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Activating Dark Excitons on Carbon Nanotubes with Electric Fields J.M. KINDER, D. ZHABINSKAYA, E.J. MELE, University of Pennsylvania — The valley degeneracy of the singlet excitons on a semiconducting carbon nanotube is lifted by Coulomb backscattering which produces two intervalley superposition states: a bright optically allowed singlet exciton, and a dark (dipole forbidden) singlet exciton at lower energy. We study theoretically the perturbations to this spectrum due to a longitudinal static electric field. We find the electric field transfers oscillator strength from the bright to the dark singlet states and activates the lower energy state in the fluorescence spectrum for modest values of the field strength. Modelling the K and K' point excitons as a two state system, we find that the field induces a complex phase in the intervalley scattering amplitude, which in turn renders the dark state optically active. We study the dependence of this effect on the chiral angle of the tube and further analyze other field configurations that can coherently manipulate the intervalley superposition states produced in this system.

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