

Physics 104
Astronomy: The Solar System
Lafayette College
Fall 2016

Instructor

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Course Website

We will use moodle, <http://moodle.lafayette.edu> or <http://my.lafayette.edu>.

Course Locations and Times

Class: Hugel Science Center 142
Monday, Wednesday, Friday: 1:10-2:00 pm

Lab: Hugel Science Center 142
Monday 2:00-4:00 pm
Lab will meet approximately six times over the semester in conjunction with class.
The first lab meeting will be September 5 (Labor Day. Sorry.).
We may occasionally use lab time for extended lectures as well (e.g., first day of classes.)
Scheduling of Monday afternoon labs will be announced at least one week in advance.

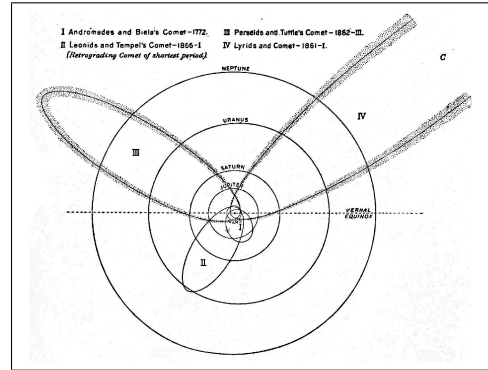
Night Lab: Merrill Creek Reservoir (bus shuttle from campus)
Departure around 7 or 8 pm (details to be announced)
Typically lasts 2–2.5 hours including travel time.
Observations are subject to cancellation due to weather. We need clear skies.
You will sign up for Monday or Tuesday evenings.
Night labs will be weekly starting October 24/25 and ending either after three successful sessions or at the end of the semester

Moon Lab: You will make observations of the Moon on fifteen evenings over the course of the semester. This will be done on your own and will require a few minutes per night. Details TBA.

Office hours

My schedule of office hours will be posted on moodle, on my homepage, and on my office door. The weekly times will vary a bit at the start of the semester but will then settle into a regular pattern.

I am often available at other times. E-mail me if you wish to meet outside my usual hours, or just stop by my office and try your luck.



Comet orbits, *The Solar System*, Percival Lowell, 1903

Text

We will use *The Cosmic Perspective: The Solar System, 8th edition, with MasteringAstronomy* by Bennett, Donahue, Schneider & Voit, Addison-Wesley, paperback, ISBN:9780134587400. The text is available at the college bookstore. It comes with access to MasteringAstronomy, an on-line system we will use for homework. If you obtain the text via another source, make sure that it comes with MasteringAstronomy access.

Note that this is a new edition, just out this year. Our knowledge of the solar system changes rapidly; for example, it turns out that the pictures of the surface of Pluto taken by a space probe last year show it to be *completely different* than we would have predicted. It is important for us to use up-to-date text.

The text we are using contains fifteen chapters. There is a larger version, also called *The Cosmic Perspective*. If you have the larger version, that will work fine. Just ignore chapters 15 to 24.

Readings will be announced week by week in class and on homework assignments.

Course Topics

The college catalog has a good summary of the course:

An introduction to the study of the Sun and its contingent of planets, moons, comets, and asteroids. Up-to-date details of the orbits, surfaces, atmospheres, and interior structures as deduced from telescopic and spacecraft data are discussed. The elementary physics of gravity, orbits, and distance measurement leads to a limited amount of problem solving. Six biweekly laboratory sessions and at least three nighttime observing sessions with telescopes. Requires only high school algebra and trigonometry.

What the catalog neglects to point out is just how cool astronomy is. It is amazing that we can use very simple rules to understand large and esoteric things like planets, stars, galaxies, and even the Universe itself. It is astounding that we can find rational ways to discuss seemingly crazy ideas like searching for extraterrestrial life. Those of us who make our living studying this stuff have a lot of fun, and we are amazed that we are actually paid to do it.

But I digress, so let's get back to the Physics 104 Syllabus.

The course is divided into the following ten topics. Time spans listed here are approximate. Weekly topic coverage and reading assignments will be given in class and listed on weekly homework handouts.

1. *Overview of the Universe and the place of the Solar System within it. (2 weeks)*
Text §1-3.
An inventory of the universe. Time and length scales. Angles and some methods of measurement. Development of the Sun-centered model of the solar system.
2. *Orbits. (1 week)*
Text §4.
Kepler's Laws.
3. *Planet surface temperatures. (1 week)*
Text §5.4 & 10.1.
Thermal radiation, energy balance, and planet surface temperatures.

4. *Telescopes. (1 week)*
Text §6.
 Design and use of telescopes: angular resolution and light gathering. Telescopes across the electromagnetic spectrum. Limits on observing due to the Earth's atmosphere.
5. *The Solar System Overview. (1 weeks)*
Text §7-8.
 Radiometric dating. Formation, age, and structure of the solar system.
6. *Terrestrial Planets. (3 weeks)*
Text §9-10.
 Mercury, Venus, Earth & Moon, Mars. Planet compositions, surfaces, atmospheres.
7. *Jovian Planets, their moons, and their rings. (1.5 weeks)*
Text §4.5, 11.
 Jupiter, Saturn, Uranus, Neptune. Composition. Moons. Rings.
8. *Smaller solar system bodies. (0.5 week)*
Text §12
 Comets, Asteroids, Kuiper Belt, Oort Cloud, etc.
9. *Extrasolar planets. (2 weeks)*
Text §5.4, 13
 Techniques for discovering planets around other stars. Inventory of known extrasolar planets. Prospects for future discoveries.
10. *Life in the universe. (1 week)*
Handouts
 Prospects for extraterrestrial life.

