

# Astronomy

## 2013-2014 Syllabus

*"What the deuce is it to me? You say that we go around the sun. If we went around the moon it would not make a pennyworth of difference to me or my work."*  
—Sherlock Holmes, in "A Study in Scarlet" by Sir Arthur Conan Doyle.

**Schedule:** Wednesdays 6:30 – 9:30 pm in Science 201. If you come late, we will often be outside or elsewhere, so look around (or better yet, don't be late).

**Instructor:** Scott Calvin. Email: SCalvin@slc.edu. Office phone: 395-2260.

### **Textbooks:**

- J. D. Fix, *Astronomy: Journey to the Cosmic Frontier*, 6<sup>th</sup> ed. (McGraw-Hill, New York, 2011).
- F. Purnell Jr., M. S. Pettersen, and M. C. Carnes, *The Trial of Galileo: Aristoteleanism, the "New Cosmology," and the Catholic Church, 1616-1633* (This title is currently switching publishers. I'm not sure yet whether it will be in the bookstore or whether we'll reprint it and sell it to you ourselves).
- Additional primary sources will be assigned as part of the reading.

### **Supplies:**

- Astrolabe custom-made for SLC (available only at SLC Bookstore).
- Galileoscope. You can purchase this from me directly for \$28.78 (a substantial discount--Amazon sells them for \$50!).
- Bound (not spiral or looseleaf) notebook *or* approved electronic notebook.
- *Starry Night College Access Code*. This lets you download software we'll be using; it costs under \$10 at the bookstore.
- Small tripod. You can get this from the bookstore, or provide your own.

**Goals:** Many of the facts and most of the theories you will learn in this class are wrong. I can say this with confidence because astronomy is still a rapidly evolving field, with new evidence and new theories being introduced weekly. Much of what I learned when I first took astronomy is now outdated, and some of it has turned out to be simply incorrect. Given this, why bother to learn (or teach) astronomy? In part, because the ideas current in the field are interesting and worthwhile in the same way that a piece of art may be interesting and worthwhile—as the product of creative intellectual effort in the context of a long tradition. Secondly, the field *does* advance; thousands of years of effort have firmly established the motions of the planets, for example. Even those current theories that turn out to be incorrect lay the basis for understanding the theories that replace them. But most of all, the *process* of observation, hypothesis, and model-building employed by astronomers will survive many of the observations, hypotheses, and models they generate. This class will emphasize the methods by which astronomers generate and communicate their ideas. Ultimately, my goal is that students who have taken this class understand the fundamentals of astronomy, are able to comprehend new developments in the field as they arise, and have learned how to make astronomical observations and to communicate astronomical results in the ways employed by practicing scientists.

**Policy on Mid-Year Drops and Adds:** This is a full-year course. Note that you need my permission to drop between Fall and Spring, which will not be routinely granted. If you know you only wish to take the course for one term, please raise this during the interview.

**Attendance Policy:** You must obtain my permission *prior* to absences for purposes such as field trips. For absences due to illness or family emergency, please contact me as soon as possible to explain the reason for the absence. Even one unexplained absence will be noted on your evaluation. **More than three absences or more than two missed conferences over the course of the year (not the semester!), whether excused or not, will generally lead to loss of credit.** Frequent lateness will also be noted on your evaluation, and may in extreme cases lead to loss of credit.

**E-mail:** You are expected to check your email frequently, preferably every weekday. We will also make considerable use of the class web page on MySLC.

**Field Trip:** There will likely be an optional field trip each term. The first is likely to be to the Westchester Amateur Astronomers' Starway to Heaven on Saturday, November 2, weather permitting.

**Coursework:** In addition to attending and participating meaningfully in class, you will be expected to complete the following:

**Scientific Notebook:** You are required to keep a scientific notebook during the semester. This notebook should include the following:

- Class notes;
- Astronomical observations;
- Summaries of what was discussed in class each meeting, including points you found confusing or disagreed with;
- Summaries and reactions to the readings;
- Zooniverse notes;
- Notes for the other projects listed below;
- Notes on your conference project;
- Anything else you feel is appropriate.

Notebooks will be collected from randomly selected students each class meeting. Standards for notebooks will be discussed the first day of class.

**Studies:** You will be expected to conduct astronomical observations outside of class and analyze the results. Each time a study is completed, one group (two or three people) will present a scientific poster on this experiment to the class. You will then participate in writing a short paper in the form of a scientific journal article to be posted to the web board the following week. A paper may have from one to three authors; each author is responsible for contributing to and approving the content; the “lead author” is responsible for the final form of the paper. Each student must be lead author on at least one paper during the course. These will then be assigned to anonymous reviewers both within the class and in other classes. Each lead author must, in consultation with coauthors, revise at least one paper in this course in response to the peer reviews.

**Comparative Astronomy Poster:** In pairs, students will prepare a scientific poster on the astronomy of one culture. These posters will then be presented in class.

**Solar System Presentation:** Each student will make an 8-minute PowerPoint presentation to the class on one portion of the Solar System (e. g. Jupiter or the Asteroids).

