

RESEARCH PROJECT FOR UNDERGRADUATES | IKASIKER 2016

Spin Hall effect in novel materials

Spintronics is a rapidly growing research area that aims at using and manipulating not only the charge, but also the spin of the electron, with potential application to information technology. Pure spin currents, in which spin angular momentum with no electric charge is transported, are essential to achieve this goal. One of the most promising methods to create pure spin currents is the spin Hall effect which, in presence of spin-orbit coupling (SOC), generates a spin current transverse to the charge current.

Within this framework, we want to study novel materials that maximize the spin Hall effect, which can arise from either intrinsic or extrinsic mechanisms. We expect that light metals with heavy metal impurities will show very large extrinsic effects.

In this project, the student will do some basic use of high vacuum sputtering system to grow metallic thin films of 3d ferromagnetic metals (Fe, Co, Ni) with impurities of different prototypical metals with large SOC (Pt, W, Ta). Devices in the form of Hall bars will then be fabricated and characterized with anomalous Hall measurements (directly related to the spin Hall effect). The student will learn how to measure magnetotransport properties by using a cryogenic system (which can lower the temperature down to 2 K) with high magnetic fields (up to 9 T) that works with liquid helium.

SUPERVISOR: Luis Hueso / Felix Casanova

SUITABLE FOR: physicists, chemists, engineers