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Topological Hall Effect in Skyrmions: A Nonequilibrium Coherent Transport Approach[1] GEN YIN, Univ of California - Riverside, JIADONG ZANG, Johns Hopkins University, ROGER LAKE, Univ of California - Riverside
— Skyrmion is a topological spin texture recently observed in many materials with broken inversion symmetry. In experiments, one effective method to detect the skyrmion crystal phase is the topological Hall measurement. At adiabatic approximation, previous theoretical studies show that the Hall signal is provided by an emergent magnetic field, which explains the topological Hall effect in the classical level. Motivated by the potential device application of skyrmions as digital bits, it is important to understand the topological Hall effect in the mesoscopic level, where the electron coherence should be considered. In this talk, we will discuss the quantum aspects of the topological Hall effect on a tight binding setup solved by nonequilibrium Green's function (NEGF). The charge distribution, Hall potential distribution, thermal broadening effect and the Hall resistivity are investigated in detail. The relation between the Hall resistance and the DM interaction is investigated. Driven by the spin transferred torque (SST), Skyrmion dynamics is previously studied within the adiabatic approximation. At the quantum transport level, this talk will also discuss the non-adiabatic effect in the skyrmion motion with the presence of the topological Hall effect.

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