New Course Offering:
Physics 594 –

Special Problems in Accelerator Physics

Credit: 3 Credit Hours

Level: Appropriate for graduate students or senior undergraduates in science or engineering

Prerequisites: knowledge of classical mechanics and electromagnetism

Particle accelerators are widely used in science and industry, with many applications ranging from fundamental physics and cosmology, to understanding the structure of materials, to medical applications such as isotope production and cancer treatment. The world's largest pulsed neutron source, the Spallation Neutron Source (SNS), is now under construction at Oak Ridge National Laboratory. Career opportunities in accelerator science and technology are good, with positions at universities, national laboratories, and in industry. A number of graduate research positions with potential thesis topics are available at SNS.

This course will provide an introduction to the physics of particle accelerators at the graduate level. Its emphasis will be on the basic concepts involved in accelerating and manipulating charged particle beams. It will be suitable for nonspecialists in science and engineering as well as for those interested in specializing in accelerator related research. Whether considering a career in accelerators or not, the use of particle accelerators is so extensive that a basic knowledge of beam physics is a valuable asset.

The technical qualifications are classical mechanics, including special relativity and the Lagrangian and Hamiltonian formulations, and electromagnetism at the graduate level. The course will cover the following topics: methods of acceleration and phase stability; transverse linear motion; coupling, nonlinear effects, and resonances; collective effects due to space charge, wake fields and impedances; Landau Damping; emittance preservation; and synchrotron radiation. Throughout the presentation, the basic concepts will be applied to existing and planned accelerators, particularly the Spallation Neutron Source.

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Text: D.A. Edwards and M.J. Syphers, ***An Introduction to the Physics of High Energy Accelerators***, A Wiley-Interscience Publication, John Wiley and Sons, Inc. (New York: 1993).