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Quantum Interference Between the Third and Fourth Excitonic States in Semiconducting Carbon Nanotubes HAGEN TELG, JUAN G. DUQUE, Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Los Alamos, NM 87545, USA, HANG CHEN, ANNA K. SWAN, Department of Electrical and Computer Engineering, and Photonics Center, Boston University, Boston, MA 02215, U.S.A., XIAOMIN TU, MING ZHENG, Polymers Division, National Institute of Standards and Technology, 100 Bureau Drive, Gaithersburg, MD 20899-8540, U.S.A., ANDREW P. SHREVE, STEPHEN K. DOORN, Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Los Alamos, NM 87545, USA — We exploit an energy level cross-over effect[1] to probe quantum interference in the resonance Raman response from carbon nanotube samples highly enriched in the single semiconducting chiralities of (8,6), (9,4), and (10,5). UV Raman excitation profiles of G-band spectra reveal unambiguous signatures of interference between the third and fourth excitonic states (E33 and E44). Both constructive and destructive responses are observed and lead to anomalous intensity ratios in the LO and TO modes. Especially large anomalies for the (10,5) structure result from nearly identical energies found for the two Eii transitions. The interference patterns demonstrate that the sign of the exciton-phonon coupling matrix elements changes for the LO mode between the two electronic states, and remains the same for the TO mode. Significant non-Condon contributions to the Raman response are also found.[2]

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[1]Hároz, E. H. *et al.*; *Phys. Rev. B.* **2008**, *77*, 125405
[2]Duque, J. G. *et al.*; *ACS Nano* **2011**, *5*, 5233–41

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