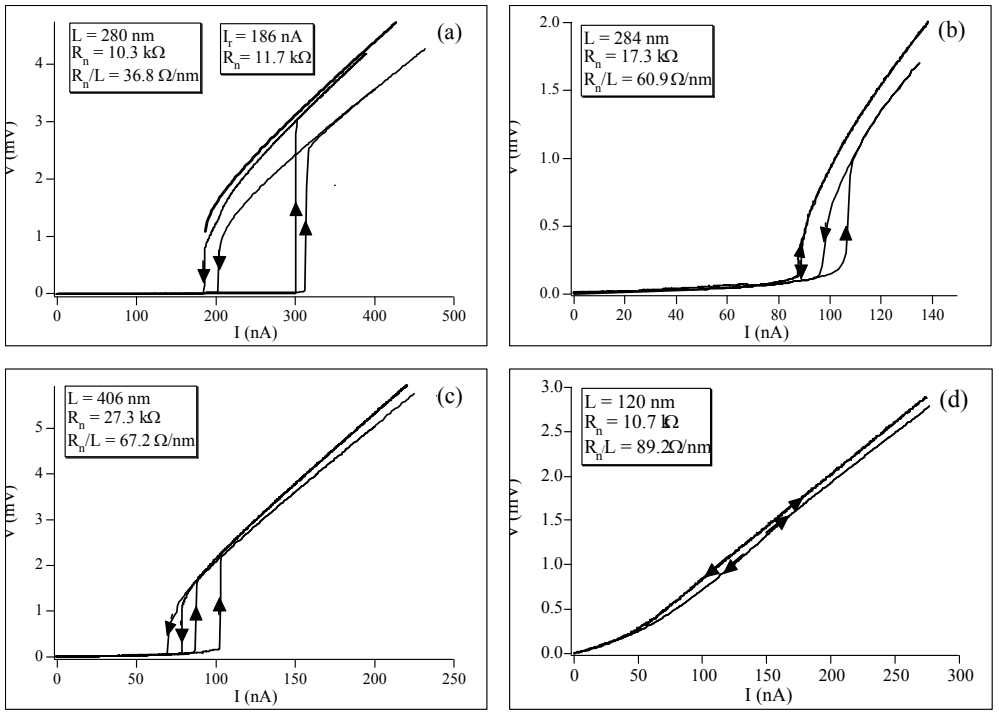
Quantum Resistance in Superconducting Nanowires
M. Tinkham, Harvard University, DMR-0244441

The absence of resistance in superconductors is a unique advantage for development of quantum computers. However, our experiments indicate that wires thinner than ~10nm appear to show some resistance caused by quantum jumps even at very small currents, while thicker wires show hysteresis and dissipation at larger current levels. Our numerical simulations show that our measured size-dependent hysteretic I-V curves can be accounted for by a model that combines microscopic quantum dissipation with classical heat flow along the nanowire. Further work will be required to establish whether these dissipative processes can be avoided in practical designs.



Comparison of measured *I-V* characteristics (solid curve) and simulated (dashed curve) of four representative superconducting nanowires. The dotted curve in (a) is the prediction of an analytic model applicable only to thick wires. [Phys. Rev. B**68**, 134515 (2003)]

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Education and Outreach

Two undergraduates (Blake Johnson [Harvard] and Claudio Lopez [REU student from Roxbury Community College]), two postdocs (Nina Markovic and William Neils), and a professor (John Free) on sabbatical leave from a small liberal arts college (Eastern Nazarene College) contributed to this work during the past year. Markovic has subsequently advanced to an Assistant Professor appointment at the Johns Hopkins University; Johnson is applying to graduate schools; and Lopez is planning to transfer to a 4-year college.

John Free supervising Claudio Lopez in mounting a sample in the He3 system for measurement of quantum resistance in superconducting nanowires.

Luncheon for summer undergraduate researchers from under-represented groups sponsored by the Harvard Foundation for Intercultural Relations (Prof. Tinkham and Claudio Lopez, on right, facing camera).