1992 US Particle Accelerator School / June 15-26, 1992

APPLIED PHYSICS 493A

Physics of Particle Accelerators
3 Credit Hours
Donald A. Edwards and Michael J. Syphers, SSC Laboratory

Topics in the dynamics of high energy particle accelerators, with emphasis on the basic physics involved. Single particle dynamics of linacs and synchrotrons, including nonlinear motion. Intensity dependence, including space charge effects, coherent instabilities, and statistical phenomena. Examples taken from current accelerator research and development.

APPLIED PHYSICS 493B

Topics in Experimental Accelerator Physics
3 Credit Hours
Robert H. Siemann, Stanford University

This course presents phenomenology of particles and beams in storage rings and linear accelerators from an experimental point of view. Topics to be covered include: single particle non-linear motion; experimental beam optics - beam-based diagnostics; optics measurements and corrections; and Schottky signals, coherent motion and beam density distribution measurements.

APPLIED PHYSICS 493C

Applied Hamiltonian Dynamics
3 Credit Hours
Keith Symon, University of Wisconsin

This course covers the application of Hamiltonian dynamics to accelerator orbit problems. We begin with a review of Hamiltonian dynamics, including canonical transformations, matrix methods, use of time as a coordinate, and change of the independent variable. We study the methods of solution of the linear problem. Lie transforms are introduced, and applied to the Birkhoff-Moser perturbation theory. Other topics covered are the smooth approximation, adiabatic invariants, the nonlinear oscillator, and nonlinear resonances.

APPLIED PHYSICS 493D

Physics of Beam Instabilities in Accelerators
3 Credit Hours
Alexander Chao, SSC Laboratory

This course introduces the subject of collective instabilities of intense relativistic beams in accelerators. We will introduce and analyze the various instability effects, observed, or yet to be observed, in accelerators. The emphasis in the course is on the underlying physical principles of these instabilities. The prerequisites are classical electrodynamics and mathematical physics at a lower graduate level. Topics covered include space charge effects, wakefields and impedances, the beam break-up instability in linacs, Robinson and head-tail instabilities in circular accelerators, Landau damping, perturbation techniques using the Vlasov equation, and others.

APPLIED PHYSICS 493E

Charged Particle Optics
3 Credit Hours
Karl L. Brown, Stanford University and
Roger Servranckx, University of Saskatchewan

This course will introduce and develop matrix methods, phase ellipse theory, and techniques for handling higher order aberrations to evolve basic optics modules that are useful for designing more complex systems such as beam lines, spectrometers, circular machines and linear colliders. Among the modules that will be discussed are FODO arrays, matching transformers, 1st and 2nd order achromats, -I transforms, chromatic correction sections, dispersion suppressors, and others as time permits. In addition, an excursion into new optical tools and computer codes that are in the process of being evolved will be presented to demonstrate the most recent developments in the field. A problem set will be provided each day to illustrate the basic optics principles presented. Each afternoon a computer class will be given using some well known optics codes for students to exercise their skills.

APPLIED PHYSICS 493F

Management at National Laboratories
3 Credit Hours
Bruce Chrisman, Fermi National Accelerator Laboratory
W.K.H. Panofsky, Stanford University
William Wallenmeyer, Southeastern Universities Research Association
Wu-Tsung Weng, Brookhaven National Laboratory

The management of the laboratory: organization, mission and relations with academia, government and industry. The government role: the budget process, science and technology policy and long-range planning. The administration of the laboratory: operations, R&D, budget and controls, procurements and contracts, documentation and federal regulations, and personnel. Project management: project organization, proposal, review process, cost estimating, budget and financial control, construction, procurement, and R&D. The course will include lectures, tests and case studies.