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Visualization of weak ferromagnetic domains in multiferroic hexagonal ferrite thin film[1] WEIDA WU, WENBO WANG, Department of Physics and Astronomy, Rutgers University, Piscataway, NJ, 08854 USA, JARRETT A. MOYER, PETER SCHIFFER, Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801, USA, JULIA A. MUNDY, DAVID A. MULLER, School of Applied and Engineering Physics, Cornell University, Ithaca, New York 14853, USA, DARRELL G. SCHLOM, Department of Materials Science and Engineering, Cornell University, Ithaca, New York 14853, USA — Hexagonal h-$LuFeO_3$ thin film has been reported to be a room-temperature multiferroic [1]. Extensive studies on high quality MBE thin films revealed a magnetoelectric phase with weak ferromagnetism emerges below $T_N \sim 147\,\mathrm{K}$ [2]. However, the direct observation of weak ferromagnetic domain structures is still lacking. Here we report cryogenic magnetic force microscopy (MFM) results on 200 nm thick h-$LuFeO_3$ film grown by molecular-beam epitaxy (MBE) on (111)-oriented yttria-stablized cubic zirconia (YSZ) substrates. Labyrinth-like weak ferromagnetic domain structures were observed with a domain size $\sim 1\,\mu m$ and domain wall width $\sim 0.4\,\mu m$. Field-dependent MFM data indicates the coercive field is $\sim 2.66\,\mathrm{T}$ at $50\,\mathrm{K}$ and $\sim 3.15\,\mathrm{T}$ at $6\,\mathrm{K}$. [1] W. Wang et al., Phys. Rev. Lett. 110, 237601(2013). [2] J. A. Moyer et al., APL MATER. 2, 012106 (2014).

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