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Dissipative dynamics of magnetic solitons in metals CLEMENT WONG, YAROSLAV TSERKOVNAYK, UCLA — We develop the hydrodynamic theory of collinear spin currents coupled to magnetization dynamics in spin-textured, metallic ferromagnets. The equation of motion for the electronic current consist of a dissipative spin-motive force generated by magnetization dynamics and a magnetic texture-dependent resistivity tensor. The Onsager principle implies a reciprocal dissipative, adiabatic spin torque on the magnetic texture. Due to thermal fluctuations, electronic dynamics contribute to a non-local Gilbert damping tensor in the Landau-Lifshitz-Gilbert equation for the magnetization. Appling our hydrodynamic equations to soliton dynamics, we find that soliton motion generate electrical currents, which produce backaction through spin torques. We include such effects in a modified the Landau-Lifshitz-Gilbert equation and the corresponding solitonic equations of motion for collective coordinates. As an example, we consider the orbital motion of a vortex in a point-contact spin valve, and find modifications to orbit radius, frequency, and dissipation power.

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