Enhanced Many-Electron Effects in Gated Bilayer Graphene

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Our first-principles GW-Bethe-Salpeter Equation (BSE) simulation reveals that many-electrons effects are crucial to decide the electronic structure and optical excitations of gated bilayer graphene (GBLG), a two-dimensional narrow-gap semiconductor. Enhanced electron-electron interactions dramatically enlarge the quasiparticle band gap; the infrared optical absorption spectra are dictated by a bright bound exciton, which well explains recent experiments. Moreover, our calculation predicts an unusual low-energy dark exciton whose electron and hole are condensed onto two graphene layers, respectively, providing a neat object to study entangling effects of electron-hole pairs. Since all aforementioned many-electron effects can be efficiently tuned by the applied gate field, our calculation paves the foundation for optoelectronic applications based on GBLG.

[1] E. V. Castro *et al.*, Phys. Rev. Lett. **99**, 216802 (2007).

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