



COURSE ANNOUNCEMENT

Fall Semester 2004

PHYS 598SCM

ELECTRONIC STRUCTURE OF CONDENSED MATTER

Professor Richard Martin

Time: 1:00-2:20 Tues., Thurs.

Place: 322 Loomis

Credit: 4 Hours

Call Number: 34940

The study of the electronic structure is at a momentous stage, with new algorithms and computational methods, and rapid advances in basic theory. Many properties of materials can now be determined directly from the fundamental equations for the electrons, providing new insights into critical problems in physics, chemistry, and materials science. Increasingly, electronic structure calculations are becoming tools used by both experimentalists and theorists to understand characteristic properties and to make specific predictions for real materials and phenomena. This course is designed to provide a unified exposition of the basic theory and methods of electronic structure, together with instructive examples of practical computational methods and real-world applications. It will include the approach most widely used today – density functional theory – with emphasis upon understanding the ideas, practical approaches, and limitations. In addition, electronic structure is an interacting many-body problem that ranks among the most pervasive and important in physics. The course will include many-body concepts and methods with introductions to quantum Monte Carlo simulations, the “GW” method, and dynamical mean field theory.

An important part of the course will be a project in which each student can explore an area of his or her choice. The emphasis is on phenomena and useful techniques, and the course is intended for both experimentalists and theorists.

Course Material – *Electronic Structure: Basic Theory and Practical Methods*, by Richard M. Martin, Cambridge University Press, 2004, additional material on many-body methods, and many other resources found at <http://ElectronicStructure.org>

Prerequisites -- Knowledge of solid state physics and quantum mechanics at the level of Physics 489 or equivalent and quantum mechanics Physics 480 or equivalent; or consent of instructor.

