Syllabus for ASTR 1304
Solar System Astronomy
Class # 93507 1:30 – 2:50 Tuesday – Thursday HLC 2103

Instructor: James (Jim) Heath

Office Hours: Highland Campus 2408

MW	1:30 – 4:00 PM
TTh	9:00 AM – 10:30 AM
TTh	3:00 – 4:00 PM
Fridays by appointment	

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Class Website: http://www2.austincc.edu/jheath (click on "The Starry Site")

Text: *Astronomy Today*, 9th Edition by Chaisson and McMillan (Prentice Hall)
We will only be using Volume 1: The Solar System

I will also be "assigning" videos from the Crash Course Astronomy section on YouTube. You can find them by typing "Crash Course Astronomy" into the search window on YouTube.

Course Overview:

Description from the ACC catalogue: A study of the Sun and its solar system: planets, satellites, meteors, comets, asteroids. Theories about the structure and origin of the solar system, with emphasis on recent discoveries. Includes a scientific investigation of other solar systems and the possibilities for extraterrestrial life.

After an introduction to some basic terminology, we shall discuss the history of astronomy, from Plato to Isaac Newton. In this sense, the history of astronomy is essentially the history of science itself, and we shall view this history in the context of the development of the Scientific Method, a technique that is the cornerstone of modern science. Basic laws of physics will be introduced and discussed which we will be returning to time and again.

That done, we will indulge in a guided tour of the planets of our Solar System, beginning with the Earth as a planet. Then we will discuss the other "Terrestrial Planets": Mercury, Venus, and Mars. We will focus on how the planets are similar, how they are different, and why. Moving to the outer part of the System, we shall explore the "Jovian Planets": Jupiter, Saturn, Uranus, and Neptune. Again, comparison and contrast of these bodies will be a key topic. Distant Pluto will be our segue to talk about the lesser inhabitants of the solar system: asteroids, comets and meteors. We will then sum up all that we have explored and try to arrive at a sound theory about how the Solar System came to be.

Instructional Methodology and Course Rationale:

This course is a lecture-based course which may include class discussions, demonstrations and student projects. It is an introduction to Solar System Astronomy, providing students with a science course suitable for transfer to a four-year college or university. Therefore, the course will be taught at the university level. The course prerequisites are MATD 0390 (Intermediate Algebra) or one year of high school algebra or the equivalent. One year of high school science is recommended, but not required.

Purpose of this Course:

I've heard it said that the purpose of education is to give people the ability to tell when someone is "talking rot" and when they are making sense. This skill is becoming even more important in the modern day, surrounded as we are by science and technology. Con-artists and opportunists are learning to wrap themselves up in technology to better deceive people: astrologers are starting to carry around laptop computers, for example. I believe that science courses should help give people the tools they need to become "scientifically literate," and be able to evaluate "scientific claims" in their lives as consumers and voters. It is my hope that this course can serve part of that purpose.

Course-Level Student Learning Outcomes

Upon successful completion of this course, students will be able to:
• Demonstrate understanding of the nature of science and the Scientific Method.
• Demonstrate knowledge of the basic laws of physics that pertain to the study of the bodies of the solar system.
• Compare and contrast the characteristics of the terrestrial planets, and demonstrate understanding of the causes of their similarities and differences.
• Compare and contrast the characteristics of the jovian planets, and demonstrate understanding of the causes of their similarities and differences.
• Demonstrate understanding of the differences between the terrestrial and jovian planets, and of how those differences came to be.
• Demonstrate understanding of the properties of the smaller bodies of the solar system.
• Demonstrate knowledge of the current best scientific explanation of the origin and evolution of the solar system.
• Demonstrate knowledge of recent discoveries about extrasolar planetary systems.

General Education Student Learning Outcomes

Upon completion of this course, students will demonstrate competence in:
• Critical Thinking – Gathering, analyzing, synthesizing, evaluating and applying information.
• Interpersonal Skills – Interacting collaboratively to achieve common goals.
• Quantitative and Empirical Reasoning – Applying mathematical, logical and scientific principles and methods.
• Technology Skills – Using appropriate technology to retrieve, manage, analyze, and present information.

Goals and Objectives:

The simplest and most obvious goal for this course is to convey to you the basic concepts of solar system astronomy. I realize that only a few of you would even consider a career in astronomy, so this course is not necessarily "pitched" to future scientists. I hope to be able to give you enough of a background in the "facts" and theories of astronomy to be able to understand claims made by astronomers in the popular media, and maybe even enjoy astronomy as a hobby.

