

Philosophy 311
Philosophy of Science
Fall 2008

Morton Hall 337
MW 3:55-5:15

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Course Description

This course is a survey of philosophical issues that arise within modern science. The course has two components. The first is an introduction to the major issues in the philosophy of science, including: scientific explanation, hypothesis testing and confirmation, the relation between theory and observation, theoretical underdetermination, and the rationality of paradigm changes. The second component is an introduction to issues in the foundations of quantum mechanics, including determinism, the double-slit and EPR experiments, Bell's theorem, the measurement problem, and interpretations of quantum mechanical formalism.

Course Aims

Upon successfully completing this course, students will be able to

- understand some of the major philosophical issues that arise within modern science and quantum mechanics;
- write better essays;
- better detect and address weaknesses in arguments;
- better present and support ideas in public.

Course Texts

- Peter Kosso, *Reading the Book of Nature: An Introduction to the Philosophy of Science* (Cambridge). Henceforth RBN
- Peter Kosso, *Appearance and Reality: An Introduction to the Philosophy of Physics* (Oxford). Henceforth A&R
- Optional: Milton A. Rothman, *Discovering the Natural Laws: The Experimental Basis of Physics* (Dover). Henceforth DNL
- Supplementary articles, to be provided by the instructor

Lecture, Reading, and Assessment Schedule (*Tentative*)

- Aug 18: Theories, Good and Bad. Read RBN Chapter 1
Aug 20: Theoretical Virtues. Read RBN Chapter 2
- Aug 25: The Standard Model of Explanation. Read RBN 51-60 and Carl Hempel and Paul Oppenheim, "Studies in the Logic of Explanation," Sections 1-3
Aug 27: Explanation and Truth-Conduciveness. Read RBN 60-68 and Nancy Cartwright, "The Truth Doesn't Explain Much," Chapter 2 in *How the Laws of Physics Lie*
- Sept 1: No Class
Sept 3: The HD Method of Confirmation. Read RBN 69-78 and Neil Tennant, "The Logical Structure of Scientific Explanation and Prediction: Projectiles in a Uniform Gravitational Field"
Sept 5: "Philosophical Issues about Idealizations in the Sciences," for RELACS
- Sept 8: The Quine-Duhem Problem. Read RBN 78-86 and Pierre Duhem, "Physical Theory and Experiment," from *The Aim and Structure of Physical Theory*
Sept 10: The Raven's Paradox. Read Peter Lipton, "The Ravens Revisited," 75-80
Receive Take-Home Midterm Examination 1
- Sept 15: Antirealism. Read RBN Chapter 5 and Bas van Fraassen, "To Save the Phenomena"
Sept 17: Realism. Read RBN Chapter 5 and James Robert Brown, "Explaining the Success of Science," from *Smoke and Mirrors*
Take-Home Midterm Examination 1 Due
- Sept 22: Observation-Theory Connections. Read RBN Chapter 6
Sept 24: Theory Choice. Read RBN 123-129
- Sept 29: Paradigms. Read RBN 130-134 and Kuhn, "The Route to Normal Science," Chapter 2 in *The Structure of Scientific Revolutions*
Oct 1: Coherence and Truth. Read RBN Chapter 8
- Oct 6: Bayesianism. Read Peter Godfrey-Smith, "Bayesianism and Modern Theories of Evidence," Chapter 14 in *Theory and Reality*
Oct 8: Objectivity. Read RBN Chapter 9
Receive Take-Home Midterm Examination 2
- Oct 13: Physics and Philosophy. Read A&R Chapter 1 and 25-30
Oct 15: Probability and Determinism. Read A&R 110-116
Take-Home Midterm Examination 2 Due
Term Paper Abstract Due
- Oct 17: Michael Weisberg, "Deploying Highly Idealized Models," Philosophy Forum
- Oct 20: The Two-Slit Experiment. Read A&R 116-121

- Oct 22: The Photo-Electric Effect. Read A&R 121-126
- Oct 27: Complementarity and Uncertainty. Read A&R 126-133
Term Paper Outline Due
- Oct 29: Spin and EPR. Read A&R 133-139
- Oct 31: Derek Turner, "What Is Evolutionary Contingency?," Philosophy Forum
- Nov 3: Bell's Theorem. Read A&R 139-150 and Guy Vandegrift, "Bell's Theorem and Psychic Phenomena"
- Nov 5: Philosophical Issues in Quantum Mechanics. Read A&R 150-151
- Nov 7: "Against Pluralistic and Inexact Ontologies," Phil. Science Assoc. Conf., U Pitt
- Nov 10: The Significance of Bell's Theorem. Read A&R 152-157
Term Paper Draft Due
- Nov 12: The Quantum/Classical Distinction and Copenhagen. Read A&R 157-163
- Nov 17: The Measurement Problem. Read A&R 163-167
- Nov 19: Other Interpretations of Quantum Mechanics. Read A&R 168-176
- Nov 24: Realism and Antirealism. Read A&R Chapter 8
Term Paper Due
Receive Take-Home Final Examination
- Dec 3: **Take-Home Final Examination due no later than 5:00pm**

Student Expectations

Abide by the UAH Code of Student Conduct.

In Class

Attend class regularly. It is unlikely that one can succeed in this course without doing this.

Arrive at class in a timely fashion: lateness is disruptive.

Ask questions and share thoughts, especially if something is not understood.

Participate courteously in class discussions.

Treat other people's questions as opportunities for learning rather than distractions from lecture.

Outside of Class

Keep up with the material.

Carefully read the selections assigned for each class.

Seek help from the instructor (or other students) as often as needed.

Familiarize oneself with science, via science textbooks, history books, and so on.

Consult additional readings on an as-needed basis.

Assessment

There are **two midterm examinations**, each worth 20% of the final grade.

There is **one final examination**, worth 20% of the final grade.

There is **one term paper** due: the **abstract** is worth 5% of the final grade; the **outline** is worth 10% of the final grade; and the **paper** itself is worth 15% of the final grade.

Thoughtful participation is worth 10% of the final grade.

Assessments and final grades are assigned according to the following measure:

> 94% = A	80-82% = B-	67-69% = D+
90-93% = A-	77-79% = C+	60-66% = D
87-89% = B+	73-76% = C	< 60% = F
83-86% = B	70-72% = C-	

Only dire circumstances merit an incomplete, and anyone who has not taken each of the first two examinations will receive an incomplete.

Cheating is unacceptable. You shouldn't cheat. Don't cheat. Seriously.

Late submission of assessments, and submission of assessments by email, is permissible if and only if the student obtains prior consent from the instructor.

Retain a copy of all graded work, in order to resolve grade disputes.

- The instructor is not responsible for "lost" material.

The instructor reserves the right to augment the final grades of students who demonstrate superior class performance, and to lower the grades of students who demonstrate a dereliction of their work or contribute to a classroom environment that is not conducive to learning.

Miscellany

If at any time you would like to discuss the issues covered in this course, or philosophy in general, feel free to visit during office hours or to arrange a meeting.

If at any time you are having problems with the subject matter or the manner of its presentation, do not hesitate to bring this to my attention (in person, via email or anonymous note, etc). It is your responsibility to bring any course-related concerns to my attention.

I encourage a free and tolerant atmosphere in class. I encourage and expect questions and challenges at appropriate times during class. I welcome visits to my office. *I am here to help you learn.*

I expressly reserve the right to alter any or all portions of this syllabus, at my sole discretion, at any time, and in any manner.