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Macroscopic Artificial Magnetic Honeycomb Lattice of Thermally Controlled Ultra-Small Bonds BROCK SUMMERS, ASHUTOSH DAHAL, Univ of Missouri - Columbia, LISA DEBEER-SCHITT, Oak ridge National Lab , JAGATH GUNASEKERA, DEEPAK SINGH , Univ of Missouri - Columbia — The two-dimensional artificial magnetic honeycomb lattice system is evolving into a new research arena to explore a plethora of novel magnetism that are predicted to occur as functions of temperature and magnetic field: a long-range spin ice, spin liquid, an entropy-driven magnetic charge-ordered state involving topological vortex pairs and a spin-order due to the spin chirality. We have created macroscopic samples of artificial magnetic honeycomb lattices of Cobalt and Permalloy having connected ultra-small elements (bonds), with length scales of sub-10 nm to 30 nm, which have never before been possible. The equivalent energy of the resulting systems is 10-100 K and is thus amenable to both temperature- and field-dependent exploration of novel magnetic phenomena. We have performed detailed magnetic and small angle neutron scattering measurements (SANS) on the newly fabricated honeycomb lattice of Permalloy that show the thermal character of the system. Furthermore, the experimental data reveals the onset of magnetic ordered regimes in temperature that are consistent with the predicted novel phase diagram in artificial honeycomb lattice. Research is supported by U.S. Department of Energy, Office of Basic Energy Sciences under Grant No. DE-SC0014461.

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