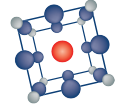




UNIVERSITÉ
DE GENÈVE

FACULTÉ DES SCIENCES
Section de physique



MaNEP
SWITZERLAND

Doctoral program – Geneva
Autumn semester 2008

Applications of the Many-Body Formalism in Condensed-Matter Physics

Main course by Christophe Berthod (DPMC)

Description — This course will describe how the many-body formalism is used to interpret experiments in condensed-matter physics.

The first semester will be devoted to the formalism, with a special emphasis on correlation functions at finite temperature. After a short reminder of second quantization the general properties of the correlation functions will be discussed and several sum rules derived. Various methods to calculate correlation functions will be presented: equation of motion, Ward identities, perturbation theory (Feynman diagrams), Luttinger-Ward functionals, conserving approximations. The imaginary-time formalism in the grand-canonical ensemble will be used throughout.

Specific topics treated in the first semester include impurity scattering (Born approximations), electron-phonon coupling, electron-electron interactions, mean-field superconductivity (Gorkov and Bogoliubov-de Gennes equations), strong-coupling superconductivity (Eliashberg equations).

In the second and third semesters this formalism will be used for the description of several experimental measurements: resistivity (involving phenomena like impurity scattering, electron-phonon and electron-electron interactions, Kondo effect, weak localization); ARPES (sudden approximation, spectral function, Fermi-liquid concepts, strong-coupling effects); tunneling (tunneling-Hamiltonian formalism, tunneling in superconductors, impurities, vortices); neutron scattering (phonons, spin fluctuations); optical conductivity (Drude peak, phonon peaks, optical sum rule).

Format — The course lasts three semesters in the form of one 2-hours lecture per week.

Date and place — The first lecture will be given on

Tuesday October 7, 2008 at 10:00

in room 102 (Sciences I). The subsequent dates will be decided following the demands of participants.