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JOHANNES GUTENBERG UNIVERSITÄT MAINZ

Theory of Condensed Matter: Hard Condensed Matter

July 2, 2019 at 2 p.m.
Galilei Room, 01-128 (Staudinger Weg 9)

Ran Cheng
University of California, Riverside

Antiferromagnetic Magnons - A tale of two spins

Magnons, the quanta of spin-wave excitations, can transport spin angular momenta over long distances without incurring Joule heating. They are promising alternatives to electrons in building next-generation nanotechnology. To fully function as electrons, however, magnons should bear an intrinsic degree of freedom similar to the electron spin. In antiferromagnets, spin-up and spin-down magnons coexist and form a unique degree of freedom capable of encoding information, which can be controlled through the Dzyaloshinskii-Moriya interaction, temperature gradient, etc. Guided by the resemblance between antiferromagnetic magnons and electrons with spin being an active variable, we propose a series of physical phenomena where magnons can function as electrons in transporting and transferring spin angular momenta, including magnon-induced interlayer coupling, spin Nernst and spin Edelstein effects, and magnonic spin torques in an insulating spin valve with antiferromagnetic spacer. These phenomena introduced a vibrant playground for new fundamental physics and opened the exciting possibility of utilizing magnons as primary information carriers in electronic devices.

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