PHYS751 - Particle Physics and Cosmology I The course meets Tues/Thurs 2 - 3:15pm

"The course should be of direct interest to students wishing to pursue research in (i) Particle Theory and (ii) High Energy Experiments. It should also be of major interest to students of nuclear theory and nuclear experiments as well as of relativity and astrophysics. Anyone wishing to know what we are made of and how we fit into the universe at large should find this course useful."

A detailed description follows:

Subject: Physics 751 - Particle Physics and Cosmology I (for Fall '02)

Prerequisite: 2 semesters of quantum mechanics

Co-requisite: Introduction to Relativistic Quantum Mechanics (PHYS 624)

Physics 751 will be offered in Fall' 01! This course will aim to introduce modern aspects of particle physics with an emphasis on symmetries and unification. In particular it will introduce the standard model of particle physics consisting of the electroweak and the quantum chromodynamics (QCD) gauge forces and discuss their relevance to major experimental projects. It will also stress the significance of recent discoveries including neutrino oscillations. The course will introduce elements of quantum field theory as well as group theory to the extent they will be used in covering some of the materials effectively. In the last part of the course, time permitting, elements of cosmology will be introduced in a way that emphasizes the link between the very large and the very small. Topics to be covered include:

(i) Basic building blocks of nature and their forces: A Preview

(ii) Quantum Fields: A brief summary and overview: spin 0, spin 1/2 and spin 1 Fields / Antimatter / Feynman Diagrams/Sample Calculations of decay rates and cross sections.

(iii) Force Transmitters - photon, pions, gluons, W and Z.

(iv) Determining spins & parities / Resonances (N*, r, w, K*)

(v) Discrete symmetries: P, C, T, CP, CPT

(vi) Continuous Symmetries: Elements of Group Theory, Isospin SU(2), SU(3)of flavor (vii) Quark Model - SU(3) of Color

(viii) Deep Inelastic Scattering: Scaling/Jets/Quarks as Partons.

(ix) Quantum chromodynamics: Asymptotic Freedom and Confinement; Tests

(x) The Electroweak force - Discoveries of Neutral currents, W and Z / Higgs Searches

(xi) Discoveries of J/Y, and D Particles (naked charm), Tau lepton, upsilon, and B-particles (naked bottom), Tau neutrino and the top quark.

(xii) Neutrino Oscillations.

(xiii) Elements of Cosmology as time permits

(xiv) Glimpse at physics beyond the standard model.