MICROWAVE OSCILLATIONS INDUCED BY SPIN POLRIZED CURRENTS

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PhD may follow: Yes

Summary :

One of the basic concepts of spintronics is the spin momentum transfer where spin polarized conduction electrons can transfer a magnetic moment to the magnetization of a thin magnetic film. This magnetic momentum transfer is responsible for the excitation of high frequency (Gigahertz range) magnetization oscillations and opens new possibilities for the development of integrated radio frequency oscillators. SPINTEC develops and studies the autonomous and non-autonomous operation of such spintronics oscillators (STOs) from a fundamental point of view but also in context of possible applications. A current important question considers how the spin momtnum transfer driven dynamics interacts with other excitations of the spintronics nanodevice that can influence for instance the frequency characteristics and overall RF performances.

TWO MASTER PROJECTS are currently available within a group of 7 people to study spin torque driven magnetization dynamics in innovative spintronics oscillator configurations.

Full description :

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subject 1) Self-polarising Magnetic Multilayer

While standard spintronics oscillators are made of a polariser (to spin polarise the current) and a free layer (in which the dynamics is excited by spin momentum transfer), novel structures consider magnetic multilayers made of several (more than two) magnetic thin layers, separated by a non-magnetic layer. Here each layer is supposed to spin polarise the current and to be excited at the same time. The objective is to study spin polarised collective excitations coupled via spin momentum transfer, dipolar field and exchange interaction.

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Ssubject 2) Spin orbit torque oscillator

Current spintronics devices are based on the two terminal concept, where the current to excite and to detect the magnetization oscillations is injected perpendicular to the magnetic layers. Since the current to excite is much larger than the one to detect, this can lead to a deterioration of the device, which is thus not robust against repeated measurements. This can be avoided in a three terminal device that exploits novel spintronics concepts of spin orbit torques. The objective here is to realize such three terminal devices and to study the high frequency response.

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EXPERIENCE GAINED The experimental master projects provide a large variety of training by developing the magnetic stacks (experience in materials fabrication), participation in the nanofabrication (cleanroom experience), characterization of the microwave performance (experience of using state of the art RF measurement tools), data analysis (programming and signal treatment), modelling and simulations as well as learning advanced concepts of spin electronics.

Requested skills :

Motivated students with a sound background in solid state physics and/or nanosciences and keen to explore new concepts and ideas that are at the interface between physics (spintronics) and applications (microwave oscillators).

Interested candidates should send their CV, letter of motivation and a copy of all diplomas and extracts of grades to the above mentioned contacts.