

# PHYS 1311

## Elements of Astronomy

### Syllabus



SMU Department of Physics  
SMU-IN-TAOS, AUG. 2016

Professors Jodi Cooley and Stephen Sekula

# Syllabus for PHYS 1311

## General Information

A descriptive survey of astronomy from the sun and planets to the outer galaxies, and to the ultimate structure and origin of the cosmos. Associated laboratory work provides experience in making measurements and working with real astronomical data. Prerequisite: high-school algebra.

## Pure and Applied Sciences Pillar Student Learning Outcomes

- Students will be able to demonstrate basic facility with the methods and approaches of scientific inquiry, hypothesis development, and/or problem solving.
- Students will be able to explain how the concepts, advancements, and findings of science or technology in general, or of particular sciences or technologies, shape our world.

## Quantitative Reasoning Student Learning Outcomes

- Students will be able to solve problems using algebraic, geometric, calculus, statistical and/or computational methods.
- Students will be able to interpret and/or draw inferences from mathematical models, data, graphs or formulas.

## Course-Specific Goals

The students should be able to:

- Describe the paradigm shift produced by the work of Copernicus, Galileo and Kepler.
- Describe the basic composition of the solar system, the galaxy, and the larger cosmos, and explain how information is gathered about these structures.

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- Describe what the H-R diagram revealed about stars.
- Describe what the properties of stars have revealed about larger structure of the cosmos.

## Textbooks

Chaisson, Eric and McMillan, Steve. “Astronomy: A Beginner's Guide to the Universe.” 7<sup>th</sup> Edition. Pearson Education, Inc. 8<sup>th</sup> Edition. 2013.

Prather, Edward, Slater, Timothy, Adams, Jeffrey, and Brissenden, Gina. Lecture-Tutorials for Introductory Astronomy. Pearson Education, Inc. 3<sup>rd</sup> Edition. 2013.

Laboratory Manual for “Elements of Astronomy: PHYS 1311”.

## Plan of Activities

The course meets for 3.5 hours; 1.5 hours are used for lecture, 1.5 hours for laboratory work, and 30 minutes are used as a quiz period and short break between lecture and laboratory.

AUGUST 2016						
DAY	LEAD	LECTURE (90 minutes)	TOPIC	LAB (90 Minutes)	TOPIC	MATERIAL COVERED (Chapters; Lab)
1	Sekula	Foundations of Astronomy; Survey	Historical	Measurement and Measurement Errors		0, 1; Lab 1
2	Sekula	Light and Telescopes	Matter;	Study of the Electromagnetic Spectrum		2,3; Lab 2
3	Cooley	General Intro to the Solar System; Earth and Moon		Properties of Lenses		4,5; Lab 3
4	Sekula	Example Planets: Venus and Mars; Jupiter		Study of Mars using Rover/Orbiter Data		6, 7.1, 7.3, 7.4, 7.6; Mars Lab Handout

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5	Sekula	The Sun	Measuring the Solar Constant	9; Lab 7
6	Cooley	Measuring Stars and the Interstellar Medium	Plot the H.R. Diagram	10, 11; Lab 9
7	Sekula	Stellar Evolution	Parallax and the Measurement of Distance	12; Lab 8
8	Sekula	Extreme Stars: Neutron Stars and Black Holes	The Crab Nebula	13; Lab 10
9	Cooley	Galaxies; The Milky Way; Kinds of Galaxies	Stars, Dust, and Gas in the Milky Way	14, 15; Lab 11
10	Cooley	Dark Matter and Galaxy Formation	Measuring Rotation Curves	16; Galactic Rotation Curves Handout
11	Cooley	Cosmology; The Accelerating Expansion of the Universe	Measure the Expansion of the Universe	17; Expansion of Universe Handout
12		FINAL EXAM		

In addition, we plan to host two non-mandatory movie nights on the two Saturdays during the term:

- First Saturday: “For All Mankind,” a 1989 documentary film of the NASA Apollo Mission to land human beings on the Moon.
- Second Saturday: “Interstellar,” a 2014 work of fiction with the most precise computer simulations of extreme gravitational phenomena ever visualized by human beings.

