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Interaction between spin-wave excitations and pure spin currents in magnetic structures[1]

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The generation of pure spin current (PSC) in magnetic structures has attracted much attention not only for its fundamental importance in spintronics, but also because it opens up potential applications. One of the most exciting aspects of this area is the interplay between spin-waves (SW) and PSC. Here we report experimental results in which the PSC, generated by both spin pumping (SPE) [1] and spin Seebeck (SSE) [2] effects, can exert a spin-transfer torque sufficient to compensate the SW relaxation in yttrium iron garnet (YIG)/non-magnetic structures. By measuring the propagation of SW packets in single-crystal YIG films we were able to observe the amplification of volume and magnetostatic modes (MSW) by both SSE and SHE [3,4]. The excitation and detection of the SW packets is carried out by using a MSW delay line device. In both cases the amplification is attributed to the spin-transfer torque due to PSC generated by SSE as well as SHE. It will also be presented new results in which PSC are simultaneously excited by SSE and SPE effects in YIG films. While the spin current generated by SPE is obtained by exciting the ferromagnetic resonance (FMR) of the YIG film, the spin current due to SSE is created by applying a temperature gradient along the film plane. The effect of the superposition of both spin currents is characterized by measuring the spin Hall voltage (V_H) along thin strips of Pt deposited on top of the YIG films. Whereas V_H corresponding to the uniform FMR is amplified due the SSE the voltages corresponding to the other magnetostatic spin-wave modes are attenuated [5].

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