

The Physics of Astronomy  
Winter and spring quarters, 2003-2004

DRAFT 5 March 2003

Faculty: E.J. Zita

Enrollment: 25

Prerequisites: Sophomore standing or above, transfer students welcome. One year of calculus-based physics.

Faculty Signature: No. Details at <http://academic.evergreen.edu/z/zita/home.htm>

Special Expenses: Expensive textbooks, up to \$500 total, to be used all year, must be purchased by the second day of class; good binoculars and journal subscriptions.

Internship Possibilities: No

How can we discover the genesis, structure, and evolution of our universe? What does physics tell us about the past, present, and future of our solar system, galaxy, and beyond? This program will study fundamental concepts in classical and modern physics, with astronomy, astrophysics, and cosmology as central areas of inquiry. Key themes will include scientific model making and conservation laws. We will study our current models of the universe, especially the role of electromagnetism and classical and quantum mechanics in understanding stars, galaxies and black holes. We will examine such questions as: How do we know that stars use fusion to produce energy? How do we interpret theory and experiments for objects such as stars and black holes? What are some of the ramifications of embracing one model instead of another? What is energy and how is it related to mass, space and time? Are we learning about pre-existing objective facts (truth) or do our experimental results depend on our theories?

We will examine the ideas of leading thinkers in physics, mathematics and philosophy to explore these questions. Although we will find many strange and provocative answers to our questions, our goal will be to learn to ask even more sophisticated questions about "nature" and "reality." Seminar is a fundamental and required part of this program.

This program is necessarily mathematical. Required mathematical methods (such as differential equations and vector calculus) will be developed as needed in the context of their use in the physical sciences. The central role of mathematics in describing nature is one of the core intellectual issues in this program. Quantitative problem solving will be emphasized. Students must subscribe to three journals—*Sky and Telescope*, *Science News* and *Physics Today*. These journals will be used in weekly discussions and student presentations about recent developments in astronomy and modern physics. We will use our eyes, binoculars and telescopes to examine the sun and the night sky—so we'll need to meet at night a few times each quarter.

Credit awarded in: astronomy, modern physics, quantum theory, electromagnetism, and history and philosophy of science. Upper-division credit is possible for more than half of the total credits depending on performance.

Total: 16 credits each quarter.

This program incorporates or complements core elements of both Physical Systems and Astronomy & Energies, which are usually offered in alternate years. We will interact with new Astronomy students in spring quarter.

Program is preparatory for: careers and future studies in science and mathematics, especially physics, astronomy, philosophy, mathematics, or engineering.

Planning Unit(s): Scientific Inquiry