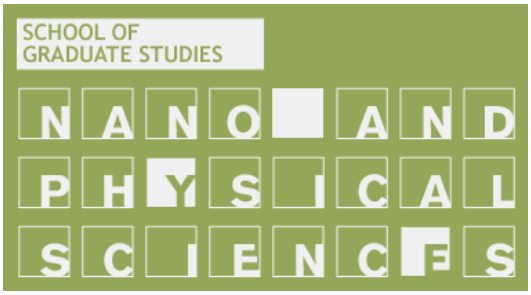

The Course of the PhD School in Nano and Physical Sciences 2011
"Quantum transport in mesoscopic systems" (3 ECTS) Dr. Andrea Bertoni
Will be held in **November 2011** at third floor (Aula Seminari) Physics Department
Dates still to be defined.

- Introduction ( )
  - An overview of present and future semiconductor electronic devices.
  - Semiclassical approach to charge transport.
  - Is quantum transport necessary ?
  - Sources of decoherence.
  - Low-dimensional structures.
  - Coulomb and spin-blockade.
  - Relevant experimental results.

- Single-particle picture (and)
  - Electron flow, rate equations and the quantum of conductance.
  - Landauer-Buttiker formula.
  - Nonzero temperature and linear response regime.
  - Open systems.
  - The quantum transmitting boundary method.
    - Numerical example: Resonant tunneling diode.
  - Green functions method.
    - Numerical example: The self-energy of the leads.

- Mean-field approach ( )
  - Relation with the multi-electron picture: Charging energy and correlation energy.
  - Solution of the Poisson equation.
  - Self-consistent Schrodinger-Poisson procedure.
  - Density of states and Fermi integrals.
    - Numerical example: MOS capacitor.

- Multi-particle picture ( )
  - Coherence, dephasing and entanglement.
    - Numerical example: double Electronic Mach-Zehnder interferometer.
  - Fano resonances.
  - Density matrix and Wigner function formalisms.
  - Dissipative evolution: The Lindblad master equation.

- Quantum Hall effect and edge states transport ( )
  - Integer quantum Hall effect and Landau levels.
  - Edge states as perfect 1D conductors.
  - Electronic Hanbury-Brown-Twiss interferometry.
  - Relevant experimental results.

The director of the PhD School