

凝縮系物理学ゼミナール

Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 1 November 2023

Title: Quantum skyrmion Hall effect in f-electron systems

Speaker: Prof. Robert Peters (Condensed Matter Theory Group)

Abstract:

The flow of electric current through a two-dimensional material in a magnetic field gives rise to the family of Hall effects. The quantum versions of these effects accommodate robust electronic edge channels and fractional charges. Recently, the Hall effect of skyrmions, classical magnetic quasiparticles with a quantized topological charge, has been theoretically and experimentally reported, igniting ideas on a quantum version of this effect.

In this talk, I will explain our recent dynamical mean-field-theory calculations on localized f electrons coupled to itinerant c electrons in the presence of spin-orbit interaction and a magnetic field. I will show the emergence and stability of localized quantum nanoskyrmions in this model. Furthermore, I will show the effect of an electric field on the quantum skyrmion using linear response theory. I will demonstrate that the quantum skyrmion starts moving transversally when a charge current flows. These results show the time-transient buildup of the quantum skyrmion Hall effect, accompanied by an Edelstein effect and a magnetoelectric effect that rotates the spins.

Reference :

[1] RP, J. Neuhaus-Steinmetz, and T. Posske; Phys. Rev. Research **5**, 033180 (2023).