A deeper goal for this course is to give you practice in "thinking scientifically." In-class material, as well as most graded activities, are intended to help you improve your abilities to organize, reason, make conclusions based on evidence, and otherwise think logically. Other activities will help you practice other aspects of a scientific mind, such as creativity, ability to observe, and the practice of examining your own attitudes and "biases." These are skills that employers are looking for, and skills a scientifically aware citizen should have. Everyone has these skills inside them, and part of my job is to help you sharpen these skills.

Of course, the most important goal in this class is to have fun. Astronomy is an exciting field that is changing every day, and a fun hobby to pursue. I hope some of my enthusiasm about science and astronomy will be infectious. Remember that a lot of the responsibility for this rides on you: you can only have as much fun as you allow yourself to have. Be involved in the class! Be energetic!

Grading System:

I. Tests

To evaluate student progress in the course, four tests will be given, approximately one every six class days. Each test will be worth 17% of the final grade, for 68 % total. The tests will NOT be comprehensive (but there will be certain concepts that will recur throughout the semester, so don't forget everything too quickly!), and there will be no final or midterm exams. Exams will consist of definitions and essay questions, some of which can be chosen from lists. Since I realize that many students have "math anxiety," no required essay question will be mathematical in nature. This math deficiency will be compensated for on the homework assignments.

The exams will be mostly essay because I am interested in testing your understanding of the material, not just your raw knowledge. The emphasis will be on the ability to analyze (break things apart) and synthesize (put things together), rather than your ability to memorize facts. Accordingly, I will focus more on whys and wherefores in my lectures, instead of throwing a stream of trivia at you, which would bore all of us. However, I do NOT want my own words regurgitated back at me on the tests. You will be expected to explain things in your own words, and in plain English. I also prefer essay questions because I am a believer in partial credit.

Research Paper – Since anyone can have a bad day, any student wishing to do so may submit a short paper (approximately 1000 words/five pages) on a topic appropriate to solar system astronomy. You must have at least five references. To insure that only the latest information is used, the references for the paper are required to be magazine articles from the past five years; no books allowed. Internet articles may also be used, but they may not outnumber magazine articles! The grade received on this paper will take the place of the WORST test grade received during the semester. In the interest of time and sanity (both mine and yours), please try to decide on a topic and discuss it with me by May 5 at the latest and have it turned in by May 12.

II. Homework Assignments

In addition, five homeworks will be given over the course of the semester, each 3 questions in length. Each will be worth 3% of the final grade, for 15% total. As answers will be posted on the Website the day homeworks are due, no late homework will be accepted. Students are allowed to cooperate on homeworks, but deliberate copying will be severely punished! I am a great believer in rewarding effort, so partial credit will be happily given to people who attempt the problems, but for some reason or another, can't follow through to the end. Thus, I encourage you to show all your work on the homeworks. Answers without explanation will receive NO CREDIT!

My philosophy behind homeworks is as follows. Many times we read a fact in a textbook, like "the density of Saturn is so small it would float in water" or "the mass of Jupiter is such-and-such", and blindly accept it. Such blind acceptance, both in science and in "real life", is dangerous. The purpose of the homeworks is to get you to confirm these "facts" for yourselves. Many of the great computations of astronomy can be done by non-science majors using high school freshman algebra and a calculator!

High-school algebra is a pre-requisite for this class, so I will not (and should not be expected to) take up class time to re-teach it. Please go over the section of the Website titled “Basic Math"; I will be glad to discuss it with you during my office hours. I generally discuss homeworks only briefly in class, but I will happily discuss problems in detail during my office hours, either in person or on the phone.

Finally, I often hear students (especially fine arts students) complain that they are not "mathematically inclined", whatever that means. I look upon such remarks with the same displeasure as I would look upon a computer jock's whinings about not being "artistically" or "linguistically inclined". Art, mathematics, philosophy, etc., are all integral parts of the human experience, and the total person should have some proficiency in all of them. Science is not the exclusive purview of fat, balding, old males with German-sounding names; far too many people that do not fit this description sell themselves short, just like society tells them to. Such beliefs are not allowed in my class. You can all do it!

III. Opinion Paper

10% of the grade will be determined by a short (3-5 page) opinion paper. The purpose of this paper is to motivate you to think about your own attitudes and feelings towards science, and a chance to be creative in your writing. The topic will be more fully discussed in class, and details of the paper are on the Website. The Opinion Paper will be due April 30.

