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Magnon Interferometry in Homogeneous Thin Films

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The manipulation of spin waves (or their quanta magnon) in thin ferromagnetic films, which allows to carry information without moving charges, appears as a potential solution for low-power computing components [1]. Additionally, provided with unique anisotropic dispersion relations as well as non-reciprocal properties, magnonics devices could soon be part of integrated circuit technologies with unconventional electronic applications. In parallel, the direct interference of short wavelength spin waves in continuous layers is starting to show new possibilities for efficient signal processing [2]. Related to this effort, several independent works already demonstrated that the propagation of spin waves in ferromagnetic thin films could be shaped using several concepts borrowed from optics [3]. Along with, our collaboration demonstrated that the focccused emission of spin waves beams in ferromagnetic thin films from constricted coplanar waveguide follows directly the near-field interference pattern of the constriction geometry [4]. Currently, we are investigating interference patterns created by curvilinear shaped spin wave antennae. We will review in this presentation our latest results, which includes spin wave spectroscopy measurement done on 30nm thin YIG films magnetized out-of-plane, with their analysis using both near-field interference models that we developed (cf Fig. 1) as well as MuMax3 micromagnetic simulation.

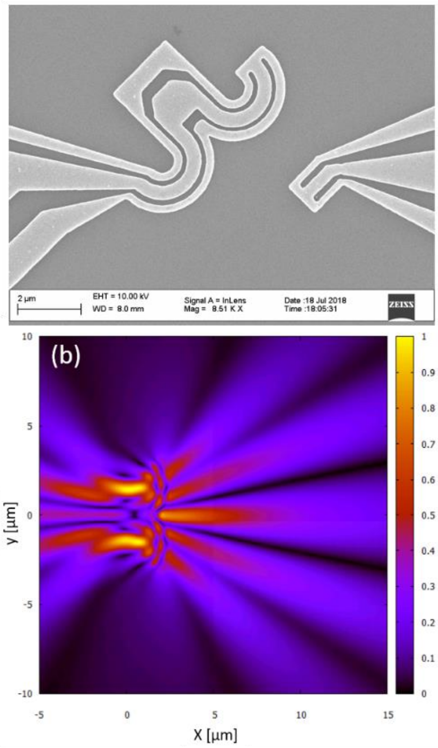

Figure 1: a) SEM picture of a spin wave interferometric device on top of a continuous YIG film. b) Near-field diffraction simulation for $\mu_0 H_{ext}$=308mT (out-of-plane), and f=5.06GHz.

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