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Spin-torque excited spin waves revealed by micro-focused Brillouin light scattering[1]

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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.

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