

# Physics of Condensed Matter II

## Typical Textbook

*Condensed Matter Physics*, Michael P. Marder, Wiley New York, 2000.

## Content

1. Justification of semiclassical approximation for electron dynamics using wave packets, Hall effect.
2. Electron dynamics in a magnetic field: magnetotransport, de Haas van Alphen oscillations, Giant magnetoresistance
3. Transport theory: relaxation time approximation, Boltzman equation, electrical and thermal conductivity and thermo-electrical effects, scattering rates for various scattering processes.
4. Semiconductor electronics: carrier statistics, behavior of a diode and other basic devices, point defects in semiconductors, effective mass approximation, Green's function approach, supercells, experimental approaches such as DLTS, PL, EPR.
5. Optical properties of solids: Kubo formula, semiconductors, insulators,(LO-TO phonon splitting), excitons, metals
6. Magnetism: para and diamagnetism of isolated ions and the electron gas, ferro and antiferromagnetism, mean field theory, Heitler-London model, Heisenberg and other spin Hamiltonians, spin waves, Kondo effect
7. Superconductivity: basic phenomenology, Ginzburg-Landau equations, BCS theory..