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High frequency properties of individual metallic carbon nanotubes[1]

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We study the electrical and electrothermal dynamics of individual metallic single-walled carbon nanotubes (SWNT). Using Johnson noise thermometry, we characterize the dependence of the electron temperature on the dc bias current. This allows us to determine the thermal conductance associated with cooling of the nanotube electron system as a function of both temperature and nanotube length [1]. This thermal conductance can be used to predict the measured radio frequency (rf) bolometric response. At low temperatures and low bias current, an additional rf response is observed from the (non-thermal) electrical nonlinearity of the contacts [2]. Finally, we compare these rf measurements with measurements of terahertz (THz) detection. The THz measurements are used as a probe of plasmon standing wave resonances on the SWNT.

[1] D.F. Santavicca, J.D. Chudow, D.E. Prober, M.S. Purewal, and P. Kim, Nano Lett. 10, 4538 (2010).
[2] D.F. Santavicca, J.D. Chudow, D.E. Prober, M.S. Purewal, and P. Kim, Appl. Phys. Lett. 98, 223503 (2011).

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