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Possible electric-field induced one dimensional excitonic insulators in carbon nanotubes pairs[1] JAY SAU, University of California Berkeley and MSD Lawrence Berkeley National Laboratory , MARVIN COHEN, University of California, Berkeley and MSD, Lawrence Berkeley National Laboratory — Recently there has been significant interest in the possibility of realizing excitonic insulator states in semiconducting systems in electric fields. Using a tight-binding formulation of the GW and Bethe-Salpeter methods parametrized from first-principles density functional theory calculations, we show that an electric field strength of 0.06 eV/Å fails to close the quasiparticle gap of the system but closes the excitonic gap. This can cause a phase transition of the system into an excitonic phase where the ground state is populated with a quasi-one dimensional repulsive gas of excitons. Such a state provides a realization of a one-dimensional excitonic insulator phase with a spin degree of freedom which can lead to novel phases. We discuss some of the properties of the resulting excitonic phase and the transition and also discuss how similar properties may be observed in experiments on nanotube bundles.

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