Condensed Matter Seminar

Date: Jan. 28 (Mon.) 14:00 〜16:00

Speakers:

(1) Mr. **C-H. Chen** (GCOE & Taiwan Univ.)

(2) Mr. **M. Hatami** (GCOE & TU Delft)

Title:

(1) Disorder effects due to non-magnetic and magnetic impurities in a finite Rashba spin-orbit interacting system

(2) Applications of thermodynamics of electron spin-flow at magnetic nanostructures

Room: 2nd floor, IFCAM Bldg

Abstract (1):

Yielding manipulating spins in an electrical way, the spin-orbit interaction has been a potential candidate to take advantage of for the designs of spontronics devices. One of the intensively investigated spin-orbit interactions, Rashba interaction, exists in many materials—for example, the InGaAs/InAlAs heterostuctures grown along [001] as will be focused here. In this report, we study the disorder effects due to the presence of nonmagnetic and magnetic impurities (specifically, manganese with maximum spin $S_z=5/2\hbar$) doping in a finite Rashba spin-orbit interacting system. For the case of a non-magnetic impurity, by using the Landauer-Keldysh formalism, the accumulation patterns of electron spins are analyzed. We find that, around the impurity, the accumulations are patterned by the spin-dipole geometry which was proposed earlier with another approach dealing with the infinite Rashba system. For the case of a magnetic impurity, by incorporating the mean-field theory with the Landauer-Keldysh formalism, the phase transition, from magnetized phase to un-magnetized phase of this impurity, is identified. Depending on the strength of the Rashba and the exchange interactions, the transitions occur at various temperatures.

Abstract (2):

Spin-caloritronics seeks to exploit coupling between the thermo-electric charge and spin transport at magnetic nanostructures. We predict that the magnetization direction of a ferromagnet can be switched by spin-transfer torque accompanying heat currents. The concept of a spin heat accumulation in a normal metal, i.e. a directional imbalance in the temperature of majority and minority spins is investigated. In spin-valve nanostructures we find angular magneto-thermopower and thermal conductance with sensitivity to spin-flip as well as inelastic scattering by which the spin heat accumulation decays. The spin-valves might then be suitable for monitoring energy relaxations at finite temperatures.

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