We also plan to host telescope viewing parties each night of the week and possibly on weekends, as viewing conditions allow. These will allow students to get first-hand experience in utilizing telescopes to find, focus, and track celestial objects including, but not limited to, the Moon and Saturn. Attending at least 1 viewing night is mandatory, and part of the final grade.

## Assessment

Student performance will be assessed as follows:

- Daily lecture-based take-home homework assignments (30% of total grade) and in-class quizzes (10% of total grade)
- In-class Laboratory Exercises (30% of total grade)
- Attending 1 Out-of-class Star Viewing Night (5% of total grade)
- A final examination (25% of total grade)

## Quizzes

Quizzes are in-class, once per class day. They will occur after lecture and before lab, and will spot-check learning on the material in the reading for that day and the lecture material covered that day. Quizzes will be 20-minutes in duration. Quizzes are open-note and you can use a non-internet-connected calculator, but you cannot use the textbook or other computational aids (mobile phone, laptop, tablet, etc.).

## Homework

Homework will be assigned each class day and due by the beginning of the next class day. You are encouraged to work together on the homework, but please make sure that the final product you hand in is your own work. We recommend that, if you like, you discuss with your peers the questions where you are stuck or unsure, but work alone in a quiet environment at the end when you compose your final work for the assignment. This will insure you have personally digested information and can express answers to questions in your own words and with your own understanding.

## Laboratory

Laboratory will follow lecture and quiz. The labs will be conducted using the required laboratory manual. At the end of lab period, you are to hand in your lab manual and any associated materials for review and assessment.

## Viewing Nights

The viewing conditions in Taos are generally better than in Dallas, owing to the low light pollution, but the weather is more variable at Taos than in Dallas over short periods of time. As a result, a viewing night cannot be guaranteed each day until about 8pm of the night. Since you only are required to attend one viewing night, plan ahead. It is better to attend an earlier clear night of viewing than gamble on a later one, only to be stymied by continual bad weather. (Real astronomers have suffered because of weather for centuries. Long-planned time on shared telescopes have famously been ruined by cloudy nights at the viewing site. While missing your viewing night due to weather is a mark of professional pride, it's not good for your grade).

Assume that every night is a possible viewing night. To see if the viewing night is happening, go to the Taos Dining Hall and look at the message board outside the hall (just inside the lobby). The instructors will post a sign there by 8pm each night of the August term to indicate whether a telescope viewing is ongoing. The nominal viewing location is at the Parade Grounds, near Fort Burgwin (look for the flag pole and go there).

## University Honor Code

The student honor code can be found on page 32 of the 2014-2015 student handbook<sup>1</sup>. All students will be expected to adhere to it. Any student found cheating or plagiarizing another's work will be given a zero for that work and a complaint will be filed through the Vice President for Student Affairs Office. If you are uncertain of the definition of plagiarism as it regards independent works of mathematical and physical computation, documentation, and demonstration, it is your responsibility to speak with the instructor and understand these rules.

## Disability Accommodations

Students needing academic accommodations for a disability must first be registered with Disability Accommodations & Success Strategies (DASS) to verify the disability and to establish

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<sup>1</sup> <http://www.smu.edu/StudentAffairs/StudentLife/StudentHandbook>

eligibility for accommodations. Students may call 214-768-1470 or visit the DASS website<sup>2</sup> to begin the process. Once registered, students should then schedule an appointment with the professor to make appropriate arrangements.

Please find detailed information about DASS at the end of this syllabus.

## **University Policy on Religious Holidays**

Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

## **Excused Absences for University Extracurricular Activities**

Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

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<sup>2</sup> <http://www.smu.edu/ALEC/DASS>