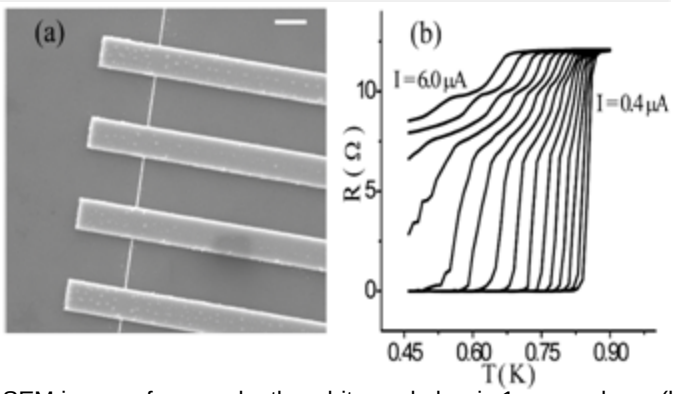
Tunneling and Transport in Nanowires

A. M. Goldman (PI), S. Snyder, Y. Chen
Physics, University of Minnesota

NNIN Facility utilized: Nanofabrication Center & Characterization Facility

Fabrication and Characterization of Superconducting Nanowires

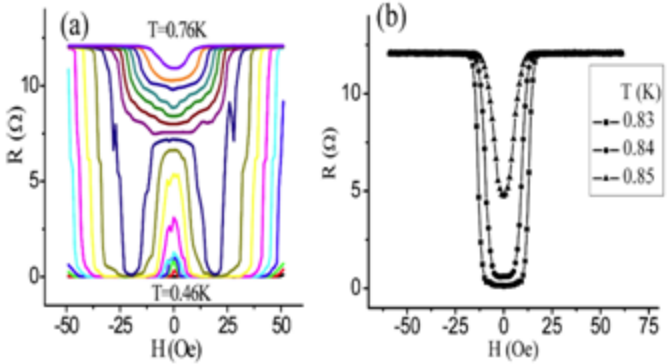
- Zn and Al nanowires were fabricated using electron-beam lithograph
- They were cooled below the transition temperature and driven resistive by the application of current.



(a) SEM image of a sample, the white scale bar is 1 μιχρον long. (b) Temperature dependence of the wire resistance in zero magnetic field with currents ranging from 0.4 microamps to 6.0 microamps in increments of 0.4 microamps.

MAJOR OBSERVATIONS

- Application of a magnetic field restored the superconductivity
- From the angular dependence of the response it is possible to infer that the generation of quasiparticles by the field dampens resistance producing phase fluctuations thus restoring the superconductivity.



a) Magnetic field dependence of wire resistance, at I = 4.4 μιχροαμπσ, with temperatures ranging from 0.46K to 0.76K, every 0.02K. b) Magnetic field dependence of wire resistance, at I = 0.4 microamps, with temperatures ranging from 0.83K to 0.85K, every 0.01K.

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, Yen-Hsiang Lin, S. D. Snyder and A. M. Goldman, Phys. Rev. B **83**, 054505 (2011).