Outcomes

After completing this course, among other things, you will be able to....

- Use simple optical telescopes.
- Understand how the Solar System is studied using telescopes and space probes.
- Make geometric calculations for purposes such as measuring distances.
- Calculate planet surface temperatures and understand the greenhouse effect.
- Describe the basic characteristics of the bodies in the solar system.
- Understand how the bodies in the solar system formed and obtained their present-day characteristics.
- Understand how planets are discovered around other stars.

In addition to the outcomes listed above, this course will promote the following outcomes from the Natural Sciences section of the Common Course of Study:

- NS1. Employ the fundamental elements of the scientific method in the physical and natural world.
 - NS1a. Identify and/or formulate a testable scientific hypothesis.
 - NS1b. Generate and evaluate evidence necessary to test and/or revise a hypothesis.
- NS2. Create, interpret, and evaluate descriptions and representations of scientific data including graphs, tables, and/or models.
- NS3. Understand how scientific uncertainty informs the evaluation of hypotheses.

Homework

There will be weekly homework assignments. Most will include both on-line and paper components. Assignments will be distributed on paper in class and also posted on moodle. On-line problems will be done on masteringastronomy.com in course PHYSICS104FALL2016, which is also titled “Lafayette College Physics 104 Fall 2016.”

Homework will be due on Fridays in class. The first assignment will be due Friday, Sep. 9. Late written work will be accepted for 50% credit through the following Monday. Late on-line work will be accepted on a sliding scale (with gradually increasing penalties) from Friday at 1 p.m. until Monday at 1 p.m.

If you cannot complete a homework due to illness, family emergency, or similarly compelling reason, please contact me. (Also see the section on “Dean’s excuse policy” in the Student Handbook.)

I encourage you to work with other students on problems involving calculations and analysis. Try the problems yourself. When you get stuck, talk to someone else about them. Physics and astronomy can be challenging subjects! Working with others is a great way to learn.

Homework assignments may include reading quizzes or similar work not involving calculations or analysis. Such quizzes should be done on your own.

I will have extensive office hours (see moodle for an up-to-date list). They will be purposely scheduled on days before homework is due. Please come and visit.

Exams

There will be two in-class “hour exams” (actually 50 minutes long), given on Friday, October 7, and Friday, November 18. **Note that the first exam is the day before fall break. Plan your travels accordingly.** Each exam will cover material from the weeks leading up to it. Exam problems will typically resemble homework problems.

There will be a final exam, three hours long, during finals week, at a time and place designated by the registrar. It will be a comprehensive exam, covering all aspects of the course.

Exams will be closed-book, but you will be able to create your own crib sheets for the exams. Details of the crib-sheet procedure will be given at least a week before the first exam.

Grading

There must be grades. Your grade will be based on:

Lab, Observing, Moon Project	15%
Homework	25%
Exam #1	15%
Exam #2	15%
Exam #3 (finals week)	30%

Class participation, effort level, etc., may be factored into your final grade after your score is calculated using the above percentages. This will be most important if you are on the borderline between two grades.

Whom we root for (besides Lafayette, of course)

We root for the Philadelphia Eagles. In emergency situations, when the Philadelphia Eagles are not available to be rooted for, we root for the Green Bay Packers.

What to call me

Please, let's all use first names. Call me David.

Intellectual honesty

You are expected to abide by the principles of intellectual honesty outlined in the Lafayette Student Handbook (available from <http://studentlife.lafayette.edu>).

Learning is a collaborative process. Discussion and collaboration on homework in this course is very strongly encouraged. "Collaboration" does not mean "copying." You must understand and individually write out your answer to each problem.

For some labs and observing projects, you will collect data and submit reports with other students. For others the work must be entirely your own. Details will be announced with each lab or observing project. When in doubt, ask.

Exams must be done on your own, using only materials specifically allowed. This will be discussed in detail before each exam.

Accommodation

My policy. It is important to me that you do well in this class. If you have any disabilities which you feel may interfere with your ability to succeed and prosper in this class, please contact me to discuss ways of accommodating them.

Mandatory statement for any Lafayette course with a disability policy. In compliance with Lafayette College policy and equal access laws, I am available to discuss appropriate academic accommodations that you may require as a student with a disability. Requests for academic accommodations need to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students must register with the Office of the Dean of the College for disability verification and for determination of reasonable academic accommodations.

Mandatory Moodle privacy statement

Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure to unauthorized parties violates federal privacy laws. Courses using Moodle will make student information visible to other students in this class. Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class. Questions can be referred to the Registrar's Office.

Mandatory credit hour statement

The student work in this course is in full compliance with the federal definition of a four credit hour course.