Introduction to Astronomy Lab

Physics 091, Spring 2020

The laboratory associated with Introduction to Astronomy.
Revised: February 12th, 2020
Any minor updates to the syllabus will be available at:
physics.stmarys-ca.edu/courses/Phys091/20S
The on-line version is generally more useful because of the links to other web pages.

INSTRUCTIONAL TEAM

- 1st lab section:
  - Prof. Brian Hill, physics.stmarys-ca.edu/faculty/brianhill/index.html
  - Teaching Assistant: Connor Martin
- 2nd lab section:
  - Prof. Aaron Lee, physics.stmarys-ca.edu/faculty/aaronlee/index.html
  - Teaching Assistant: Angelo Karam
- 3rd lab section:
  - Prof. Hans de Moor, math.stmarys-ca.edu/faculty-staff/demoor/
  - Teaching Assistant: Benjamin Harte

OVERVIEW

This lab is the corequisite (required companion) to Physics 90. You will do experimental work to round out your understanding of: light; optics; the constellations and the celestial coordinate system; the motions of the Moon, the Sun, and the planets; and telescope operation.

MATERIALS

- Handouts that will be provided for each lab.
- A mechanical pencil (or an ordinary pencil and a way to keep it sharp), and an eraser.
- For the evening observing labs, especially in the beginning of the semester, you will need to dress warmly. Temperatures during early spring evenings sometimes drop into the 30s.

SCHEDULE

Overview

The indoor lab topics are star charts, reflection, refraction, lenses and spectra. The outdoor lab topics progress from no instruments to advanced instruments: naked-eye observing, binocular observing, and a sequence of three labs using German equatorial mounted refractor telescopes.

All labs are conducted on Wednesdays, except the make-up lab, which will be conducted on Thursday, April 30th in coordination with the Seminar Informal Curriculum schedule.

Afternoon labs for Section 1 are conducted between 4:30pm and 6:30pm; and for Section 2 and 3 between 6:30pm and 8:30pm.

Evening observing labs for all three sections begin at about sunset. Sunset varies a lot during the semester. For example, if we had had an outdoor lab on February 12, we would have met about 5:30pm because sunset is at 5:44pm in Moraga on Feb. 12. Sunset on Thursday, April 30th is 7:59pm.

We will watch the weather and weigh in other factors (like the Moon phase) and email you by noon on Monday to tell you whether you have an indoor or an outdoor lab on that Wednesday. You should not continue in Physics 90 and 91 if you have other Wednesday evening commitments.

For the Spring Semester of 2020 there are 12 Wednesdays from February 19 to March 13. We will try to keep a balance of five indoor labs and five outdoor observational labs. Obviously we don't have perfect forecasting, especially with the very variable spring weather, and therefore one of the Wednesdays is budgeted for one outdoor lab cancellation. On two recent springs we have been limited to just four outdoor labs, and when that happened, we have counted the star charts lab as if it were an observing lab.

Outdoor Labs

The outdoor observational labs are held at the SMC Campus Observatory Pad. Most of you have passed this while walking to the Cross.

If you aren't familiar with the location, these campus observing night directions directions will likely be helpful:
physics.stmarys-ca.edu/observatory/astro-nights/index.html#place

At present the following outdoor labs are planned:

- Naked Eye Observing Lab: understand the celestial coordinate system, the ecliptic, the elementary use of star charts, and get oriented at the Pad

- Binocular Observing Lab: continue developing the use of star charts, understand field of view, become more accurate in locating celestial objects
- Three Telescope Observing Labs: developing the use of star charts, understand field of view, become more accurate in locating celestial objects.

The telescope observing labs will start with easy (large, bright) targets selected from those that are available in the early evening, and proceed toward observation, including note-taking and drawing of more difficult targets. Targets will range over all of those discussed in the course: the Moon, the planets, double stars, clusters, novae, and galaxies. The last two types of objects are extremely difficult to see due to light pollution. We will nonetheless attempt to find some of them.

Indoor Labs

At present, the following indoor labs are planned:

- Creation of Star Charts: supports the understanding of the celestial coordinate system (declination and right ascension), builds scientific graphing ability (including interpolation skills), and is essential preparation for the outdoor observing labs.
- Circular and Parabolic Motion Lab: supports the understanding of Newton's Universal Law of Gravitation, and develops data-taking and hypothesis-checking concepts
- Reflection lab: supports the understanding of ray tracing and other techniques of geometrical optics, supports the ideas of light gathering and reflector telescope principles
- Refraction and Lenses Lab: supports the understanding of Snell's law, focal lengths, real and virtual images, and refractor telescope principles
- Spectroscopy and Doppler Shift Lab: supports the understanding of light as a spectrum and the fundamental reasoning that led Hubble to the believe in the Big Bang

GRADING

The Physics 91 lab grade is separate from the Physics 90 lecture grade. For each lab, one of the following scores will be recorded.

- 0: This score is earned if you are absent from lab.
- +6: This score is earned by not completing the lab in some significant way.
- +8: This score is earned by completing everything but being hazy or careless with some parts.
- +10: This score is earned by completing everything and being careful and clear in your work and answers.
- >10: This score (this is a rare occurrence, probably not worth trying for) is earned by completing everything and being clear about everything and then going on to independently investigate further in a structured way.

There are 100 points possible for the 10 labs. There are no "allowed" absences. However, as noted above, we will provide one makeup lab on Thursday, April 30t, so if you miss one lab and did the makeup and all the others perfectly you could still manage to get a perfect score.

Since you will not receive any credit for an absence, and since there are 10 labs required, each absence will in effect subtract 10% from your final grade. Final letter grades will be assigned as follows: 90-100% is the A range, 80-89% is the B range, 70-79% is the C range, 60-69% is a D, and 0-59% is an F.

OTHER

The Stem Center Tutoring, Academic Honor Code, and Student Disability Services statements from the Physics 90 syllabus are also applicable to Physics 91.