Abstract Submitted
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Exciton Annihilation Processes in Individual Single-Wall Nanotubes[1] ADITYA MOHITE, PRASANTH GOPINATH, HEMANT SHAH, BHASKAR NAGABHIRAVA, TANESH BANSAL, BRUCE ALPHENAAR, University of Louisville — Field enhanced photocurrent measurements of individual single-wall nanotubes show that bound exciton dissociation occurs through two distinct processes. At low fields, the barrier to field ionization is not surmounted but bound carriers can still dissociate by tunneling into the free carrier states. At high fields (approximated by the binding energy divided by the Bohr radius, or,E_b/r) the bound excitonic state is destroyed. We measure the photocurrent of a SWNT capacitor, in which the nanotubes lie on a 100 nm oxide dielectric on doped silicon substrate. This allows us to apply extremely large electric fields across the nanotube. Excitons do not contribute to the photocurrent unless dissociation into free carrier states occurs. At fields below $1 \times 10^8 V/m$ the exciton peak increases according to Fowler-Nordheim field dependence. At a field of approximately $1.2 \times 10^8 V/m$the photocurrent rapidly increases by more than an order of magnitude suggesting a huge increase in the exciton dissociation rate. This corresponds to the predicted field required for exciton annihilation to occur.

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