition, getting 90%, 80%, 68%, 55% of the total possible points guarantees at least an A, B, C, D, respectively. You can monitor my current estimate of your grade as the semester progresses from the *What's my Grade Right Now?* link on the class webpage.

Late or Missing Work

If you are going to miss a day of class when there is a major in-class assignment (midterm or final), it is essential that you let me know in advance. No makeup work is allowed after the deadline without my prior approval.

- **Homeworks:** Homeworks must be in by the due date. If you will be away that day, please slip it under the door to my office before the deadline or have a friend hand it in for you.
- **Midterms and Final:** Please make every effort to be in class for these important exams. In exceptional cases, I will arrange for a makeup exam.

Missing work gets a zero - not recommended.

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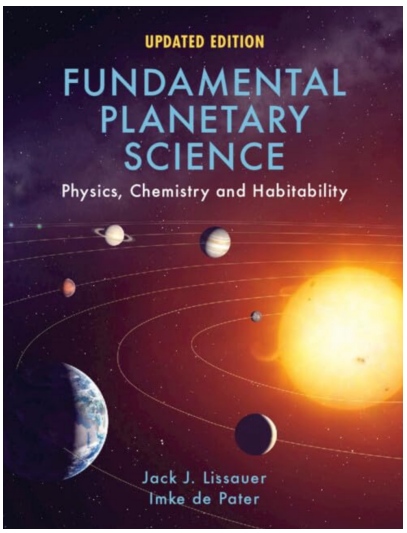
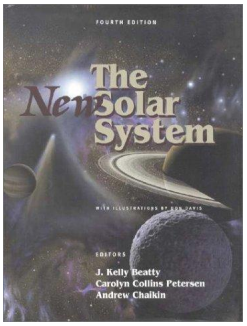
ASTR430 Textbooks



Required:

Fundamental Planetary Science (J.J. Lissauer and I. de Pater). An excellent quantitative introduction to the physics of the planets. About $70.
Errata for the 2013 edition and updated 2019 edition.



Recommended:

The New Solar System (J.K. Beatty and A. Chaikin, Eds., 4th Edition). About $10 second hand.
Excellent qualitative introduction to planetary science. Descriptive chapters are each written by experts in the field. Published in 2000, so sadly out of date but still a good value.

Good General Solar System Information:

- The Nine Planets.
- NASA Photo Gallery.

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ASTR430 Spring 2026 BLOG

Always Click Reload to Update Blog

Post a Message!

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I encourage you to write about any astronomical topic. Feel free to talk about homework problems, but do not just broadcast your answers to others. Your name will appear with what you write. No cussin'!

Blog Post #1. Sun Jan 25 16:18:38 2026. **Prof. Doug Hamilton** wrote:

Welcome to the Fundamental Planetary Science Reading Log! I hope that this tool will help make reading the textbook easier and more fun as we are all in it together. If you keep up with the reading, you'll have a much better understanding of what is going on in class, you'll do better on exams, and you will be able to make better contributions here. Please post questions about the reading, answers to questions from others, comments on the coolest new thing that you learned, compliments or gripes about the writing, etc.

- Step 1: Always do the reading assigned for a given lecture!
- Step 2: When you are finished, post something good here!

Your Reading Log posts count towards your class participation grade, so please make an effort to participate. I expect everyone to post something before the second week of classes.

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ASTR430 LECTURE SCHEDULE

Lecture Date	Lecture Topic	Reading
Tue. Jan. 27	**SNOW DAY!**	Read the book before class! Post to the Reading Log! Come to class prepared to discuss the reading!
Thu. Jan. 29	**SNOW DAY!**	Read the book before class! Post to the Reading Log! Come to class prepared to discuss the reading!
Tue. Feb. 3	Introduction, Problem Solving Techniques	Preface, Chapters 1, 2.1.1, 3.2 and look over Appendices A-F
Thu. Feb. 5	Atmospheres: Density and Thermal Structure	Chapters 5.1, 5.2
Tue. Feb. 10	Atmospheres: Composition	Chapters 5.3, 5.4
Thu. Feb. 12	Atmospheres: Climate	Chapters 5.5, 5.6
Tue. Feb. 17	Atmospheres: Climate	Chapters 5.7, 5.8
Thu. Feb. 19	Planetary Interiors	Chapter 6.2; **HW #1 due**
Tue. Feb. 24	Planetary Surfaces	Chapter 6.3; **QUIZ #1**
Thu. Feb. 26	Impact Cratering	Chapter 6.4
Tue. Mar. 3	Impact Cratering	Chapter 6.4
Thu. Mar. 5	Jupiter and Saturn	Chapter 8.1; **HW #2 due**
Tue. Mar. 10	Uranus, and Neptune	Chapter 8.2, 8.3
Thu. Mar. 12	**EXAM I**	Chapters 1, (some of 2-4), 5-6, some of 8; Homeworks 1,2; Quizzes
Tue. Mar. 17	**SPRING BREAK!**	
Thu. Mar. 19	**SPRING BREAK!**	
Tue. Mar. 24	Interiors of Giant Planets	Chapter 8; **HW #3 due**
Thu. Mar. 26	Interiors: Gravity and Magnetic Fields	Chapter 8

