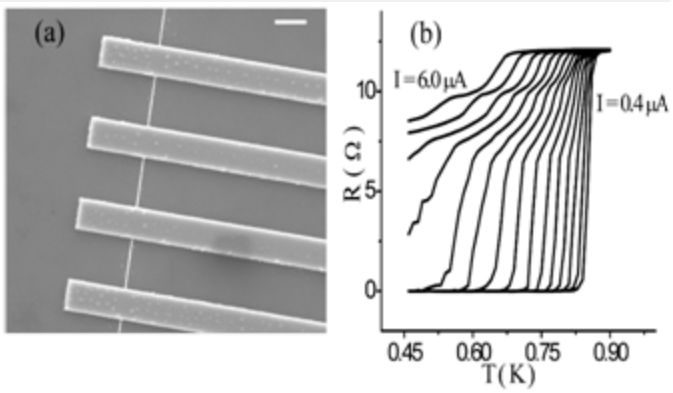
Field-Induced Re-entrant Superconductivity

Allen M. Goldman (PI), Yu Chen, Steven Snyder
School of Physics and Astronomy, University of Minnesota

DESCRIPTION OF WORK

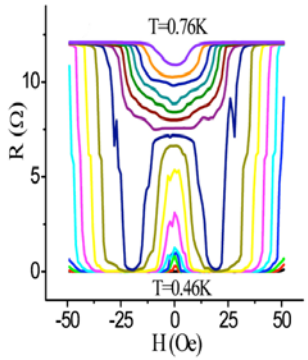
- Fabrication of Zinc nanowires by electron beam lithography and liftoff.
- Measurement of resistance as a function of current below the transition temperature of 0. 85 K.
- Application of Magnetic Field.



(a) SEM image of a typical sample. The white scale bar is 1 μm in length. (b) R(T) at different currents with a spacing of 0.4 μA.

MAJOR OBSERVATIONS

- Wires re-enter the superconducting state upon application of small magnetic fields.
- Detailed investigation of orientation dependence of the effect leads to the conclusion that it is controlled by the effect the magnetic field has on the wide electrodes.
- The effect appears to be associated with the dampening of phase fluctuations by quasiparticles generated in the electrodes.



Magnetic field dependence of the wire resistance at a current of 4.4 μA with temperatures ranging from T = 0.46 K to T= 0.76 K with intervals of 0.02 K. The magnetic field is applied perpendicular to the plane of the structure.

Publications

- "Magnetic Field Induced Superconductivity in Out-of-Equilibrium Nanowires," Yu Chen, S. Snyder, and A. M. Goldman, Phys. Rev. Lett. **103**, 127002 (2009).
- "The Stabilization of Superconductivity by Magnetic Field in Out-of Equilibrium Nanowires," Yu Chen, S. Snyder, and A. M. Goldman, submitted to Phys. Rev. B. (arXiv:1002.2016)