Abstract Submitted
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Length-dependent optical properties of single-walled carbon nanotubes[1] J. R. SIMPSON[2], J. A. FAGAN, B. J. BAUER, E. K. HOBBIE, A. R. HIGHT WALKER, NIST, Gaithersburg, MD 20899 — Length proves to be an important physical characteristic of single-walled carbon nanotubes (SWCNTs) strongly affecting optical absorption, photoluminescence, and resonance Raman spectroscopies.[3] Our samples include HiPco, CoMoCat, and arc-discharge SWCNTs dispersed in aqueous solutions by wrapping with either DNA or surfactant and exhibiting an exceptionally low degree of SWCNT bundling/clustering. Size-exclusion chromatography or density sorting ultracentrifugation collect length fractions ranging in size from approximately 50 nm to 1000 nm. The optical spectral weight specific to the SWCNT electronic states and photoluminescence peak emission intensity, compared to their underlying backgrounds, scale approximately linearly with length. All observed Raman vibrational modes exhibit a monotonic increase of scattering intensity with nanotube length. Resonance Raman of the radial breathing mode reveals a blueshift of the excitation energy for shorter nanotubes. Localization of bound excitons along the nanotube may explain the observed length-dependent optical properties.

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[2]Present address: Towson University, Towson, MD 21252
[3]J. A. Fagan *et al.*, J. Am. Chem. Soc. **129**, 10607 (2007).

Jeff Simpson
National Institute of Standards and Technology

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