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Thin film ferromagnets acting like a compressible fluid[1] EZIO IACOCCA, Univ of Colorado - Boulder, THOMAS SILVA, National Institute of Standards and Technology, MARK HOEFER, Univ of Colorado - Boulder — Spin dynamics in ferromagnetic materials are mathematically described by the Landau-Lifshitz equation of motion. Recently, it has been shown that this equation can be exactly rewritten as a system of hydrodynamic equations [1] that are analogues of the isentropic Euler equations of compressible gas dynamics. These equations exhibit intriguing features such as a velocity-dependent pressure law and broken Galilean invariance, implying that the ferromagnets fluid-like physics are reference-frame dependent. A magnetic Mach number is defined from which subsonic and supersonic conditions are identified. By introducing finite-sized obstacles, we numerically observe laminar flow or the nucleation of ordered vortex-antivortex pairs in the subsonic regime; and the formation of a Mach cone, wavefronts, and irregular vortex-antivortex pairs in the supersonic regime. Our approach identifies a deep connection between ferromagnetism and fluid dynamics, enabling new predictions for thin film ferromagnets and opening up a new paradigm for magnetic research. References: [1] Iacocca, Silva, and Hoefer, arXiv:1606.01565 (2016)

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