Spin Wave Dynamics in Nano-Contact Spin Torque Oscillators

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In a spin torque oscillator (STOs), a spin polarized direct current can excite highly nonlinear magnetization dynamics in a thin magnetic film by means of spin torque transfer.
In this talk, I will review our most recent results related to the spin wave dynamics in *nano-contact* STOs. In particular, I will show how two intrinsically different spin wave modes (localized and propagating) can be excited in these devices, and the fundamental role played by the current induced Oersted field. Besides frequency-domain measurements, I will also present our latest time-domain measurements obtained with a state-of-the-art real-time oscilloscope (25 GHz, 80 GSa/s), which reveal details of the dynamics previously accessible only indirectly through micromagnetic simulations. The inclusion of such simulations, given how well they reproduce the experimental data, provides a detailed understanding of the spatial properties of the current induced spin wave dynamics.
In our nano-contact STOs, a large surface area of up to tens of squared microns contains excitations of non-linear spin waves. This would allow for investigations with the magnetic characterization techniques that are currently being developed at the last generation of synchrotron light sources, and that could potentially access the still challenging question of visualizing current induced spin wave dynamics in real space.