Abstract book

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SPIN WAVES LOCALIZATION INDUCED BY STRAY FIELD OF SUPERCONDUCTING STRIPE

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Investigation of spin waves (SWs) in ferromagnetic films is of great importance because knowledge of these phenomena is crucial for the designing of magnonic devices [1]. One of the current problems in this research area is how to control SW propagation and localization. Here we propose to localize SWs in a ferromagnetic film using electromagnetic coupling with a superconducting (SC) stripe. We present the theoretical description and micromagnetic simulation for SW dynamics in the system, which consists of a ferromagnetic thin film and infinite SC stripe that is placed above the film – see Fig.1.

We assumed that the external magnetic field is directed perpendicularly to the film's plane. The infinitely extended ferromagnetic film creates a magnetic field that is uniform in its plane, whereas the SC stripe provides the non-homogenous magnetic field distribution in the plane of the film, which can be controlled by an external field (Fig.2). So, the presence of SC stripe and its static coupling to ferromagnetic layer provides the consolable landscape of internal field for SWs.

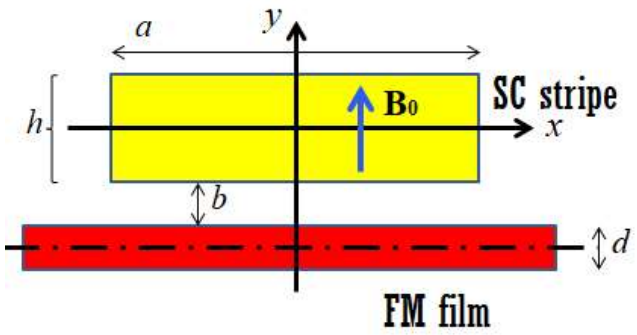

Figure 1. The sketch of the system, where d is film thickness, b is the distance between the film and SC stripe, a and h are stripe weight and thickness respectively, and B_0 is an external magnetic field.

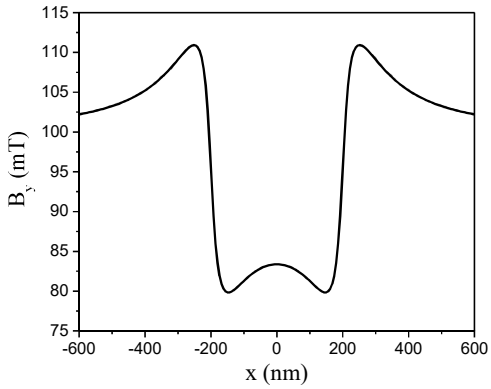

Figure 2. The distribution of the magnetic field created by the SC stripe of a small London penetration depth, taken in the middle of the film (dashed-dot line in Fig.1).

The ferromagnetic resonance conditions in the film area under the stripe will differ from the ones in other film parts. As a result, propagating SWs could be localized in the area under SC. Moreover, since the resonance conditions could be changed by variation of the external magnetic field, it opens the possibility to control the frequency and the strength of SWs' localization.

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[1] T. Y., Gerrit E. W. Bauer (2022), Efficient Gating of Magnons by Proximity Superconductors, Phys. Rev. Lett. 129, 117201.