Tue. Mar. 31	The Moon and Mercury	Chapter 9.1, 9.2
Thu. Apr. 2	Venus and Mars	Chapter 9.3, 9.4
Tue. Apr. 7	Planetary Satellites	Chapter 10.1, 10.2; **HW #4 due**
Thu. Apr. 9	Planetary Satellites	Chapter 10.3, 10.4, 10.5
Tue. Apr. 14	**EXAM II**	Chapters 8,10; Homework 3
Thu. Apr. 16	Meteorites	Chapter 11.1, 11.2, 11.3, 11.4
Tue. Apr. 21	Meteorites	Chapter 11.5, 11.5, 11.6, 11.7; **HW #5 due**
Thu. Apr. 23	Planetary Rings	Chapter 13.1, 13.2, 13.3
Tue. Apr. 28	**CLASS PRESENTATIONS**	Chapters 7, 12, 14, 16
Thu. Apr. 30	Planetary Formation	Chapter 15.1, 15.2, 15.3
Tue. May 5	Planetary Formation	Chapter 15.4, 15.5, 15.6; **HW #6 due**
Thu. May 7	Review for Final Exam	All Chapters
Mon. May 18	**FINAL EXAM: 1:30pm-3:30pm, ATL2416**	All Chapters, Homeworks, and Quizzes!

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Problem Solving Hints

This page is meant to give you advice to help you improve your problem solving skills and your homework writeups. I expect you to follow these points for ASTR430 homeworks, and encourage you to employ them in your other science classes as well.

- **Write up Neat Homeworks.** Take pride in your homework writeups and do the best job that you can on them. Take the time to solve the homework problems roughly on scratch paper, and then copy them over neatly, filling in additional details on your final copy.

- **Show Your Work.** Give written descriptions of what you are doing, and why you are doing it. This is often especially useful at the beginning of a problem where it will force you to think about the problem physically and formulate your approach mathematically. Descriptions will also maximize the chances that I can follow what you have done in a derivation (especially if you go off on a wild tangent!) and will help me to give you constructive comments on your work. Give enough detail, and show enough mathematical steps, that students less advanced than you could understand your derivation!

- **Avoid Tech Solutions.** Try not to use symbolic alegeba and other machine assists to calculations, etc. Keep answers in symbol form as long as possible - calculators are most useful at the end of a problem. This allows for far better error checking using units, limits, symmetries, etc. Train yourself for the in-class Exams where none of these tools will be available.

- **Check Units.** Any equation that you write must be dimensionally correct. Check your equations occasionally as you go through a derivation. It takes just a second to do so, and you can quickly catch many common errors. Remember this general rule: in all physically valid solutions, the argument of all functions (e.g. trigonometric functions, exponentials, logs, hyperbolic functions, etc.) must be dimensionless. Taking the cosine of something with units of mass or length makes no physical sense.

- **Check Limits.** Check all of your final answers and important intermediate results to see if they behave correctly in as many different limits as you can think of. Sometimes you will know how a general expression should behave if a particular variable is set to zero, infinity, or some other value. Make sure that your general expression actually displays the expected behavior!

- **Take Advantage of Symmetries.** Symmetries are fundamental in physics (and astronomy!). Problems can have symmetry about a point (spherical symmetry), a line (cylindrical or axial symmetry), or a plane (mirror symmetry). You can use symmetries in two ways: 1) to check your final answer to a problem or, with a little more effort, 2) to simplify the derivation of that final answer. As an example, time-independent central forces (like gravity) have spherical symmetry because the force depends only on the distance from the origin. In this case, spherical symmetry means that once we find one solution (e.g. a particular ellipse for gravity), all other possible orientations of this solution in space are also solutions.

- **Use Common Sense.** Usually you will have some physical insight into how the solution to a problem should look. Compare your derived solution to a problem to what you expect from physical insight. Trust your instincts! If a derived equation or numerical value looks funny, go back through the derivation and look for an error. If you can't find an error, make a note of your concerns near your final solution and I will comment on them.

- **Get Help from Others.** Work on the homework problems on your own first and get as far as you can on

them. This is the best way to improve your problem solving skill and prepare for in class tests. But by all means get help from other people (other students, or me) when you are stuck! By trying the problems first, you will be able to ask more intelligent questions and better understand the ideas of other students and/or the hints that I might give.

- **Go over Homework Solution Sets.** When you get homeworks back from me, go over the solution sets and your corrected homework together. Use the solution set to see how to get past points where you were stuck, and make sure that you could easily do a similar problem if given the chance, say on a midterm. Even if you get a particular problem correct, there is always much to learn by following through someone else's solution. I spend a lot of time writing up solution sets so that you can all improve you problem solving abilities. Take advantage of the opportunity!

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