# Polarized photoluminescence excitation spectroscopy of single-walled carbon nanotubes in VIS - UV range

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Recently there has been considerable interest in the optical properties of single-walled carbon nanotubes (SWNTs) as one of the ideal quasi one-dimensional systems. Due to their one-dimensionality, the optical responses of SWNTs are strongly dependent on the polarization direction of the incident light with respect to the SWNT axis.

In this report, we present that distinct absorption peaks can be observed in the photoluminescence excitation (PLE) spectra in VIS range for the polarization perpendicular to the SWNT axis [1], although the perpendicular excitation has been considered to be strongly suppressed due to the induced self-consistent local field (depolarization effect [2]). Furthermore, using a procedure to determine the fractional contribution of parallel and perpendicular absorption and emission dipoles [3], the PLE spectra are decomposed into 'pure' components for parallel and perpendicularly polarized excitations. The observed transition energies for perpendicular excitation was considerably higher than theoretical predictions within a single particle theory. This discrepancy is discussed with the excitonic effect along with some available theoretical works [4, 5].

In addition to the measurement for VIS range, we have studied polarized PLE spectra for UV range. As shown in Fig.1, we found that there exist small, but nonzero intensity tails above the distinct peaks for perpendicular excitation, and the PL intensities corresponding to the perpendicular excitation were even comparable to those for the parallel excitation in a certain energy region in near UV range. This result indicates that one can not neglect the contribution of perpendicular excitations in optical measurements of SWNTs for VIS to UV range.

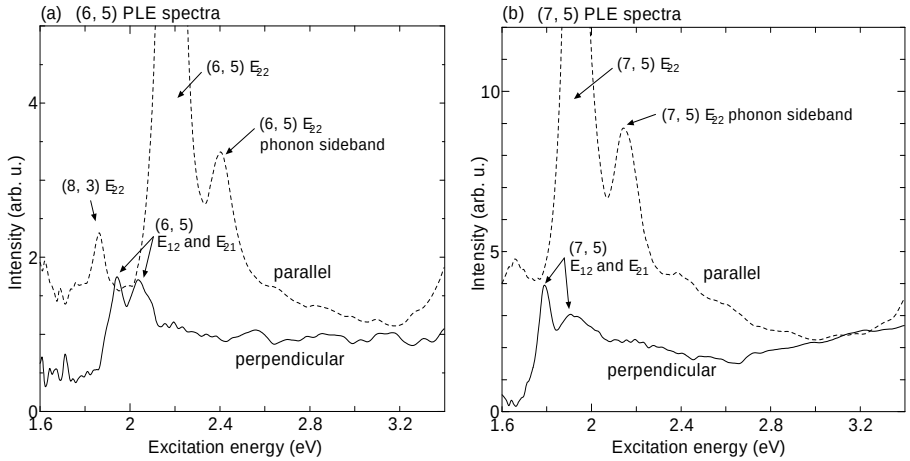


Fig. 1: Decomposed PLE spectra of (a) (6, 5) and (b) (7, 5) SWNTs for parallel (dotted line) and perpendicular (solid line) excitations. PLE spectra were measured along PL emission energies of 1.268 eV and 1.210 eV for (6, 5) and (7, 5) SWNTs, respectively.

**References**

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