

Physics 5K Introduction to Physics III – HONORS SECTION Spring 2012

Class meets: Friday 9:30 – 10:40 am in ISB 231

Instructor: Joel Primack– office hours: Thurs 2:00-3:00 pm or by appointment
Office: ISB 318, phone: 459-2580, email: joel@ucsc.edu

Website: <http://physics.ucsc.edu/~joel/Phys5K>

Brief Course Description: Weekly 70-minute 2 unit section covering advanced and modern aspects of electricity and magnetism, including aspects of relativity, quantum mechanics, and solid state physics. Concurrent enrollment in course 5C is required. Grades will be based on four or five homework assignments and class participation. The goal is to help students understand some of the most interesting aspects of physics, and have fun doing so.

Topics to be covered include the following:

Some key ideas of quantum mechanics, illustrated by the two-slit experiment.

How the laws of classical mechanics follow from extremizing the action, and how this generalizes to quantum mechanics: the path integral formulation of quantum theory.

How quantum mechanical particles can travel through “barriers” – regions that are forbidden according to classical physics. Connections with radioactivity, nuclear fusion, and the scanning tunneling microscope.

The piezoelectric effect and ferroelectricity.

The photoelectric effect and the band theory of solids. Why metals are shiny and gold is golden. How a light emitting diode (LED) works.

Superconductivity. Fermions and bosons. Flux quantization. Applications of superconductivity.

Relativity thought experiments and computer games. Cosmic rays and magnetic fields.

Relativity and electromagnetism: why electrical phenomena in one reference frame are a combination of electric and magnetic phenomena in another frame.

Electromagnetic waves in the universe, including radiation from matter falling into giant black holes in the centers of galaxies.