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Experimental Realization of Artificial Skyrmion Lattices DUSTIN GILBERT, BRIAN MARANVILLE, NIST Center for Neutron Research, ANDREW L. BALK, Center for Nanoscale Science and Technology, NIST, BRIAN J. KIRBY, NIST Center for Neutron Research, PETER FISCHER, Advanced Light Source; Univeristy of California, Santa Cruz, DANIEL T. PIERCE, JOHN UNGURIS, Center for Nanoscale Science and Technology, NIST, JULIE A. BORCHERS, NIST Center for Neutron Research, KAI LIU, University of California, Davis — Magnetic skyrmions exhibit topologically protected states, offering new mechanisms for high density/low dissipation information storage, and also exhibiting a host of unique topological phenomena. In bulk crystals, chiral spin textures are only found in certain systems and in limited regions in the temperature-magnetic field parameter space. We present experimental evidence of room-temperature artificially structured skyrmion lattices fabricated by carefully controlling the three dimensional anisotropy of a Co on Co/Pd hybrid structure. The hybrid structures were fabricated by patterning chirality controlled vortex-state Co nanodot arrays on top of a Co/Pd multilayer with perpendicular anisotropy; chirality control was confirmed by microscopy and magnetometry. The vortex polarity is set by an external magnetic field to manifest the skyrmion state, and confirmed by magnetometry measurements. The chiral structure of the nanodots is imprinted into the Co/Pd underlayer, as revealed by polarized neutron reflectometry and spin-transport studies. These artificial skyrmion lattices offer a convenient platform to explore skyrmion physics. This work has been supported by the NSF (DMR-1008791 and ECCS-1232275).

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