

Syllabus

Introduction to Astronomy Physics 090, Spring 2018

A cosmic tour ablaze with painstaking observations, remarkable inspiration, and an occasional wrong turn, beginning with the light refracting in a drop of water and finishing with the red-shifted photons that have been traveling to us for 13 billion years since the Big Bang.

Last revised: February 11th, 2018

The most current version of the syllabus is at:

physics.stmarys-ca.edu/courses/Phys001/18S

INSTRUCTIONAL TEAM

- Prof. Brian Hill (Lecture and first lab section)
 - The web server with my home page is (I hope very temporarily!) down. I will email the whole class with the information on that page, including my office phone, office location and office hours. When the server comes back up, it will be again be handy at physics.stmarys-ca.edu/faculty/brianhill
- Prof. Brandon Eberly (2nd and 3rd lab sections)
- Teaching Assistants:
 - Syeda Mohsin (Lecture TA)
 - Joshua Mills (1st lab section TA)
 - TBA (2nd lab section TA)
 - Ariana Hofelman (3rd lab section TA)

OVERVIEW

Astronomy is a wonderful subject for the sheer pleasure of perusal, and the variety of exotic phenomena in the sky makes it a life-long interest for many people. However, the goal of the science of astronomy is to understand the great variety of observations in terms of the rather few principles of physics.

Understanding astronomical observations from physics turns out to be a two-way street. Some of the principles of physics — for example, Newton's Law of Universal Gravitation — or that neutrinos change type as they travel — were deduced from astronomical observations in combination with laboratory physics experiments. The relationship is so close that the field is now most often called "astrophysics" and it can be considered a branch of physics, like condensed matter physics or particle physics.

The associated laboratory course (Physics 91) will have roughly equal numbers of afternoon labs where physics experiments (on optics, spectroscopy, the Doppler shift) are performed, and evening labs where you will learn to operate and make observations with the College's telescopes.

Necessarily, the class will include mathematics. This is integral to the scientific method. Every physics theory that we are confident of, we are confident of precisely because it has been tested quantitatively as well as qualitatively. Theories that are motivated principally by esthetic considerations, or only give qualitative answers, have generally turned out to embarrassingly far off in the weeds.

The interplay between astronomical observations, physical principles and quantitative predictions is an excellent example of what the [Core Curriculum](#) refers to as "Mathematical and Scientific Understanding" — one of the Core's four pathways to knowledge. This course is designed for you to acquire a new-found or deepened understanding of that pathway while simultaneously having the pleasure of studying the most singular and spectacular phenomena that nature has to offer.

OUTCOMES

The College's summary of what constitutes [Mathematical and Scientific Understanding](#) states as its overall learning goal that students "will develop quantitative, observational, and problem-solving abilities." In addition, it states that "students will examine mathematics and science as a creative endeavor," and "they will also consider the social and ethical issues of scientific inquiry and application."

The course is designed to address those overall learning goals and five more specific outcomes enumerated in the mathematical and scientific pathway to knowledge:

- Apply abstract and logical reasoning to identify patterns and solve mathematical problems.
- Communicate mathematical ideas and concepts accurately and clearly using mathematical symbols, language, and formulas.
- Demonstrate an understanding of scientific concepts, principles, and theories that explain the natural and physical world.
- Collect, analyze, and interpret empirical data gathered in a laboratory or field setting.
- Examine social or ethical issues that arise in the process of scientific inquiry or out of scientific or technological developments.

MATERIALS

- Textbook: [The Cosmos: Astronomy in the New Millenium, 4th edition](#) by Jay M. Pasachoff and Alex Filippenko (digital edition is ok if you prefer that to the paperback)
- Workbook: [Astronomy: Activity and Laboratory Manual](#) by Alan W. Hirshfeld (has tear-out pages — if you buy used, be sure yours has all pages present). Bring you workbook to all classes and labs. We will sometimes tear out pages, staple them and hand them in.

SCHEDULE

For the [Spring Semester](#) we are allotted 14 weeks, not counting the additional week reserved for the [Final Exam Schedule](#). Subtracting one week for Easter break, there remain 13 weeks available to cover the five units:

- Unit 1: Light, Matter, Energy, Geometrical Optics, Telescopes.
 - Textbook Chapters: 2 and 3
 - Note: The Geometrical Optics and Telescopes part of this unit will be covered almost entirely within the [Physics 91 lab](#). In class, we will focus on Light, Matter and Energy.
- Unit 2: The Motions of the Earth, the Moon and the Planets.
 - Textbook Chapters: 4 and 5
- Unit 3: The Composition and Properties of The Sun and the Planets.
 - Textbook Chapters: 6, 7 and 10
- Unit 4: The Composition and Lifecycle of Stars, Nova, Supernova and Black Holes
 - Textbook Chapters: 11 to 14
- Unit 5: Our Galaxy, Other Galaxies, Galaxy Clusters, The Big Bang, Dark Matter.
 - Textbook Chapters: 16 to 19

Five units in 13 weeks means that our pace will be about 2 1/2 weeks per unit. There will be an exam after each of the first four units, and a final exam that is cumulative and covers the last unit. The exam dates will be added to Moodle during each unit.

EXAMS AND GRADING

25% for the in-class assignments, 10% for the at-home assignments, 10% on each unit exam (totaling 40%), 25% final.

Many quiz and exam problems will be multiple choice. To ease my and the teaching assistants' loads, many of the in-class and take-home assignments will simply be graded pass-fail.

Carefully compare your work with the detailed solutions whenever solutions are given in class or handed out, even if you got full credit. You may have gotten full credit just for effort.

Late in-class and take-home assignments are generally accepted with a valid excuse, but only until the corresponding unit exam. In other words, Unit 1 assignments will not be accepted after the Unit 1 exam is given.

Athletes or performers who have given me their schedule of away games have a totally valid excuse that I will do my best to accommodate. Expect that there will be a lot to make up. Rely on your classmates, their notes, the textbook and the workbook. I simply can't re-deliver lectures to all the people who will inevitably miss one or more of them.

STEM CENTER TUTORING

Saint Mary's has a center for students taking STEM classes in Assumption Hall, Room 200. The STEM Center provides several services, including free tutoring in math, chemistry, physics, and biology. Please be very respectful of the Assumption Hall residents.

ACADEMIC HONOR CODE

The Saint Mary's Academic Honor Code (AHC) is applicable to this (and all) Saint Mary's courses. You are responsible for familiarizing yourself with it: [AHC Website](#).

STUDENT DISABILITY SERVICES

Accommodations that take into account the context of the course and its essential elements for individuals with qualifying disabilities are extended through the office of Student Disability Services (SDS). Information regarding the services available may be found on the [SDS Office Website](#).

MISSION

John Baptist de La Salle dedicated himself to serving students who could not afford the private tutoring that was the primary form of education in his day. Saint Mary's is an heir to that mission and its faculty and staff are entrusted with carrying it out.

It is my goal to make each of you feel and know that you are valued and belong, regardless of your background or demographic. Please let me know if I am falling short in that. We all have blinders. I am constantly re-examining and trying to correct my own.

A syllabus is not the place to enumerate all of the ways the physics faculty are striving to align with the mission and to help everyone be successful. We are fully occupied teaching and doing physics and almost all of the time you will hear us talking about physics. Please be assured that we take the mission of the College very seriously even when we aren't talking about it.