Physics 12: Physics for Poets
(Everything You've Wanted to Know About Einstein's Work, But Were Afraid to Ask)

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Spring Quarter at Foothill College, Room 5015, 6 pm to 8:30 pm, Tues and Thur

This non-mathematical introduction to the ideas of modern physics is designed for those not majoring in the physical sciences. After a brief introduction to physics in general and atomic theory specifically, the course focuses on three areas of modern physics that have revolutionized our understanding of nature: thermodynamics and the concept of entropy, the special and general theories of relativity, and quantum mechanics. Throughout we will look at Einstein's contributions to modern physics and what factors in his life and thought allowed him to make such spectacular leaps in understanding. We also examine (briefly) the impact these physics ideas have had on other fields, such as poetry, literature, and music. No background in science or math will be assumed.

Topics Covered:

A. Introduction to Science and the Cosmos
1. The nature of science and the scientific method
2. A grand tour of the physical universe

B. What's Everything Made of
1. The history of Atomic Theory (the work of Thomson, Rutherford, and others)
2. Einstein's work on Brownian Motion

C. Classical Physics
1. The beginnings of physics -- Galileo and the experimental method
2. Newton's Laws: The constitution of the Universe
3. Work, energy, power
4. Classical gravity: Not everything that goes up must come down

D. Thermodynamics and Entropy
1. Heat and temperature
2. The laws of thermodynamics
3. Entropy and the (dreaded) second law of thermodynamics
4. The arrow of time and the ultimate fate of the universe
5. Reflections of thermodynamics in literature

E. The Life and Time of Albert Einstein
1. Brief biographical overview
2. Einstein's views of science and the world

F. The Special Theory of Relativity

1. Time Dilation, Lorentz-Fitzgerald Contraction, the guillotine problem
2. The role of mass and energy; $E = mc^2$
3. Realistic space travel as an illustration of special relativity

G. The General Theory of Relativity
1. The "warping" of space-time
2. Black holes
3. Time machines in science: Using general relativity

H. Einstein, Relativity and the Rest of Human Culture
1. Images of Einstein in popular culture & the public view of scientists
2. Einstein and the bomb
3. Relativity in fiction

I. Quantum Mechanics
1. The nature of light -- a historical development: waves versus particles
2. The nature of matter -- waves versus particles
3. The uncertainty principle and its implications
4. Probability interpretations of nature: Does God play dice with the universe?
5. The many-worlds interpretation (briefly)
6. Quantum mechanics in literature

J. Recent Developments
1. Stephen Hawking's work combining relativity & quantum mechanics
2. Quantum black holes

Required Readings:

1. Textbook (well, main book): Parker, Barry: *Einstein's Brainchild* (2000, Prometheus)

2. *The Fiction:* I ask that you read one of the following two novels:
Thomas Pynchon: *The Crying of Lot 49* (goes with thermodynamics)
Robert Coover: *The Universal Baseball Association* (goes with quantum mechanics)

3. In addition, I will distribute further reading assignments in the form of short stories, poems, etc. Note that a few questions about the fiction will appear on the quizzes and exams in the later part of the course, so don't take the class if you really hate reading fiction!

Library Reserve: Many materials to help students with the course or with pursuing their own interests in physics are on reserve in the instructor's name in the Foothill Library. Don't hesitate to ask me for additional reading suggestions on any of the course topics (including good science fiction stories to read.) I will also distribute a separate resource (reading) list for the course, with books, articles, web sites, and science fiction stories about each topic we cover.

Note: This is a course about physics & culture, not a complete introduction to physics. If you pursue a science major, some universities will not count this as a course that prepares you for a science degree!