Newton (Phil 8019/5099)
Spring 2013

This course will focus on the transformation in philosophy of science wrought by Isaac Newton’s *Principia*. We will examine the philosophy of science of Galileo Descartes, Boyle, Hooke, and Hobbes, and contrast their ideas about scientific investigation and progress with those of Newton. In particular, we’ll discuss these thinkers’s response to the threat of underdetermination regarding fundamental ontology, the nature of scientific idealization and its place in explanation and experimentation, and the very possibility of a mathematical science that can capture the structure of the world. We’ll also investigate the foundations of Newtonian science: his accounts of space, time, matter, and force, and God’s relation to the nature and existence of these four fundamental kinds.

**Grading:**

**Graduate Students:**

Grades will be based on two presentations (schedule worked out in class) and writing assignments. You have two options:

- **Option A:** Weekly writing.
  1000 words of writing each week, on that week’s writing. The writing must address (although not comprehensively, of course) each of the week’s readings. This should not be a laundry list of reactions, but a single idea that you are beginning to flesh out that involves all of the readings. You can miss up to two weeks (i.e., 11 completed assignments).

- **Option B:** Long paper and weekly reactions.
  A final paper for 6000 words, and 250-300 words of writing each week, on that week’s writing. The weekly writing can be very sketchy, a reaction to the week’s reading. It must, however, touch on all of the readings. A reaction paper merely expresses an idea that involves all of the reading, while the weekly writing of Option A takes that idea to a slightly more detailed level.

**Undergrad Capstone and 4+1 Students:**

See option B above. You must submit a draft of your final paper (at least 2000 words) by March 27.

**Everyone:**

The entire class will be involved is peer-reviewing each other’s weekly writing. This will be the procedure:

*The weekly writing will be due to me, by email, by 1:00PM on the day of class.* In addition to emailing me, you will also email the student responsible for
peer-reviewing your writing for the week (see chart from class). You will review their writing. The primary concern will be on issues discussed in the Zinsser text (see below). You should also comment on content, but this is a secondary concern. Edits must be done using the reviewing mechanism of Word or Acrobat. **The revisions of weekly writing should be send to me and the original author by Friday, 5PM.**

**Texts:**


All other texts will be available on blackboard, which you must consult regularly.

**Schedule:**

**Jan 9: Introduction: The Scientific Revolution, Broad Context.**

**Jan 16: The Standard Story**

**Topics:**

- What is Newton’s place in the history of physics and philosophy?
- What was Newton’s achievement in physics?
- What methods of physical investigation were prominent before Newton?
- What was the role of mathematics in natural philosophy before Newton?

**Readings:**

1. I.B. Cohen, *Birth of a New Physics* (excluding appendices, but *all the rest*).
4. Zinsser, chaps 1-9, 11, 14, 15, 22.

**Jan 23: Copernicus & Kepler**

**Topics:**

- The Realism / Instrumentalism debate in the 15th century.
- What were Copernicus’s and Kepler’s methods of theory construction? What is the role of experiment?
• How is the use of mathematics in natural philosophy related to questions of ontology?

Readings:
2. Owen Gingerich, “Kepler as a Copernican”.

Recommended Readings:

Jan 30: Galileo I

Topics:
• Galileo presents a variety of arguments for the Copernican hypothesis and for the foundational principles of a mathematical science of motion. What are they? What scientific methods to they embody?

Readings:
2. Selection from Discourse on Two New Sciences (1638)


Feb 6: Galileo II

Topics:
• What is the regressus? Is this scientific methodology revealing? Trivial?
• How does Galileo idealize?
• What is a ‘mixed-mathematical’ science? How does it incorporate idealization and abstraction?
• How is scientific ‘modeling’ related to the above scientific methods?
• What substantive assumptions do the above scientific techniques/methods make about the world?

Readings:

Feb 13: **Galileo III**

*Topics:*
- Let’s be real, we didn’t finish last time.

*Readings:*
1. Finish the readings.

*Recommended Readings:*
1. Seriously, finish the readings.

Feb 20: **Cartesian Science**

*Topics:*
- Why does Descartes’s ‘science’ appear less sophisticated than that of his predecessors? [Hint: time to think of historical categories. What is ‘natural philosophy’? What is a mathematical or ‘mixed-mathematical’ science? What reasons did one have to pursue one over the other?]
- How does Descartes establish the principle of inertia, his first law of nature? What is the role of “force” in this reasoning?
- Descartes makes the “Laws of Nature” a standard concept for use in physical theory. On what presuppositions does the use of this concept rely? How is it related to idealization and abstraction?

*Readings:*
1. Rene Decartes, selections from *Le Monde* and *Principia Philosophiae*.

Feb 27: **Descartes and the Mechanical Philosophy**

*Topics:*

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• What is the mechanical philosophy? How does its supposed methodology and substantive assumptions about the world compare to those of ‘mixed-mathematical’ sciences?

Readings:

Recommended Readings:

Mar 6: Newton: The Laws of Motion, Force and Matter

Topics:
• If motion is a state and not a species of change, why does inertial motion require a force?
• Fluxions for Babies
• How does Newton solve the direct problem? What’s the direct problem?
• How are the laws of motion justified? (This question will remain w/ us for the rest of the course).

Readings:

Recommended Readings:
Mar 13: **Newtonian Metaphysics of Space and Time.**

*Topics:*
- How does Newton establish the existence of an insensible, immobile, absolute space? Did he, as Leibniz (and Mach) asserted, overreach?
- Overview of absolute vs. Relational spacetime debate.
- What evidence did Newton marshal for the existence of absolute space? What evidence did he marshall for the nature of absolute space? Are Newton's theological concerns independent of his physical ones?

*Readings:*
1. Principia, scholium on space and time. In Newton *Philosophical Writing*, pp. 64--70.

Mar 27: **Newtonian Metaphysics of Space and Time.**

*Readings:*

Apr 3: **Newtonian Method.**

*Topics:*
- How is Newtonian methodology different from the one implicit in mechanical philosophies?
- How does Newtonian methodology deal w/ the problem of underdetermination?
- Was Newton’s methodology novel, or a simple refinement of previous methods?

*Readings:*


Recommended Readings:

Apr 10: Rules, Hypotheses, and Phenomena
Topics:
• What purpose do the Rules serve in the Principia? Why are they introduced in the Second Edition?
• Do the rules embody the implicit method of the Principia previous discussed? What is the relation between the Rules and the implicit methodology?

Readings:

Recommended Readings:

Apr 17: Catch-Up, or Presentations.
Topics:
Readings:
Recommended Readings: