Trivial and topological confinements in bilayer graphene

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We discuss and compare two different types of confinement in bilayer graphene by top and bottom gating with symmetrical microelectrodes. Trivial confinement corresponds to the same potential of all top gates, which is opposed to that of all bottom ones. Topological confinement requires the polarity of part of the top-bottom pairs of gates to be reversed. We show that the main qualitative difference between trivial and topological bound states manifests itself in the magnetic field dependence. We illustrate our finding with an explicit calculation of the energy spectrum for quantum dots and rings. Trivial confinement shows bunching of levels into degenerate Landau bands, with a non-centered gap, while topological confinement shows no field-induced gap and a sequence of state branches always crossing zero-energy [1-3].

The conductance of electrostatic wire junctions in bilayer graphene is calculated next. We report a conductance quench of the trivial-topological junction, with a conductance near quantization to $4e^2/h$, which is only half of the maximum value allowed by the Chern number of a kink-antikink system. The analysis allowed us to uncover the existence of a chiral edge mode in the trivial wire under quite general conditions. A double junction, trivial-topological-trivial, displays periodic Fano-like conductance resonances (dips or peaks) induced by the created topological loop [4].

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