

# ASTRONOMY 9: HISTORY OF COSMOLOGY

## Course Information

J. E. Baker

UC Berkeley, Spring 2000

<http://astro.berkeley.edu/~jbaker/courses/ay9/>

*I don't pretend to understand the universe—it's a great deal bigger than I am.*

—Thomas Carlyle, 1868

*The history of cosmic theories, in particular, may without exaggeration be called a history of collective obsessions and controlled schizophrenias.*

—Arthur Koestler, 1959

### General Information

**Lectures:** MWF 3:00–4:00 pm, in 343 LeConte

**Instructor:** Jonathan E. Baker

**E-mail:** [jbaker@astro.berkeley.edu](mailto:jbaker@astro.berkeley.edu)

**Course web page:** <http://astro.berkeley.edu/~jbaker/courses/ay9/>

**Office:** 653 Campbell Hall      **Office hours:** TBA

**Phone:** 642-6110

**Mailbox:** Sixth floor, Campbell Hall (across from the elevators)

### Course Summary

This course will explore the history of humanity's answers to such fundamental questions as: Did the universe have an origin? How did it begin and evolve? What is our place in it? What is its ultimate fate?

We will trace the development of cosmological thought from ancient mythology and philosophy to the frontiers of modern science and science fiction. Defining cosmology in the broadest sense, we will begin with a comparative survey of cosmological myths from different cultures, examining the common themes of the quest to define our place in the cosmos.

We will discover the brilliant advances of Newton and Einstein, who laid the foundations on which the science of modern physical cosmology stands. We will focus the second half of the course on this twentieth-century science, with an emphasis on the rapid progress of the last few decades, current research, and unsolved problems. Although the focus will be on the development of science, we will not shy away from issues of philosophy and religion where they arise.

This course should give you a feel not just for the body of our scientific knowledge about the universe, but for the very human, personal, and highly non-linear development of scientific thought, with all of its blind alleys and “controlled schizophrenias” in place. The essential theme will be the mystical process of humanity standing in awe before the universe, asking the ultimate questions of origin and meaning.

### Prerequisites

The course will be at an introductory level suitable for enthusiastic non-science majors, but students should be comfortable with high-school mathematics. Some knowledge of physics may be helpful but is not required. No astronomy background is necessary. If you have already taken Astronomy 10, you will meet some of the same material here, but in more depth and with a more historical perspective.

### Textbooks

#### Required Texts

The following are required for the course and are available (or, in the case of Hawley & Holcomb, should be available in the next day or two) at the bookstore:

- Hawley, J. F. and Holcomb, K. A. *Foundations of Modern Cosmology*. Oxford: Oxford University Press, 1997.
- Sproul, B. *Primal Myths*. San Francisco: Harper, 1992.
- Benford, G. *Cosm*. New York: Avon, 1999.

The **course reader** will be available by the end of the month; stay tuned for details. Be sure to pick up a copy of Sproul now, as we will start using it immediately.

### Recommend Texts

I highly recommend the following text; unfortunately the publication of the second edition has now been delayed until at least March, so I will let you know when it arrives. The (somewhat dated, but still useful) first edition is out of print but will be placed on reserve at Moffitt.

- Harrison, E. R. *Cosmology: The Science of the Universe*, 2nd edn. Cambridge: Cambridge University Press, 2000.

### Books on Reserve

The following books will be placed on reserve at the Moffitt library desk for your use.

- Gleiser, Marcelo. *The Dancing Universe: From Creation Myths to the Big Bang*. New York: Penguin, 1997.  
A very readable popular account of the development of cosmology and physics.
- Harrison, E. R. *Cosmology: The Science of the Universe*, 1st edn. Cambridge: Cambridge University Press, 1981.
- Koestler, Arthur. *The Sleepwalkers: A History of Man's Changing Vision of the Universe*. New York: Penguin, 1968.  
A fascinating history of cosmology, focusing on the developments from Copernicus through Newton, filled with interesting opinions on the personalities involved and the very non-linear development of science.
- Kragh, Helge. *Cosmology and Controversy: The Historical Development of Two Theories of the Universe*. Princeton: Princeton University Press, 1996.  
A history of the Big Bang vs. Steady State theories, tracing the historical development of cosmology from about 1920 to 1970.
- Leslie, John, ed. *Physical Cosmology and Philosophy*. New York: Macmillan, 1990.  
Good collection of essays by cosmologists and others on the philosophical implications of scientific cosmology. There is an updated edition titled *Modern Cosmology and Philosophy*, which the library doesn't have, but you can order it from Amazon.

### Grades, Assignments, and Exams

Your grade for the course will be broken down as follows:

- 30% Final exam (Tuesday 5/16, 5:00 pm)
- 25% Term paper (due Monday 5/8, 3:00 pm)
- 25% Journal assignments (weekly)
- 15% Midterm exam (Friday 3/10, in class)
- 5% Class participation

## Term Paper

You will write a term paper (2000–3000 words) on any topic of your choice related to the course. As the course will be a broad survey of a vast subject area, this will give you the chance to explore an idea that interests you in more detail. A brief (1 paragraph) description of your topic and a preliminary bibliography must be submitted for instructor approval by 3:00 pm Monday, April 10. I will soon distribute a list of references which you may use as a starting point for your explorations.

## Exams

The final exam group for this course is 11. If you have a **direct** conflict (i.e., another exam at the same time) with this exam, see me ASAP. Your exam cannot be rescheduled unless you have a direct conflict. The final will be comprehensive, covering all of the material from lecture and homework assignments. The in-class midterm will cover the history of cosmology before the twentieth century.

## Journal Assignments

Most of the time I will assign directed topics for you to write about, but occasionally the journal will give you a chance to *react* to the subject material: tell me about things that excite or bore you or challenge your beliefs, things that seem completely crazy or incomprehensible, or a new theory of the universe which is dying to get out, whatever you're thinking.

As the course progresses into the more scientific realm, we will begin to do some numerical homework problems which you should record in your journal. Note that you must show all work:

NO WORK = NO CREDIT!

Also be sure to write down the units for numerical results. Remember the guys at NASA who recently crashed a probe into Mars because they thought a force was measured in pounds instead of Newtons (the metric unit)? Well, they would not have gotten any credit for their work in this class! You may collaborate with your classmates, but the work you turn in must be your own and may not be copied from anyone else. You will not get credit for late assignments, because I will make solution sets available immediately after the due date.

I would prefer you to keep your journal in a loose-leaf binder, so that I don't have to carry the whole thing around every week. The journal is meant to be like a homework grade and should not be too onerous—a couple of handwritten pages per week will be sufficient for an excellent grade. The grade will mainly reflect the **effort** you put into it, and not your brilliance or writing style.

## Participation

This class will be what **you** make of it, and I expect you to come to lecture prepared for discussion. We will cover many rather tricky concepts which are far removed from the world of common sense, and so it is essential that you come to class armed with your questions. This grade will reflect the degree to which you actively engage the subject material. Attendance at the optional observing sessions, etc. will also help raise your grade.

## Lectures and Course Material

I will generally hand out rough outlines of the lecture material; these are meant as guides for your studying and are **not** a replacement for attending lecture. It is very important that you attend, as the lectures will flesh out and explain the ideas in the notes (and of course attendance will affect your participation grade). Also, you are only responsible for the material actually covered in class, which may not correspond exactly to the material on the outlines.

Note that all handouts and homework assignments will be made available through the class web page, so you need not take hard copies in lecture if you are so inclined. The web page will also contain links to useful outside material as well as course updates.