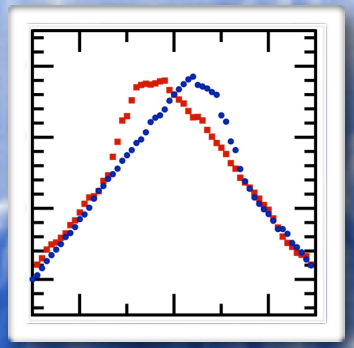
Magnetic-Semiconductor Nanowires

Center for Nanoscale Science, Penn State. DMR-082404
J. Liang, N. Dellas, B. J. Cooley, J. Wang, D. Rench, P. Schiffer, S. Mohney, N. Samarth



Integrating ferromagnetism with semiconductor nanowires is an important step for future-generation information technology, since it provides a pathway for combining computational logic with non-volatile memory at the nanoscale. MRSEC researchers have developed hybrid magnetic-semiconductor nanowires that seamlessly integrate a magnet material, manganese arsenide, with semiconductor nanowires made from gallium arsenide in a multilayered core-shell geometry. Measurements of single nanowires show that they are ferromagnetic (like a bar magnet) at room temperature; previous magnetic semiconductors worked only at much colder temperatures that are less practical for applications. These new nanosystems also show an unusual linear dependence of the resistance on the magnetic field, which could be the first observation of the scattering of electrons from magnetic excitations in a one-dimensional system.

Appl. Phys. Lett. 97, 072505 (2010)