Spin-torque excited spin waves revealed by micro-focused Brillouin light scattering

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Since the discovery of the spin transfer torque (STT) effect [1,2] a great effort has been devoted to the realization and study of spin torque oscillators (STOs) because of their potential applications as spin waves injectors in magnonic devices or current-tunable broad-band microwave sources. More recently the possibility to synchronize multiple STOs [3,4] via the emitted spin waves, propagating in the magnetic “free” layer, envisioned a way to overcome their main limitation in the output power. For these reasons it’s now crucial to obtain a detailed knowledge and understanding of the emitted spin waves properties like: their spatial distribution, their propagating or localized character, their decay length, wavelength and group velocity. In the last two years micro-focused Brillouin light scattering (µ-BLS) revealed to be a powerful tool in order to investigate several of this properties [5,6]. In this presentation we discuss the potentialities of µ-BLS to the study of emitted spin waves in STOs systems with particular focus on the results of our latest work [6]. Here we took advantage of our µ-BLS setup in order to study spin waves emitted by an out-of-plane magnetized nano-contact STO. Performing a “wave-vector resolved” µ-BLS experiment we provided the first direct experimental evidence of the propagating nature of SWs emitted from an out-of-plane magnetized STO. The decay of the propagating SW intensity up to several microns away from the nano-contact position showed great potential for STT based magnonic devices. We also investigated the STO tunability measuring the emitted SW frequency as a function of both the applied direct current and external field intensities. Micromagnetic simulations provided the theoretical support to quantitatively reproduce the results.


Support from European Community 7th Framework Programme under G.A. no228673 (MAGNONICS) is gratefully acknowledged.