Inelastic spin wave beam scattering on localised modes for controlling beams' trajectory and frequency.

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Spin waves (SWs) show potential for being a low-energy demanding information carrier and offer easily achieved non-linear processes such as confluence and splitting processes. In our investigation, we study the non-linear interaction of an incident SW beam with a localised SW edge mode of a thin ferromagnetic film. We propose two methods of localising the edge mode: introducing a ferromagnetic strip directly over the thin layer's edge, thus creating a magnonic Gires-Tournois [1,2] interferometer and using the demagnetising field [3]. We show that the SW beam inelastic scattering process results in creation of two new SW beams with shifted frequency that are additionally laterally shifted with respect to the SW beam's incident spot. Both the later shifts of inelastically scattered beams and their amplitudes depend on localised SW edge mode's frequency which is a tunable external parameter. Thus, our findings provide new ways to control and modulate SWs by using non-linear processes. These new possibilities will be applied in the future design of magnonic circuitry for modulating the SW signal's frequency and splitting information encoded in SWs to direct it to different channels.

References:

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