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Temperature dependent magnetism and asymmetric current biasing in artificial honeycomb lattice[1] BROCK SUMMERS, Univ of Missouri - Columbia, LISA DEBEER-SCHMITT, Oak Ridge National Lab - Oak Ridge, TN, ASHUTOSH DAHAL, JAGATH GUNASEKERA, PETER KAMPSCHROEDER, DEEPAK SINGH, Univ of Missouri - Columbia — The artificial honeycomb lattice is evolving into a new research arena to explore a plethora of novel magnetism predicted to occur as functions of temperature: a long-range spin ice, a spin liquid, an entropy driven magnetic charge-ordered state due to spin chirality. At low temperatures, the spin correlation is expected to develop into a unique spin solid state with net zero entropy and magnetization for an ordered ensemble of magnetic moments. We have created macroscopic samples of artificial magnetic honeycomb lattices of Permalloy with connected ultra-small bonds, ˜10 nm bar length, which have never before been possible. The equivalent energy of the resulting systems is 10K and is thus amenable to both temperature- and field-dependent exploration of novel magnetic phenomena. We have performed detailed magnetic and electrical measurements that demonstrate the temperature dependent evolution of the magnetic correlation that reaches the spin solid state at low temperature for the first time. The electrical data exhibits an asymmetric current bias at higher temperatures, analogous to the properties of a semiconductor diode. This unique finding can be utilized to create a magnetic transistor and provides a new platform for spintronic applications.

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Brock Summers
Univ of Missouri - Columbia

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