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Exciton diffusion and related decay processes in individual air-suspended carbon nanotubes

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We investigate exciton diffusion, end quenching, and exciton-exciton annihilation processes in individual air-suspended carbon nanotubes by photoluminescence microscopy [1]. We have performed excitation spectroscopy on thousands of nanotubes to identify their chiralities and filter out bundles. In such a large dataset, we observe slightly redshifted satellite peaks which suggest the existence of single chirality bundles. Intrinsic exciton diffusion lengths for six different chiralities are obtained by analyzing the length dependence of emission intensity with a random walk theory [2,3]. We also estimate absorption cross sections by comparing the power dependence with Monte Carlo simulations, and inspired by the agreement, we have obtained an analytical expression that reflects the one-dimensional nature of exciton diffusion.

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