PAUL SCHERRER INSTITUT

PSI

CONDENSED MATTER THEORY SEMINAR

Dynamics of Skyrmions in chiral magnetic insulators

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WHGA/121 (PSI-West)

Abstract:

We study the quantum propagation of a skyrmion in chiral magnetic insulators by generalizing the micromagnetic equations of motion. The fluctuations around the skyrmionic configuration give rise to a damping derived microscopically, which in some limit reduces to a skyrmion mass. We demonstrate that a skyrmion in a confined geometry behaves as a massive particle, a discovery with great impact on the technologically important case of linear tracks relevant for magnetic memory devices. An additional quantum mass term is predicted with an explicit temperature dependence which remains finite even at zero temperature. In the presence of time-dependent oscillating magnetic field gradients, the unavoidable coupling of the external field to the magnons gives rise to time-dependent dissipation for the skyrmion, with measurable consequences on the skyrmions path. These ac fields act as a net driving force on the skyrmion via its own intrinsic magnetic excitations.

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