Spin transfer induced dynamics of magnetic solitons in nanostructures : from multi-vortices to magnetic skyrmions

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In the last decade, the use of a spin polarized current to manipulate, through the spin transfer torque, the magnetization configuration of a nanostructure has stimulated a considerable research effort. Besides the existing application of spin torque to write the information in next generation of ST-MRAM, spin transfer induced dynamics might potentially generate a complete new generation of magnetic memories and radiofrequency devices.

In this talk, I will first focus on the case of a single magnetic vortex excited by a spin polarized current and demonstrate how it represents a model system to study the physical mechanisms of the spin transfer phenomena in highly non uniform magnetic configuration. I will show that the detailed investigation of the role of non linearities both experimentally and analytically allows us to understand the evolution of the main parameters of the vortex dynamics that are the frequency, the emitted power and the spectral linewidth. Then I will present our recent results obtained on systems with multiple vortices demonstrating the important role of the vortices parameters to understand such spin transfer induced coupled dynamics. Finally, I will demonstrate through micromagnetic simulations that other types of magnetic solitons can be efficiently manipulated through spin torque by showing that single or multiple skyrmions in thin film strips hold promise because of their potential extremely small sizes and low threshold currents for initiating their dynamics.

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