

HONORS 210
Evolution of Scientific Thought
Spring 2010

Instructor: Mr. Clayton Gearhart

Office: Peter Engel 105 (north side, parking lot level)

Office Hours: after class; and see below

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course web site: <http://faculty.csbsju.edu/cgearhart/Courses/Honors210/Honors210.htm>
or start from <http://www.csbsju.edu/physics> and follow the links.

TEXTS:

- Thomas Kuhn, *The Copernican Revolution*
- Thomas Kuhn, *The Structure of Scientific Revolutions*
- Stillman Drake, *Discoveries and Opinions of Galileo*
- Maurice Finocchiaro, *The Galileo Affair: A Documentary History*
- Richard S. Westfall, photocopied extracts from *Essays on the Trial of Galileo*
- Richard S. Westfall, *The Life of Isaac Newton*
- Dennis Overbye, *Einstein in Love: A Scientific Romance*
- Diana Hacker, *The Bedford Handbook*
- Occasional handouts. I will usually distribute them in class and post them on the course web site.
- You will also need a laboratory notebook with a sewn binding.

USEFUL REFERENCES: (all in reference section of library)

Dictionary of Scientific Biography

Wilson Follett, *Modern American Usage*

H. W. Fowler, *Modern English Usage*

The Chicago Manual of Style

COURSE OUTLINE

The course will examine two quite different “scientific revolutions.” The Copernican revolution resulted, by the time of Newton, in a complete reformulation of the principles of both physics and astronomy. The second revolution began in the early years of the twentieth with the work of such figures as Max Planck and Albert Einstein, and has dramatically reshaped our notions of space, time, and matter. In this course we will investigate these two scientific revolutions in their historical context; in the process will try to learn how science operates (the “scientific method”), and the nature of scientific development and change.

In the first part of the course we will cover the following topics:

1. outline of ancient (Ptolemaic) astronomy
2. Copernicus
 - origins of heliocentric system
 - senses in which Copernicus was both conservative and innovative
 - reception of the new system
3. Kepler and the new astronomy
4. Galileo
 - telescopic discoveries
 - difficulties with the Church (we will work primarily with the original documents)
 - relation of astronomical discoveries to Galileo's new physics
5. Newton
 - Newton's laws
 - universal gravitation
 - absolute space and time
 - relation to Newton's interests in alchemy and theology

In the second part of the course, we will discuss the revolution in physics that is taking place in this century, concentrating on the following topics:

1. background in nineteenth century physics, especially electricity and magnetism
2. Einstein—biography
3. central ideas of relativity and (possibly) quantum physics;
4. initial reception of these ideas

COURSE REQUIREMENTS

1. **attendance and participation** in class discussion
2. **reading summaries:** On the first class day of each cycle, please submit one page organized into two paragraphs, as follows:
 - In the first paragraph, discuss some point in your reading from the previous cycle that you found particularly interesting.

- In the second paragraph, propose a topic for discussion: something from your reading or from previous classes that you don't fully understand, or think would be interesting to talk about.

These summaries should be double-spaced, with one-inch margins, and font size no smaller than 11 points.

3. **occasional papers and gobbets.** A gobbet is a short essay on a very specific topic. Typically I will give you a quotation or an argumentative statement and ask you to do whatever reading seems appropriate and write a short analytical essay. (By short I mean 500–800 words—I will not read more than three printed, double-spaced pages with one-inch margins, and font size no smaller than 11 point. I ask that these essays be well-organized and well-written, and I reserve the right to ask you to rewrite them.

Please print all papers using only one side of the page.

4. **midsemester and final essay examinations** (open book)
5. occasional **in-class reports**
6. **Laboratory**—we will do four or five experiments that relate to the course, among them Galileo's famous inclined plane experiment.

I recommend that you do some outside reading. I may place a few books on reserve, but you should not feel limited to them—both libraries have good collections in the history of science (Q, QA, QB, QC in the stacks), and I will be glad to make recommendations if you are interested in a particular topic. In addition, the course web site contains links to a good bit of interesting information.

OFFICE HOURS **Spring 2010**

1. after class
2. whenever I am in, and by appointment. My schedule for this semester is still a bit unsettled, but initially I expect to be in most afternoons.

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I will often not be in on Friday afternoons, and I sometimes work at home on odd days. Otherwise, except for occasional faculty meetings, seminars, dentist appointments, etc., I am usually around. If I am not in my office, I will often be found in one of the shops or laboratories nearby; please feel free to look for me there. Questions and other messages can be sent via e-mail. (I check e-mail several times a day, and try to respond quickly. I also occasionally check voice mail, but e-mail is almost always quicker and more reliable.)

If you are coming from any distance, please feel free to call first and see if I am in. If you have any trouble in finding me, please say something before or after class, and we will schedule a time.