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JOHANNES GUTENBERG UNIVERSITÄT MAINZ

Theory of Condensed Matter: Hard Condensed Matter

June 26, 2018 at 2 p.m.
Galilei room 01-128 (Staudinger Weg 9)

Mikhail Titov
Radboud University, Nijmegen

Dzyaloshinskii-Moria interaction in Rashba systems

We derive general finite temperature expressions for Dzyaloshinskii-Moriya interaction (DMI) and symmetric exchange in a 2D s-d ferromagnet model with momentum-dependent spin-orbit coupling (SOC) of Rashba type and arbitrary (generally non-parabolic) kinetic energy of itinerant electrons. We show that a commonly used parabolic model with Rashba SOC gives rise to vanishing of both DMI and exchange stiffness in the metal regime, i.e. for both spin-split subbands occupied. Both quantities are, however, finite if non-parabolic corrections to kinetic energy or non-linear corrections to SOC are taken into account. We further demonstrate that the commonly assumed form of the DMI in terms of Lifshitz invariants breaks down if SOC energy exceeds the s-d exchange energy. In this situation, the DMI vector becomes strongly anisotropic. It also acquires an additional essential dependence on the perpendicular-to-the-plane component of the magnetization. We discuss the relevance of our results for the formation of chiral magnetic textures in 2D systems with strong Rashba SOC.

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