**Conference Work:** At the start of most class sessions, four students will give an update of the current progress of their conference work. At a joint Science Division poster session near the end of the term (date to be announced), each student will present a poster on their conference work (unless they are presenting a poster for another class, in which case a paper can be substituted). A paper is *not* required unless you feel it is necessary to convey what you have done for conference work.

**The Trial of Galileo:** This section of the course is likely to be radically different than anything you’ve ever done in school (unless you took my Crazy Ideas in Physics or FYS course!). You will be assigned a role as a 17<sup>th</sup> century figure, most likely a Cardinal, charged with determining the fate of Galileo and his theories. This section of the course requires a minimum of 12 pages of writing (double spaced), but how that is distributed will vary depending on your role (for most, it will be several short papers or letters). This pedagogy is intensely oriented toward group work and public speaking.

**Terraforming Debate:** A debate on whether we should terraform Mars. This one doesn't require a whole lot of prep.

**The Great Debate:** You will be assigned the role of an early 20th-century astronomer debating the size of the universe and our position within it. This section of the course requires a brief presentation, as well as scientifically thoughtful role-play.

**Zooniverse:** You will be asked to complete at least ten Zooniverse tasks per week (they are very quick!).

**A Note on the Readings:** Unlike in many classes, we do not always explicitly discuss the readings in class, and when we do, it is often long after they are to be completed. You may wonder, then, why they are assigned. They comprise “deep background”—material that will influence our discussions and conclusions, and from which we can

draw. At Sarah Lawrence, you're used to a class having two "channels": class discussion and the conference project. Material you read for conference is likely to inform your discussion in class without having explicit time set aside for it. These readings, along with the notebook, form a *third* channel. You will summarize and react to the readings in your notebook; in turn, I will respond to your thoughts in written form. When you bring up something particularly interesting or important, I may then bring it into a later class discussion.

**Public and Private:** Unlike in most courses, you should consider *papers* you write for this class to be "public." They will be posted on a website where other students can see them, and given to other students to review. They may be discussed by the class or future classes. Your *notebooks*, on the other hand, are confidential. I will not share material in your notebooks with other students, current or future, without your permission.

**Special Note on Observing:** Some assignments for this course require good corrected eyesight (i.e. good eyesight with glasses or contact lenses if necessary) and a steady hand in moderately cold weather. In the event that either of these presents a difficulty for you, please contact me as soon as practical (ideally, no later than the first conference). Accommodations, in some cases consisting of alternative assignments, will be arranged.

**Falsification of Data:** Falsifying data is a very serious breach of the Sarah Lawrence College policy on academic integrity.

### **Tentative Schedule:**

This schedule is approximate, and many assignments will be due *between* class sessions. Check MySLC for up-to-date assignments. (Numbered chapters belong to the textbook; letters are appendices in *The Trial of Galileo*.)

	<u>Topic</u>	<u>Text Chapters</u>	<u>Course Events</u>
Sep. 11	Intro. To Observing		
Sep. 18	Observing/Sky Motions	1	
Sep. 25	"	2, 6.3-6.5, 16.1-16.4	Star & Sun Observing Posters (2 pair)
Oct. 2	Ancient Astronomy	3 + A, B	Star/Sun Paper Due
Oct. 9	Renaissance Astronomy	4 + D, C, E	Faction meetings
Oct. 16	The Trial of Galileo 1 and 2		Some Trial assignments due
Oct. 23	The Trial of Galileo 3 and 4		Some Trial assignments due
Oct. 30	The Trial of Galileo 5	F	
Nov. 6	The Trial of Galileo 6 and 7		Some Trial assignments due
Nov. 13	The Trial of Galileo 8		Some Trial assignments due
Nov. 20	Comparative Astronomy	5	Comparative Astronomy Posters
Dec. 4	Planetology	6.1-6.2, 7	3 More Posters (3 pairs)
Dec. 11	"		<b>Science Div. Poster Session (date TBA)</b>
Dec. 18	"		Second Study Paper Due
Jan. 22	Stars	8-15 (one per student)	
Jan. 29	Terraforming	16.1-16.4, <i>Red Mars</i>	Solar System Presentations
Feb. 5	Stars	16.5, Kelvin	"
Feb. 12	"	16.6-16.7, Russell	Solar System Bee
Feb. 19	"	17.1, Eddington	
Feb. 26	"	17.2, Eddington	Third Study Paper Due
Mar. 5	"		
Mar. 12	"	<i>Green Mars</i>	
Apr. 2	Galaxies	Great Debate	Stellar Evolution Paper Due
Apr. 9	Cosmology	Eddington, 22.1, 23.2-23.3	
Apr. 16	The Great Debate		
Apr. 23	Cosmology	Great Debate, 22.2-22.6, 23.1, 26.1, 26.3-26.4, Origins	
Apr. 30	"	26.2, 26.5, Origins	Last Study Paper Due
May 7	Emergent topics		<b>Science Div. Poster Session (date TBA)</b>
May 14	"		