Chiral resonant scattering of spin waves in magnetostatically coupled systems

(tutorial)

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Magnetic elements may host confined spin-wave modes, e.g. Kittel resonances or higher-order modes. When a nanomagnet is magnetostatically coupled to a magnonic medium, such as a thin film, it may scatter propagating spin waves. The scattering is resonantly enhanced when the spin-wave frequency matches that of one of the local modes. The dipolar coupling may make the scattering chiral, resulting in a non-trivial angular dependence of the scattered wave. The coupling also gives rise to back-action on the confined modes. We present a phenomenological approach to such chiral resonant scattering [1,2]. We show how the salient features of the scattering in both one- and two-dimensional systems are quantitatively reproduced by the model without any adjustable parameters, as seen from comparison with direct micromagnetic calculations and data available.

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[1] K. G. Fripp, A. V. Shytov, and V. V. Kruglyak, *Spin-wave control using dark modes in chiral magnonic resonators*, Phys. Rev. B **104**, 054437 (2021).

[2] K. G. Fripp, Y. Au, A. V. Shytov, and V. V. Kruglyak, *Nonlinear chiral magnonic resonators: Toward magnonic neurons*, Appl. Phys. Lett. **122**, 172403 (2023).