IV. Website Summary and Class Participation

For 7% of the grade, I ask students to find a location on the World Wide Web that is related to astronomy, and tell me about it. Write a one page summary *in your own words* of what's on the Website, and include a printout of the first page of the site. The Website that you review CANNOT be one that is already linked to the class Website! You must find something new! The review is due January 30. Also included in this 7% is your participation in in-class discussion activities. These might be individual activities discussed with the whole class or discussions in groups of two or three. You must be in class to get these points; make-ups will only be allowed for excused absences.

Summary of Grading System:

Tests (4 @ 17% apiece)	68%
Homeworks (5 @ 3% apiece)	15%
Opinion Paper	10%
Website Review and Class Participation	7%
Total	100%

Course Policies:

Incompletes – In compliance with Physical Sciences Task Force Policy, I will not grant incompletes, except in the most extreme circumstances. In all circumstances, extensive documentation of reasons will be required. An instructor may award a grade of "I" (Incomplete) if a student was unable to complete all of the objectives for the passing grade in a course. An incomplete grade cannot be carried beyond the established date in the following semester. The completion date is determined by the instructor but may not be later than the final deadline for withdrawal in the subsequent semester.

Withdrawal Policy – It is the responsibility of each student to ensure that his or her name is removed from the roll should he or she decide to withdraw from the class. The instructor does, however, reserve the right to drop a student should he or she feel it is necessary. If a student decides to withdraw, he or she should also verify that the withdrawal is submitted before the Final Withdrawal Date. The student is also strongly encouraged to retain their copy of the withdrawal form for their records. Students who enroll for the third or subsequent time in a course taken since Fall 2002 may be charged a higher tuition rate, for that course. State law permits students to withdraw from no more than six courses during their entire undergraduate career at Texas public colleges or

universities. With certain exceptions, all course withdrawals automatically count towards this limit. Details regarding this policy can be found in the ACC college catalog.

Attendance – A number of studies in science education have revealed that class attendance is a very important factor in determining the final grades of college science students. Attendance is even **more important** than the teacher, the textbook, the student's GPA or even the student's IQ! Yet these same studies reveal that some college students enjoy exercising the "freedom to miss class" that college affords, and their grades suffer as a result.

Class time is when you can interact with your fellow students and with the instructor. More pragmatically, class time is when you find out what's going to be on the test! In this class, there will be nothing required on the test that is not discussed in class. Conversely, with the exception of a few personal anecdotes and historical vignettes to add flavor to the class, everything said in class will be on the test in one form or another. There is no substitute for coming to class.

Because attendance is so important to your success in this class, we will have the following attendance policy:

After FOUR (4) unexcused absences, I reserve the right to withdraw you from the class without further notice.

Notice that this *doesn't* mean I will automatically withdraw you, merely that I *reserve the right* to do so. It is possible to get an absence excused, by one of two methods:

1. Producing a ***documented*** valid excuse. Valid excuses include, but are not limited to

    a. Personal illness or other medical emergency
    b. Illness or death of family member
    c. Loss of transportation (*one time only*)
    d. Work conflict (*one time only*)
    e. Jury duty
    f. National Guard duty

    Valid excuses ***must*** come with written documentation (doctor's note, mechanic's receipt, etc.) to be counted. It is your responsibility to provide this documentation, and to notify me as quickly as possible of your absence, so that I won't withdraw you!

2. An adequately detailed outline of the text reading for the missed class day. I will be the final arbiter of what constitutes an adequate amount of detail, and only one rewrite will be allowed per outline.

Attendance will be taken, either verbally, or by sign-in sheet, during class. **Anyone not in roll is class when roll is called will be counted absent, and must have a valid excuse (see above) for not being there.**

A Note on Cheating:

I expect and demand that everything you do in this class will be your own work. Studies have shown that increasing numbers of college students think that cheating is acceptable, and it simply is not. Claiming someone else's work as your own is plagiarism, and both the college and I have a very low tolerance for it. Please take pride in your work, and be honest. Note that this does not forbid students from working together. If you are doubtful about where the line is between collaboration and plagiarism, talk to me, and we'll work it out before you turn things in.

Academic Freedom – Students are free to disagree with instructors on matters of opinion or personal philosophy, and will incur no penalty from doing so. However, instructors will judge student work based upon its relation to the current state of mainstream scientific fact and theory.

Student Discipline – Matters of student disciple will be adjudicated by the instructor on a case-by-case basis, in conjunction with the Department Chair or Dean. Students will want to consult with the Office of Student Services or the Assistant Dean at their campus.

Make-up Policy – As stated before, no late homeworks will be accepted. Tests missed may be made up out of class at times to be arranged if the student possesses an adequate excuse (illness, death in the family, etc. A sudden urge to go to South Padre is NOT a valid excuse!). Extensions may be granted to papers in extreme circumstances.

