

## Spin Wave Diffraction in Curvilinear Antennas

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The direct interference of short wavelength spin waves in continuous layers is bringing new opportunities for efficient signal processing [1-2]. Several pioneer works established the possibility to shape the propagation of spin waves in ferromagnetic thin films using concepts borrowed from optics [3-5]. Along these ideas, we demonstrated that the focused emission of spin waves beams in ferromagnetic thin films from constricted coplanar waveguide follows directly the near-field interference pattern of the constriction geometry [6]. In this communication, we investigate the interference patterns of spin waves excited by curvilinear shaped antennas, which produce either a concentrating or a diffusing effect. Namely, we focused our study on two different types of demonstrators: (i) a spin wave “concentrator” as shown in Fig. 1, and (ii) the equivalent of a “Young double-slit” experiment for spin waves shown in Fig. 2. Firstly, we will present a near-field interference model that can be readily implemented for all spin wave modes and any arbitrary shape of antenna [7]. We show the validity and efficiency of our approach by comparing the near-field diffraction patterns obtained with our model and the corresponding MuMax3 micromagnetic simulations for a wide scope of geometries. Secondly, we present series of propagating spin wave spectroscopy done on 30nm YIG films and a 20nm Ni<sub>80</sub>Fe<sub>20</sub> film magnetized out-of-plane, allowing for a discrete mapping of the spin wave intensity with a spatial resolution of about 1 $\mu$ m. We show that the transmission signals  $S_{21}$  measured at different locations follow very closely the simulated interference patterns for all the demonstrators, thus paving the way for future prototype of magnon interferometric devices.

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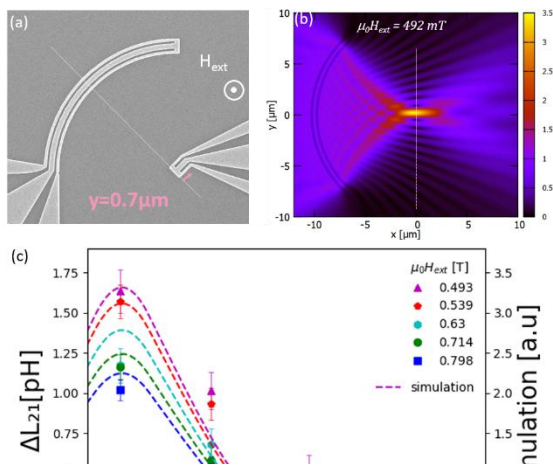


Figure 1: (a) SEM image of the concentrator device on a 30nm YIG film. (b) Near-Field diffraction simulation at 492mT. (c) Discrete mapping from spin wave spectroscopy

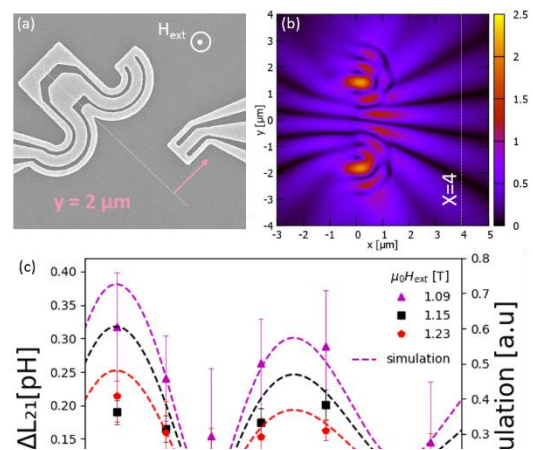


Figure 2: (a) SEM image of the Young 2-slit device on a 20nm Py film. (b) Near-Field diffraction simulation at 1.15T. (c) Discrete mapping from spin wave spectroscopy