Topological confinement and geometry dependence in bilayer graphene

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Abstract

We investigate in this work a study of topological confinement of electrons in bilayer graphene material. We discuss the case of topological loops with different shapes. These loops are created by lateral gates acting via gap inversion on the two graphene sheets. We consider loops of higher to lower symmetry (circle, square, rectangle, and irregular polygon). For a small-size loop, we found that the spectrum depends on the loop shape. By applying a perpendicular magnetic field, the spectrum shows valley splitting of the states and the emergence of persistent currents.

References

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Figures

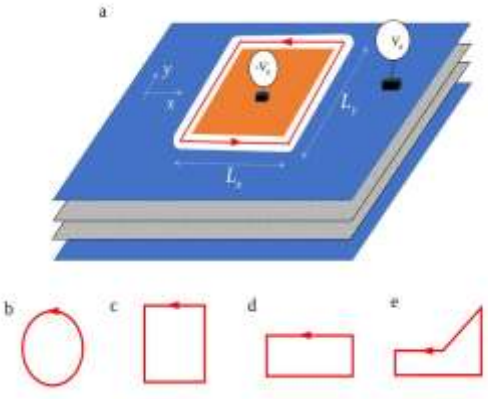

Figure 1: a) Scheme of a topological loop showing the BLG sheets (gray) and lateral gates with the applied gate potentials ±Va (orange and blue, respectively). Two identical lower gates, hidden behind the lower graphene sheet, have the opposite potentials of the corresponding top gates. The white 1D region between orange and blue gates hosts the topological loop state on the graphene sheets, with counterpropagation for the two valleys. A red arrow is indicating the circulation for only one of the two valleys. (b)–(e) Loop shapes considered in this work, from highest to lowest symmetry: circle, square, rectangle and irregular polygon.