UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Disorder Effects in Spintronic Phenomena

2425-116R-M04

Title

Disorder Effects in Spintronic Phenomena

Teacher(s)

Prof. Roberto Raimondi, Dip. di Matematica e Fisica, Università Roma Tre (Italy)

Language

English

Short description

The goal of the lectures is to provide the basics of the theoretical description, in a phenomenological way, of the disorder effects in charge and spin transport, both in the absence and presence of spin-orbit coupling.
The lectures will, approximately, follow the layout below.

1. Quantum transport theory: equation for the density matrix with impurity scattering. Diffusive approximation.

2. Spin-orbit coupling in solids: intrinsic and extrinsic effects. Dresselhaus and Rashba Hamiltonians.

3. Spin-orbit coupling in impurity scattering: skew-scattering and side-jump and their effect in transport.
4. Rashba spin-orbit coupling in the two-dimensional electron gas in the presence of disorder: Edelstein and spin Hall effect.
5. Interplay of intrinsic (Rashba) and extrinsic (impurity) spin-orbit coupling in the two-dimensional electron gas. Spin-orbit as a gauge field.
6. Quantum transport theory for disordered graphene.
7. Rashba spin-orbit coupling in graphene and monolayers systems. Edelstein effect.
8. Anomalous Hall effect in the disordered massive Dirac model: interplay of disorder and topological effects.

CFU / Hours

8 ECTS/16 hours

Teaching period

Location: Seminar Room (U5 building)

14, 15, 16, 17 January from 9.30 till 11.30
21, 22, 23, 24 January from 9.30 till 11.30

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE