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Tuning photo-carrier lifetimes by the atomic structure and environment of single-walled carbon nanotubes

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Carrier relaxation in single-walled carbon nanotubes depends on their chirality, the tube's atomic structure. Excitons decay by interacting with phonons in most tubes, but a fast electron-electron channel becomes available in a subset of tubes. Carrier relaxation at the band gap depends on the tube's environment, with an order of magnitude difference between isolated (10-100 ps) and bundled tubes (1 ps). In this talk we discuss carrier relaxation in carbon nanotubes after photoexcitation. Our results explain the varying luminescence intensity in nanotubes and why nanotube bundles do not emit light. We estimate nanotube abundances from luminescence and discuss our concepts in view of non-linear optical devices made from single-walled carbon nanotubes.