A Note about Readings:

There is no substitute for reading the book. Research has shown that one of the keys to learning science is to have "hooks," called prior knowledge, that give you someplace to "hang" new knowledge. Your own life experiences will provide some of these hooks, and I hope you will share them in class discussions. Reading material in the book before class will provide you with more hooks, so that information discussed in class will not be entirely new. To best understand the things we will discuss, you will need to "see" it from as many angles as possible.

Some truths about taking this class:

- **It is not unreasonable for me to expect you to come to class on time every day that you are physically able.**
- **It is not unreasonable for me to expect you to take notes in class.**
- **It is not unreasonable for me to expect you to do all the assignments.**
- **It is not unreasonable for me to expect you to read the book.**

All of the above are essential to your learning in this class, or any science class. You are all adult learners, and I will treat you like adults, responsible for your own learning. I provide the opportunities; you must provide the energy. If you think that any of the above are unreasonable, then you will have a difficult time in this class!

And remember, the only *really* stupid question is "Who cares?"

COURSE OUTLINE

Section 1: The Foundations of the Scientific Method

January 21	Introduction to course	Ch 1, pp 1-10
	Crash Course Astronomy #1	
January 23	Ancient Astronomy	Ch 1, pp 13-17, 24-28
	Crash Course Astronomy #2	
January 28	Greek Astronomy	Ch 2, pp 34-39
	Crash Course Astronomy #3	
January 30	The Renaissance	Ch 2, pp 40-44
February 4	Kepler's Laws	Ch 2, pp 44-49
February 6	Isaac Newton	Ch 2, pp 49-52
	Crash Course Astronomy #7	
February 11	More on Newton	Ch 2, pp 52-56
February 13	Exploring Space	Ch 6, pp 135-144, 146-147
		Ch 8, pp 196-197
February 18	TEST #1	

Section 2: The Terrestrial Planets

February 20	The Earth's Atmosphere	Ch 7, pp 161-167
	Crash Course Astronomy #9	
February 25	The Earth's Interior	Ch 7, pp 167-172, 178-180
	Crash Course Astronomy #11	
February 27	The Earth's Surface	Ch 7, pp 172-178
March 3	The Earth-Moon System	Ch 1, pp 18-24
		Ch 7, pp 180-183
	Crash Course Astronomy #4, #5, and #8	
March 5	Exploring the Moon	Ch 8, pp 188-210
	Crash Course Astronomy #12	
March 10	The Planet Mercury	Ch 8, pp 188-210
	Crash Course Astronomy #13	

March 12	Venus's Atmosphere	Ch 9, pp 215-218, 225-230
	Crash Course Astronomy #14	
March 24	Venus's Surface	Ch 9, pp 218-225
	Mars, the Red Planet	Ch 10, pp 234-236, 252-256
	Crash Course Astronomy #15	
March 26	More on Mars	Ch 10, pp 236-252

Section 3: The Jovian Planets

March 31	Jupiter, King o' the Planets	Ch 11, pp 261-269
	Crash Course Astronomy #16	
April 2	Jupiter's Interior and Magnetic Field	Ch 11, pp 269-274
April 7	Jupiter's Attendants	Ch 11, pp 274-282
	Crash Course Astronomy #17	
April 9	Saturn	Ch 12, pp 287-300
	Crash Course Astronomy #18	
April 14	Saturn's Moons	Ch 12, pp 300-310
April 16	YOO-ruh-nus and Neptune	Ch 13, pp 315-329
	Crash Course Astronomy #19	
April 21	TEST #3	

Section 4: Putting It All Together

April 23	Poor Pluto	Ch 14, pp 348-355
April 28	The Asteroids	Ch 14, pp 334-340
	Crash Course Astronomy #20	
April 30	Comets and Meteors	Ch 14, pp 340-348, 355-358
	Crash Course Astronomy #21, #22, and #23	
May 5	The Origin of the Solar System	Ch 6, pp 144-155
		Ch 15, pp 364-366
May 7	Planets Beyond our Solar System	Ch 15, pp 366-379
	Crash Course Astronomy #27	
May 12	Life, the Universe, and...	Ch 28, pp 707-723
May 14	TEST #4	

DUE DATES	
January 30	Website Review
February 13	Homework #1
February 18	TEST #1
March 3	Homework #2
March 26	Homework #3
March 26	Take-Home Test handed out to students
April 7	Take-Home Test due
April 16	Homework #4
April 21	TEST #3
April 30	Opinion Paper
May 12	All Extra Credit
May 12	Homework #5
May 12	Research Papers
May 14	TEST #4