

**Philosophy 110 Introduction to Philosophy of Science**  
Spring Semester 2013      MWF 12:20 – 1:10      214 Hammond Bldg.

**Instructor:** Emily Grosholz, Undergraduate Officer and Liberal Arts Research Professor of Philosophy, African American Studies, and English, and Member, Center for Fundamental Theory / Institute for Gravitation and the Cosmos, The Pennsylvania State University; Member, SPHERE, University of Paris Denis Diderot – Paris 7; Associate, Philosophy of Science Center, U. of Pittsburgh.

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*If at any point in the semester you feel you are getting behind or are losing your connection with the readings and class discussion, please come see me during office hours or by appointment.*

**Course Description:** This course will examine leading ideas about time and space, and cosmology (in both the seventeenth and the twentieth century), in order to gain a better sense of how both philosophers and scientists think about the world, and when and why science must be brought into relation with philosophy. What are the leading concepts and problems that cosmologists on the one hand, and philosophers on the other, confront? How do scientists decide on rules and principles? How do they represent the natural world, and time and space? How do they offer explanations? How do they bring principles and empirical evidence into relation? How do they bring the microscopic world of molecules or wave functions into relation with the macroscopic world of the laboratory, city, field and forest, and then with the great framework of the solar system, galaxies and cosmos? How do philosophers coordinate metaphysics, logic, the history of science, and the study of epistemology? Why is there something rather than nothing? We will examine critically the standard mid-century view of scientific rationality put forward by logical positivist philosophers, with its emphasis on deduction, induction and justification, and principles and theories, and then turn our attention to ampliative reasoning and processes of discovery, the nature of representation, and the development of concepts and families of problems, in relation to time and space, and the nature of the cosmos. On April 16-17, students will attend a workshop about time and cosmology held at the Center for Fundamental Theory.

**Course Objectives:**

- To learn about philosophical and scientific debates about time and space, and the cosmos
- To understand the relation between science and philosophy (and mathematics)
- To think about representation, and the role of instruments and measurement in scientific knowledge
- To meet some contemporary cosmologists and philosophers at a workshop on time and cosmology, to be held in mid-April
- To think about the metaphysical dimensions of theories of the cosmos
- To end with a more comprehensive sense of scientific rationality, and indeed reason in general

**Requirements:** Attendance and class participation are mandatory and will account for 10% of the grade: in a class this size, every student counts. If you cannot attend class, you must send me an email explaining your absence ahead of time. Every two weeks or so, students will write a short (2-3 pp.) take-home essay that answers a question raised in class discussion, using the scientific and philosophical terms developed during the previous weeks; these papers will account for 50% of the grade. The two midterm exams will be one hour each, and will account for 20% of the grade; they will be in short answer format, with short take-home questions. At the end of the semester, students will write a term paper of 6-8 pages, using 2-3 secondary sources (articles) and reflective thought. They'll choose a topic in March, and present a 3 page draft of the final paper to the professor in early April; the final version will be due on Monday (April 29) of exam week and will account for 20% of the grade.

**Policies:**

*Non-Discrimination Statement:* The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Discrimination or harassment against faculty, staff or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 328 Boucke Building, University Park, PA. 16802; Tel. (814) 863 0471.

*Academic Integrity:* Definition and expectations: Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. It is a basic guiding principle for all academic activity at the Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts. Academic integrity includes a commitment not to engage in or tolerate acts of falsification, deception, or misrepresentation. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others. We aim to protect the rights and maintain the trust of high standards of integrity and reinforce them by taking reasonable steps to anticipate and deter acts of dishonesty in all assignments. At the beginning of each course, the instructor must provide students with a statement clarifying the application of University and College academic integrity policies to that course.

*Disability Statement:* Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at <http://equity.psu.edu/ods/>. In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at <http://equity.psu.edu/ods/guidelines/documentation-guidelines>). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.”

