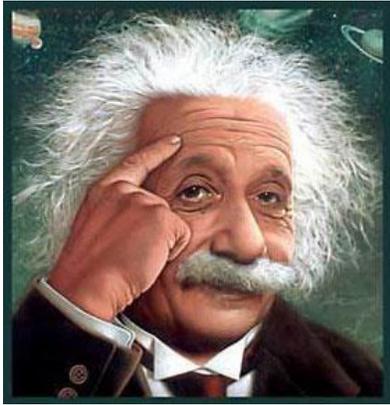


EINSTEIN FOR POETS: UNDERSTANDING THE THEORIES OF RELATIVITY WITHOUT MATH

Prof. Andrew Fraknoi



This non-technical, non-mathematical introduction to some of the most awe-inspiring ideas from the work of Albert Einstein is designed for people with little or no science background. You will come away from this course with a new appreciation of the physical world and its behavior under extreme conditions. You'll also see why Einstein's ideas continue to fascinate both scientists and science fiction fans. Our goal is to give a concise overview of Einstein's ideas, and the ways that scientists (especially astronomers) have confirmed some of the most bizarre predictions of his theories.

Outline

1. The Life and Time of Albert Einstein
 - a. Einstein: A biographical overview
 - b. How Einstein is perceived outside the world of science
2. Relativity before Einstein: Galileo and Newton and Frames of Reference
Why Relativity was needed
3. The Special Theory of Relativity
 - a. Two Postulates: How it Started
 - b. Time Dilation, Lorentz-Fitzgerald Contraction, the guillotine problem
4. The role of mass and energy: $E = mc^2$
 - a. What is energy and what forms can it take
 - b. Mass and energy in relativity and what $E = mc^2$ really means
 - c. Antimatter and the universe
 - d. Realistic space travel as an illustration of special relativity
5. The General Theory of Relativity: A New View of Gravity
 - a. Gravity before Einstein
 - b. The Principle of Equivalence
 - c. The Rubber Sheet and the Ant: Warped Space-time
6. Experimental confirmations of our new view of gravity
 - a. Eclipses and Planetary Probes
 - b. Gravity's influence on the very flow of time

7. Black Holes: Star Corpses, Space Warps, and Time Machines
 - a. The Death of Stars
 - b. Black Holes and Event Horizons
 - c. Black Holes in Space (The Real World)
 - d. Time and Black Holes

 8. Wormholes, Gravitational Lensing, Gravitational Waves and More on Time
 - a. Black Holes and Wormholes in Science and Fiction
 - b. Seeing Warped Space-time with Hubble Telescope
 - c. Gravitational Waves and their Discovery
 - d. Time Machines in Science and Fiction (for example, the film *Interstellar*)
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Reading Material: The course is meant to stand on its own, and does not require any reading. However, students may find the ideas so “mind-blowing” (or may want so much more information about some topics) that they want to look at some on-line and published sources. A separate reading list of science and fiction will be available. Many relevant astronomical topics are discussed in the free, on-line introductory astronomy textbook on which your instructor is the lead author. See: <http://openstax.org/details/astronomy>

About the Instructor: Andrew Fraknoi recently retired as the Chair of the Astronomy Department at Foothill College and is a Senior Educator at the Astronomical Society of the Pacific. He served as the Society’s Executive Director (1978-1992) and created several national astronomy education programs. He is lead author of *Astronomy*, a free on-line introductory college-level textbook, published by the non-profit OpenStax organization. His other published works include two teaching activity manuals, as well as two children’s books, and two science fiction stories. He appears regularly on local and national radio, explaining astronomical developments in everyday language. He has been teaching an “Einstein and Modern Physics” class for more than 30 years at both Foothill College and the University of California Extension (at UCLA and other campuses). Asteroid 4859 is named Asteroid Fraknoi by the International Astronomical Union in recognition of his contributions to the public understanding of science.

