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Non-radiative Exciton Decay in Single-walled Carbon Nanotubes

MARK HARRAH, ANNA SWAN, Boston University — Experiments have shown step-wise changes in the fluorescence intensity from single-walled carbon nanotubes [1,2]. It has been proposed that the underlying mechanism for the step-wise changes is diffusion-limited quenching of excitons at defects [1]. This property has been used to demonstrate single-molecule detection for biological applications [3]. We perform a Monte-Carlo simulation of nanotube fluorescence with a diffusion-limited quenching model. The fluorescence intensity is seen to depend on the mean-square distance between defects, implying a nonlinear dependence on the number of defects. The intensity for consecutive defect counts can overlap depending on the positions of the defects.

[1] Cognet, L. et al. Science 316, 1465-1468 (2007).
[2] Jin, H. et al. Nano Lett. 8, 4299-4304 (2008).
[3] Heller, D. A. et al. Nature Nanotech. 4, 114-120 (2009).

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