Superconducting Fluctuations and Phase Slips in Niobium-Nitride Nanowires on Suspended Carbon Nanotubes

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Superconducting nanowires are attractive for the low-dimensional transport study, as well as for future quantum nanodevices, such as single-photon detector and quantum phase-slip qubits. Recently, free-standing carbon nanotubes as nanowire templates for material deposition has been developed.[1] In this report, we present results on the one-dimensional (1D) superconductivity in nanowires produced by coating suspended carbon nanotubes with a Niobium-Nitride (NbN). All electrical transport measurements are carried out at low temperatures from 5 K to 20 K. The wire width $W = 10$ nm nanowire shows the superconductor-insulator transition, and $W = 25$ nm nanowire begins to show the superconducting fluctuation. From the resistance-temperature characteristic curves, the signatures of the 1D superconductivity with phase-slip events are observed in $W \geq 25$ nm nanowires.
At the Conference, we will report the details of the fabrication and transport characteristics of ultrathin NbN nanowires on suspended carbon nanotubes.

1. Bezryadin, A., Lau, C. N., and Tinkham, M. (2000). "Quantum suppression of superconductivity in ultrathin nanowires". Nature vol. 404, pp. 971-974.

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