Spectroscopy of localized excitons in cryogenic carbon nanotubes

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Semiconducting single-wall carbon nanotubes feature exciton localization by unintentional disorder or chemically tailored potential traps with peculiar consequences for their photophysical properties including non-classical light emission statistics [1] up to room temperatures [2,3]. In our most recent experiments, we used cryogenic photoluminescence spectroscopy to study (i) unintentionally localized excitons exhibiting interactions with the electrostatic environment via their permanent dipole moment [4,5] and (ii) the competition for the photogenerated population between discrete excitonic states of chemically engineered sp3-defect traps [6]. Our results shed light on internal and external parameters of localized carbon nanotube excitons with implications for their potential applications as single-photon sources and all-optical electrometers.

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