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Zero-bias anomalies in multi-section carbon nanotube FETs[1]
YANFEI YANG, GEORGY FEDOROV, Department of Physics, Georgetown University, SERHII SHAFRANIUK, Department of Physics and Astronomy, Northwestern University, RUPERT LEWIS, BENJAMIN COOPER, CHRISTOPHER LOBB, Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland, PAOLA BARBARA, Department of Physics, Georgetown University — Carbon nanotube field effect transistors (CNFETs) with high transparency contacts show maxima of differential conductance at zero bias voltage [1]. These zero-bias anomalies (ZBAs) occur at large negative gate voltages and in narrow gate voltage ranges (about 1 V wide). Our proposed explanation is superconductivity in the nanotubes, occurring when the gate voltage shifts the Fermi energy into van Hove singularities of the electronic density of states. Here we probe this scenario using 3 FETs fabricated from different sections of one semiconducting carbon nanotube. Source and drain electrodes were patterned by e-beam lithography to achieve FET lengths of 500 nm, 1500 nm and 7000 nm, respectively. All devices showed high transparency contacts to their Pd electrodes. We report the observation of pronounced ZBAs in the multi-section CNFETs, their magnetic field (up to 7 T) and temperature evolution, and the modulation on the ZBAs by Fabry-Perot oscillation. [1] J. Zhang et al., Zero-bias anomaly and possible superconductivity in single-walled carbon nanotubes, Phys. Rev. B, 74, 155414 (2006).

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