Universität Bielefeld | Fakultät für Physik

Physikalisches Kolloquium

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Magnon Transport in Spin Textures

One of the grand challenges in cutting edge quantum and condensed matter physics is to harness the spin degree of electrons for information technologies. While spintronics, based on charge transport by spin polarized electrons, made its leap in data storage by providing extremely sensitive detectors in magnetic hard-drives, it turned out to be challenging to transport spin information without great losses. With magnonics a visionary concept inspired researchers worldwide: Utilize magnons – the collective excitation quanta of the spin system in magnetically ordered materials – as carriers for information. Magnons are waves of the electrons' spin precessional motion. They propagate without charge transport and its associated Ohmic losses, paving the way for a substantial reduction of energy consumption in computers.

While macroscopic prototypes of magnonic logic gates have been demonstrated, the full potential of magnonics lies in the combination of magnons with nano-sized spin textures. Both magnons and spin textures share a common ground set by the interplay of dipolar, spin-orbit and exchange energies rendering them perfect interaction partners. Magnons are fast, sensitive to the spins' directions and easily driven far from equilibrium. Spin textures are robust, non-volatile and still reprogrammable on ultrashort timescales. The vast possibilities offered by combining this toolset of magnetic phenomena, add value to both magnonics and the fundamental understanding of complex spin textures.

I will give an introduction about magnon propagation and manipulation in microstructures with non-collinear spin textures, in particular magnons propagating in nano channels formed by magnetic domain walls. Furthermore, I will address how magnons can be excited in domain wall channels by pure spin currents originating from the spin Hall effect.

References:

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