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Excitons and High-Order Optical Transitions in Individual Carbon Nanotubes STEPHANE BERCIAUD, Columbia University, New York NY 10027, CHRISTOPHE VOISIN, Ecole Normale Supérieure, Paris, HUGEN YAN, BHUPESH CHANDRA, ROBERT CALDWELL, YUYAO SHAN, LOUIS E. BRUS, JAMES HONE, TONY F. HEINZ, Columbia University, New York NY 10027 — We address the issue of the excitonic nature of high-lying optical transitions in single-walled carbon nanotubes (SWNTs) by means of Rayleigh scattering spectroscopy of freely suspended individual nanotubes. A careful analysis of the E33 and E44 transitions in semiconducting and the M22 transitions in metallic nanotubes reveals that in both cases the lineshape is consistent with an excitonic model, but not with one involving free carriers. For semiconducting species, sidebands are observed at ∼200 meV above the main electronic transitions. These features are ascribed to exciton-phonon bound states. Such sidebands are barely visible for metallic nanotubes, as expected from the reduced strength of excitonic interactions in these systems. These findings [1] shed light on the nature of high-order optical transitions in SWNTS [2] and the strength of exciton-phonon coupling in metallic SWNTs [3,4]. **References:** [1] S. Berciaud *et al.,* submitted (2009) [2] P.T. Araujo *et al.*, PRL **98**, 067401 (2007) [3] H. Zeng et al., PRL **102**, 136406 (2009) [4] S. Berciaud *et al.,* Nano Lett. **7** 1203 (2007)

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