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Title:

Electrodynamics in Skyrmions Merging

Abstract:

In a recent study the coalescence of magnetic skyrmions was observed in a metallic chiral magnet $\text{Fe}_{0.5}\text{Co}_{0.5}\text{Si}$ when the skyrmion phase is destroyed, and numerical simulations demonstrated the existence of a monopole at the merging point of two skyrmion lines. The exchange interaction between such magnetic textures and the conduction electrons can be described by emergent electromagnetism. In this paper, we investigate the effect of a skyrmions-merging process on conduction electrons by calculating induced electric currents. Here, in addition to the exchange interactions, we consider the antisymmetric spin-orbit couplings (SOC) due to broken inversion symmetry, which is an essential ingredient for the realization of skyrmion texture. We obtain an adiabatic current which is dissipationless, and dissipative currents driven by the effective electromagnetic fields including the effect of SOC. In terms of the effective fields, a moving monopole turns out to be a dyon-like object; i.e. it has both electric charge and magnetic charge.