#### **Required Texts:**

Geoffrey Gorham, *Philosophy of Science* (Oneworld Publications, 2009)  
Peter Coles, *Cosmology: A Very Short Introduction* (Oxford UP, 2001)  
Bas van Fraassen, *Scientific Representation* (Oxford UP, 2010)  
Lawrence Krauss, *A Universe from Nothing* (Atria, 2012)  
Robin Le Poidevin, *The Images of Time* (Oxford UP, 2009)  
Andrew Liddle and Jon Loveday, *Oxford Companion to Cosmology* (Oxford UP, 2009)

#### **Schedule of Classes:**

January 7	Introductory Lecture
9	Gorham, <i>Philosophy of Science</i> , Introduction and Ch. 1. The origins of science.
11	Gorham, Ch. 2. Defining science.
14	Gorham, Ch. 3. The scientific method.
16	Gorham, Ch. 4. The aims of science.
18	Lecture on Copernicus, Kepler, Galileo and Newton. (Handouts) <b>First quiz.</b>
21	Martin Luther King Day.
23	Coles, <i>Cosmology</i> . Ch. 1. A brief history. Ch. 2. Einstein and all that. <b>First paper due.</b>
25	Coles, Ch. 3. First principles.
28	Ch. 4. The expanding Universe.
30	Ch. 5. The Big Bang.
Feb. 1	Coles, Ch. 6. What's the matter with the universe? Ch. 7. Cosmic structures. <b>Second quiz.</b>
4	Coles, Ch. 8. A theory of everything? <b>Second paper due.</b>
6	Van Fraassen, <i>Scientific Representation</i> . Part I, Ch. 1. Representation of, Representation as
8	Van Fraassen, Part I, Ch. 2. Imagining, Picturing and Scaling
11	Van Fraassen, Part I, Ch. 3. Pictorial Perspective and the Indexical
13	Van Fraassen, Part II, Ch. 4. Window on the Invisible World. <b>Third quiz.</b>
15	Van Fraassen, Part II, Ch. 5. The Problem of Coordination.
18	Van Fraassen, Part II, Ch. 6. Measurement as Representation, 1. The Physical Correlate

- 20 Van Fraassen, Part II, Ch. 7. Measurement as Representation, 2. Information.
- 22 Einstein, Bergson, Whitehead on Time. (Handout) **Third paper due.**
- 24 Krauss, *A Universe from Nothing*. Ch. 1. A Cosmic Mystery Story: Beginnings
- 26 Krauss, Ch. 2. A Cosmic Mystery Story: Weighing the Universe
- 28 Krauss, Ch. 3. Light from the Beginning of Time

### SPRING BREAK

- Mar. 11 Krauss, Ch. 4. Much Ado about Nothing. **Fourth quiz.**
- 13 Krauss, Ch. 5. The Runaway Universe
- 15 Krauss, Ch. 6. The Free Lunch at the End of the Universe
- 18 Krauss, Ch. 7. Our Miserable Future. **Fourth paper due.**
- 20 No class. (Make up is Apr. 16-17 Workshop: sign up for at least two sessions.)
- 22 No class. (Make up is Apr. 16-17 Workshop: sign up for at least two sessions.)
- 25 Krauss, Ch. 8. A Grand Accident? **Paper topic due.**
- 27 Krauss, Ch. 9. Nothing is Something. Ch. 10. Nothing is Unstable
- 29 Krauss, Ch. 11. Brave New Worlds. Epilogue. **Fifth quiz.**
- Apr. 1 Van Fraassen, *Scientific Representation*. Part IV, Ch. 12. Appearance vs. Reality
- 3 Van Fraassen. Part IV, Ch. 13. Rejecting the Appearance from Reality Criterion
- 5 Einstein, Bergson and Whitehead on time, again. (Handout) **Fifth paper due.**
- 8 Le Poidevin, *The Images of Time*. Ch. 1 and Ch. 2. Causal Theories of Representation.
- 10 Le Poidevin. Ch. 3. Egocentric and Objective Representation.
- 12 Le Poidevin. Ch. 4. Retracing the Past: Memory and Passage. **Three page final paper draft due.**
- 15 Le Poidevin. Ch. 5. Projecting the Present
- 17 April 16-17, Workshop on Time and Cosmology. (Details to be announced).
- 19 Discussion of the Workshop. **Sixth quiz.**
- Apr. 22 Le Poidevin. Ch. 6. The Wider View: Precedence and Duration. **Sixth paper due.**
- 24 Le Poidevin. Ch. 9. The Unity of Time and Narrative. Conclusion.
- 26 Summary Discussion on Time and Cosmology.

**Final ExamWeek: Final Papers due on Monday April 29.**