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Optical Spectroscopy of individual Single-Walled Carbon Nanotubes of Defined Chiral Structure MATTHEW SFEIR, Columbia University, TOBIAS BEETZ, Brookhaven National Lab, FENG WANG, LIMIN HUANG, X.M. HENRY HUANG, JAMES HONE, STEPHEN O'BRIEN, Columbia University, JAMES MISEWICH, Brookhaven National Lab, TONY HEINZ, Columbia University, YIMEI ZHU, Brookhaven National Lab, LOUIS BRUS, Columbia University — Single-walled carbon nanotubes (SWNTs) constitute of a family of nanostructures with over one hundred members. Each specific structure has distinct electronic and optical properties, varying from semiconducting to metallic. Here we study the correlation between electronic structure and physical structure in SWNTs by combing high-sensitivity Rayleigh spectroscopy and electron diffraction techniques. Simultaneous application of these experimental techniques on individual SWNTs allows for measurement of electronic transitions in tubes of fully and independently determined structure. In this manner, we directly verify the "family behavior" that has guided previous spectroscopic assignment of optical transitions in semiconducting SWNTs. We also demonstrate the previously unobserved, but theoretically predicted splitting of optical transitions in metallic SWNTs.

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