Controlling and Manipulating Nanomagnets with a DC Spin-polarized Current

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In present day magnetic devices the magnetization direction of the elements are controlled with either a static or dynamic applied magnetic field. These fields are typically applied through a permanent magnet or through the field generated by a current carrying wire.

However, several years ago it was predicted that the angular momentum in a spin-polarized current can also be used to control and manipulate the magnetization state of thin ferromagnetic materials, through the so-called "spin-transfer interaction". The interaction is based on the transfer of angular momentum from the spin-polarized current to the ferromagnetic material, resulting in a torque being applied to the ferromagnet.

At device dimensions below a few hundred nanometers, this interaction between the spin-polarized current and the ferromagnet can even dominate over the effects of an externally applied magnetic field, leading to a new ability to control the magnetization states of nanoscale magnetic devices. In this talk we will give an introduction to the general nature of the spin transfer effect, and a general overview of our work using the spin transfer interaction to induce high-frequency (< 500 ps) switching and coherent high-frequency (GHz) precession in magnetic nanostructures.