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Fluctuation-enhanced magnetoelectric effect in hexagonal manganites[1] YANAN GENG, Department of Physics and Astronomy and Rutgers Center for emergent materials, Rutgers University, Piscataway, NJ 08854 USA, HENA DAS, A.L. WYSOCKI, School of Applied and Engineering Physics, Cornell University, Ithaca, NY, 14853, USA, XUEYUN WANG, S-W. CHEONG, Department of Physics and Astronomy and Rutgers Center for emergent materials, Rutgers University, Piscataway, NJ 08854 USA, M. MOSTOVOY, Zernike Institute for Advanced Materials, University of Groningen, Nijenborgh 4, 9747 AG, Groningen, Netherlands, CRAIG J. FENNIE, School of Applied and Engineering Physics, Cornell University, Ithaca, NY, 14853, USA, WEIDA WU, Department of Physics and Astronomy and Rutgers Center for emergent materials, Rutgers University, Piscataway, NJ 08854 USA — Intensive studies have been focused on enhancing magnetoelectric (ME) effect ever since Dzyaloshinskii and Astrov's seminal works on linear ME effect in Cr_2O_3. The coupling between the magnetic and electric dipoles in multiferroic and magnetoelectric materials holds promise of conceptually new electronic devices. Herein, we report on the Magnetoelectric Force Microscopy (MeFM) studies on the multiferroic hexagonal manganites. The direct visualization of the ME domains with topological vortex pattern provides compelling evidence for the mechanism of lattice-mediated ME response. Furthermore, our MeFM results reveal a diverging magnetoelectric effect in the vicinity of a tri-critical point, suggesting a possibility to enhance ME effects by harnessing critical fluctuations.

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