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Probing Scattering in Single-Walled Carbon Nanotubes

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Transport measurements and atomic force microscopy were used to study electron scattering rates in metallic single-walled carbon nanotubes. From scaling of the resistance of the same nanotube with length in the low and high bias regimes, the mean free paths for both regimes are inferred. The observed scattering rates are consistent with calculations for acoustic phonon scattering at low biases and zone boundary/optical phonon scattering at high biases. We have also developed techniques to probe the high frequency transport properties of nanotube transistors. We have used the nanotube transistor as a microwave mixer operating at frequencies up to 50 GHz. The long-term goal is to directly measure the fundamental excitations and scattering rates. The author would like to acknowledge Ji-Yong Park, Yuval Yaish, Vera Sazonova, Xinjian Zhou, Hao Lin, Hande Ustunel, Stephan Braig, T.A. Arias, Piet W. Brower, Sandip Tiwari and Paul L. McEuen of Cornell University for their contributions to this work.