Physikalisches Kolloquium

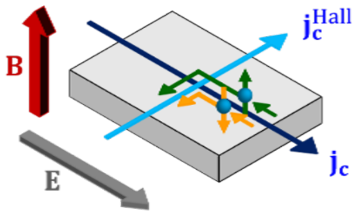
Universität Konstanz

Di 20.07.21
15:15 Uhr
Hybrid:
https://zoom.us/j/88367685820?pwd=cXQ0d2UzQ3ZscExUT1NVUkFKelV5QT09
oder R711 nach Voranmeldung

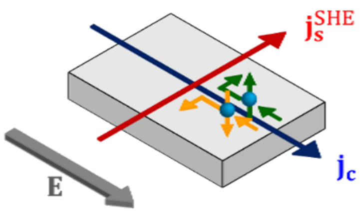
Antrittsvorlesung:

Prof. Dr. Sebastian T. B. Goennenwein
FB Physik, Universität Konstanz

Transverse Transport Effects in Magnetic Nanostructures



Hall effect
Hall, Am. J. Math. **2**, 287 (1879)



spin Hall effect
Kato *et al.*, Science **206**, 1910 (2004)

About 140 years ago, Edwin Hall observed that in a metal exposed to a magnetic field, a charge current is accompanied not only by a voltage drop along the current, but also by an electric field transverse to both the current flow and the magnetic field. Since then, the Hall effect is *the* prototypical 'transverse transport' effect. The Hall effect unambiguously shows that charge transport in solids must be discussed using a tensorial quantity, e.g., the conductivity tensor. Since similar arguments also apply to heat and to spin transport effects in solids, a whole set of transverse transport phenomena is established and exploited today.

In the talk, I will first focus on charge-based transverse transport effects in magnetically ordered materials. More specifically, I will show that characteristic transverse 'Hall' electric fields can arise not only due to an externally applied magnetic field, but also from the internal magnetization or spin structure of a solid. These effects are referred to as anomalous Hall effect and topological Hall effect, respectively, in the literature. Together with their thermal counterparts – the anomalous and the topological Nernst effect – these phenomena allow probing the spin structure of individual magnetic nanostructures.

In the second part of the talk, I will switch to spin-based transverse transport in magnet/metal heterostructures. Here, the so-called spin Hall effect has emerged as a powerful tool for the generation and detection of pure spin currents. We use this approach in particular for the investigation of magnon spin currents in magnetic insulators. I will show how the diffusion of magnons in an electrically insulating magnet can be detected and quantified using spin Hall physics, and present first steps towards magnon drift transport.