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Magnonics in skyrmion-hosting chiral magnetic materials

A magnetization that spatially varies within a plane can be characterized by a topological skyrmion number specifying how often the magnetization vector covers the unit sphere. Magnetic skyrmion textures with such a non-trivial winding number are endowed with additional functionality as they efficiently couple to magnon- and itinerant spin currents allowing for novel spintronic applications. Such textures arise, in particular, in chiral magnets where the Dzyaloshinskii-Moriya interaction favours a spatially modulated magnetization. We provide an overview of the properties of magnon excitations in such materials including its magnon band structure and its inherent non-reciprocity [1]. Due to their non-trivial topology, a single skyrmion acts like a source of flux density that leads to an emergent Lorentz force on the magnons. This gives rise to skew and rainbow scattering of spinwaves characterized by an asymmetric and oscillating differential cross section [2,3]. As a consequence of the skew scattering, a finite density of skyrmions will generate a topological magnon Hall effect. In a skyrmion crystal, this is reflected in non-trivial Chern numbers of the magnon bands also implying the presence of magnon edge states. We also discuss the momentum-transfer between magnons and skyrmions which allows to induce a skyrmion motion with the help of propagating spinwaves.

[1] M. Garst, J. Waizner, and D. Grundler, Journal of Physics D: Applied Physics,
http://iopscience.iop.org/10.1088/1361-6463/aa7573
[2] C. Schütte and M. Garst, Phys. Rev. B 90, 094423 (2014)
[3] S. Schroeter and M. Garst, Low. Temp. Phys. 41, 817 (2015)