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Aharanov-Casher Effect for Spin Waves in a Ferromagnet[1]
TIANYU LIU, GIOVANNI VIGNALE, Department of Physics and Astronomy, University of Missouri,Columbia — Spin waves play a potentially important role in spintronics as means for modulating the magnetoresistance of devices. In this work we study how the propagation of spin waves can be controlled by electric fields, which couple to electrons via spin-orbit interaction. Starting from basic models of localized spins interacting via itinerant electrons (e.g. double exchange model, RKKY interaction) we study how spin-orbit coupling between the itinerant electrons and an electric field modifies the dynamics of spin waves. In particular, we provide a first-principle derivation of the Aharanov-Casher effect on the phase of spin waves in ferromagnetic rings. In a parallel study, we consider the propagation of spin waves on a textured magnetic background (e.g. a domain wall or a spiral magnetic structure). An analogy between the effect of a non-uniform magnetization background and that of spin-orbit coupling is developed.

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