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Optical Spectroscopy of Individual Single-Walled Carbon Nanotubes

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Single-walled carbon nanotubes (SWCNTs) constitute a fascinating class of 1-dimensional materials. While the electrical, thermal, and mechanical properties of SWCNTs have been studied in depth for some time, only recently have their optical properties emerged as a major topic of research. This interest reflects several factors: The importance of nanotube optical properties for analysis of their structure, quality, and growth; the potential of nanotubes for diverse optoelectronic applications; and the unique physics of the excited states and dynamical processes in these 1-D structures. In this paper we will present an overview of our current understanding of excited electronic states in nanotubes and of the methods and applications of single-molecule optical spectroscopy of carbon nanotubes. We will present recent results on optical spectroscopy of individual carbon nanotubes as perturbed by their external environment, including by the application of strain and deposition of adsorbates. These studies were carried out in collaboration with the research groups of Profs. Louis Brus, Jim Hone, and Stephen O'Brien at Columbia and Prof. Feng Wang at UC Berkeley.