Dissipative Droplet Solitons

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Abstract:

Large amplitude, vectorial, localized, "droplet solitons" in anisotropic magnetic media were first studied theoretically some time ago [1] but have not been observed experimentally. These states satisfy a conservative Landau-Lifshitz equation with uniaxial anisotropy. This talk presents an extension of the notion of a droplet soliton to a physically realizable system: thin ferromagnetic films driven by a spin polarized current. This two-dimensional dissipative droplet soliton arises as the balance between a spatially localized spin torque and a uniform damping torque in addition to nonlinearity and dispersion. Using perturbative techniques and numerical calculations, properties of this fully nonlinear, coherently precessing state will be discussed including existence conditions, stability, and hysteresis. These properties will be used to argue that dissipative droplet solitons have been observed in recent experiments.

References:

1. B. A. Ivanov and A. M. Kosevich, Zh. Eksp. Teor. Fiz. 72, 2000-2015 (1977). A. M. Kosevich, B. A. Ivanov, and A. S. Kovalev, Phys. Rep. 194, 117-238 (1990).