

PH 407 H

**Life, the Universe, and Everything:
Physics and Metaphysics**

Spring, 2007

Course Outline

<u>Topic</u>	<u>Barrow</u>	<u>Barbour</u>
Introduction	Ch. 1	
Greek and 17 th century science	Ch. 2	Ch. 1, pp. 3-23
E&M, the notion of fields	Ch. 3, pp. 94-108	
Relativity	Ch. 3, pp. 108-127	Ch. 7 pp. 177-181
Thermodynamics and chance	Ch. 3, pp. 181-194	Ch. 7, pp. 181-194
Quantum mechanics	Ch. 3, pp. 143-173	Ch. 7, pp. 165-177
Particle physics	Ch. 4, pp. 174-217	
Cosmology	Ch. 4, pp. 218-269	Ch. 8
Laws of nature	Ch. 5-7	Ch. 5
Science and theology		Ch. 11-12

Texts: John D. Barrow, *The Universe That Discovered Itself*, Oxford University Press, 2000.
Ian G. Barbour, *Religion and Science, Historical and Contemporary Issues*,
HarperSanFrancisco, 1997.

Physics 407H

Life, the Universe and Everything: Physics and Metaphysics

Course Description

If our methods ultimately fail, then any boundary
between fundamental science and metaphysical
theology will become increasingly difficult to draw.

John D. Barrow

What is this course about?

This course explores issues that lie somewhere between science and philosophy. Many of these once seemed like the province of idle philosophical speculation such as, ‘Why is the universe the way it is?’ or ‘What is reality?’ We are a long way from answering either, but recent developments in quantum mechanics, particle physics, and cosmology provide some scientific basis for thinking about such questions. We do know in part why the observable universe has its present form, and quantum mechanics has some surprising things to say about what we regard as ‘reality’, things not too different from ideas proposed by Immanuel Kant 200 years ago.

Here are some more focused topics we will be considering. What is science and how does it work? *Does* it work, and how do you know? Are there laws of Nature? What are they and why? How does science deal with things that are very much larger or very much smaller than distances we can measure directly? How does science deal with things that happen on time scales very much longer or very much shorter than the times encountered in ordinary human experience? How do we know about the distant past? Can there be a ‘philosophy of science,’ or is that a contradiction in terms? Why is mathematics so unreasonably effective in explaining the universe? What is the relationship between science and theology? Can science say anything useful about theology? Can theology say anything useful about science?

We should consider all of science in discussing these questions. I am a physicist, however, and my sphere of competence doesn’t extend very far beyond the physical sciences. For this reason I will focus the course on philosophy and *physics* understood in the broadest sense to include astronomy and cosmology. Nuclear physics does make an important contribution to geology and paleontology because it provides the ‘clock’ that is used to measure geological time. This has in turn helped to shape our view of our place in the universe. I will touch on this briefly when we discuss time.

What do you have to know to take this course?

There are no prerequisites. I will give introductory lectures covering material from physics, history of science, and philosophy. The purpose of these lectures is not to enable you to work homework problems but rather to have the sort of general knowledge appropriate to a well-

educated layman. You can help by participating in class discussion and by presenting the results of your research on subjects of general interest to the class. The grade is based on your classroom participation and a paper due at the end of the quarter. I will ask you to choose topics that are consistent with your interests and range of knowledge.

What about the textbook?

I have chosen two outstanding books: John D. Barrow, *The Universe That Discovered Itself*, Oxford University Press, and Ian G. Barbour, *Religion and Science, Historical and Contemporary Issues*, HarperSanFrancisco. Both men are giants in their fields, and these books are the sort you keep on your shelves and read over the course of a lifetime. Unfortunately, neither of them is available through the Bookstore. I will put them on reserve at the library, but I recommend that you purchase your own copies online.

Projects and Grades

I would like you to write an essay for the course. It should be a serious in-depth study of one of the issues raised in the course. To help you in finding a more focused topic, I have compiled a list of sample projects. Note that they start with a specific question or questions and include some basic bibliography. If you would like to work on some other topic you are welcome to write up a proposal in this form and let me review it for you. These essays as well as your knowledge of the subject can be an important aid to class discussion. For this reason I would like you to start early and finish (or at least have the material well in hand) in time for time for the appropriate class period.

An essay, according to my dictionary, is ‘a short literary composition on a particular theme, generally analytic, speculative, or interpretive.’ That is well put. ‘Short’ in this context means five to ten pages (double spaced). The ‘analytic, speculative, or interpretive’ part will require some library research. The Valley Library has an excellent building and they make a mean cup of Java, unfortunately they don’t seem to have any books. You can often borrow a useful book for three weeks using the Orbis facility through Oasis. (Alas, most of the books come from U of O!) This requires some advanced planning. You can also borrow books from my personal library.

I would also like you to give a presentation in class about the subject of your paper or some related topic that is of interest to you. These talks will range typically from fifteen to thirty minutes including questions and discussion. Students often give polished presentations using PowerPoint slides. This is welcome (I’m still at the overhead transparency stage myself) but not necessary.

How can you get a hold of me?

By telephone, 737-1698, by e-mail, stetza@ucs.orst.edu, but preferably by stopping by my office, Weniger, 371. I am in most of the week and I would be delighted to talk with you.

A. Stetz