

Spin Wave Dynamics in Spin Torque Oscillators: Manipulation, Synchronization, and Prospects for Magnonics

Randy K. Dumas¹ and Johan Åkerman^{1,2}

¹Physics Department, University of Gothenburg, 41296 Gothenburg, Sweden

²Materials Physics, Royal Institute of Technology (KTH), 16440 Kista, Sweden

The spin-polarized current in a spin torque oscillator (STO) [1] can excite highly nonlinear magnetization dynamics via spin transfer torque [2, 3]. In this talk, I will discuss several results that highlight spin wave dynamics and their consequences. Firstly, evidence of two intrinsically different spin wave modes (propagating and localized) and the fundamental role played by the applied field angle and Oersted field will be discussed [4]. A combination of frequency-domain measurements, time-domain measurements [utilizing a state-of-the-art real-time oscilloscope (25GHz, 80 GSa/s)], and micromagnetic simulations provide a detailed understanding of the spatial properties of the induced spin waves. As the generated spin waves can propagate and interfere, phase locking of many STOs sharing a common magnetic layer becomes possible. The second part of the talk will be devoted to STO synchronization, in particular under modulation. We find that in their synchronized state, two STOs behave as a single entity, even under strong and rapid modulation. Finally, some of the prospects for future magnonics [5] research using STOs will be discussed.

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