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Current flow and symmetry breaking in biased bilayer graphene

CARLOS PAEZ, UNICAMP-Univ de Campinas, DARIO BAHAMON, Graphene research center, ANA PEREIRA, UNICAMP-Univ de Campinas — A remarkable interest about bilayer graphene (BLG) is the possibility of opening a band gap and controlling its size when an electric field is applied between the layers. Many electronic devices based on these systems have been proposed, which involve usually the ability to control the layer degree of freedom, i.e., to explore the charge density asymmetry between layers induced by the bias. We investigate the transport properties along a biased BLG nanoribbon with zigzag edges, focusing on the current flow. We use a recursive Green's function method, and compare the charge density distribution in each layer with the current flow. The electric field breaks not only the layer symmetry but also the sublattice symmetry. Our results show that the current does not necessarily flow in the regions of the system with higher charge density. We show that current can flow mainly through one layer while the charge density is localized mainly over one of the edges of the other layer. We show results as a function of energy around Fermi energy and electric field, elucidating the main role of sublattice on the current flow.

Carlos Paez
UNICAMP-Univ de Campinas

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