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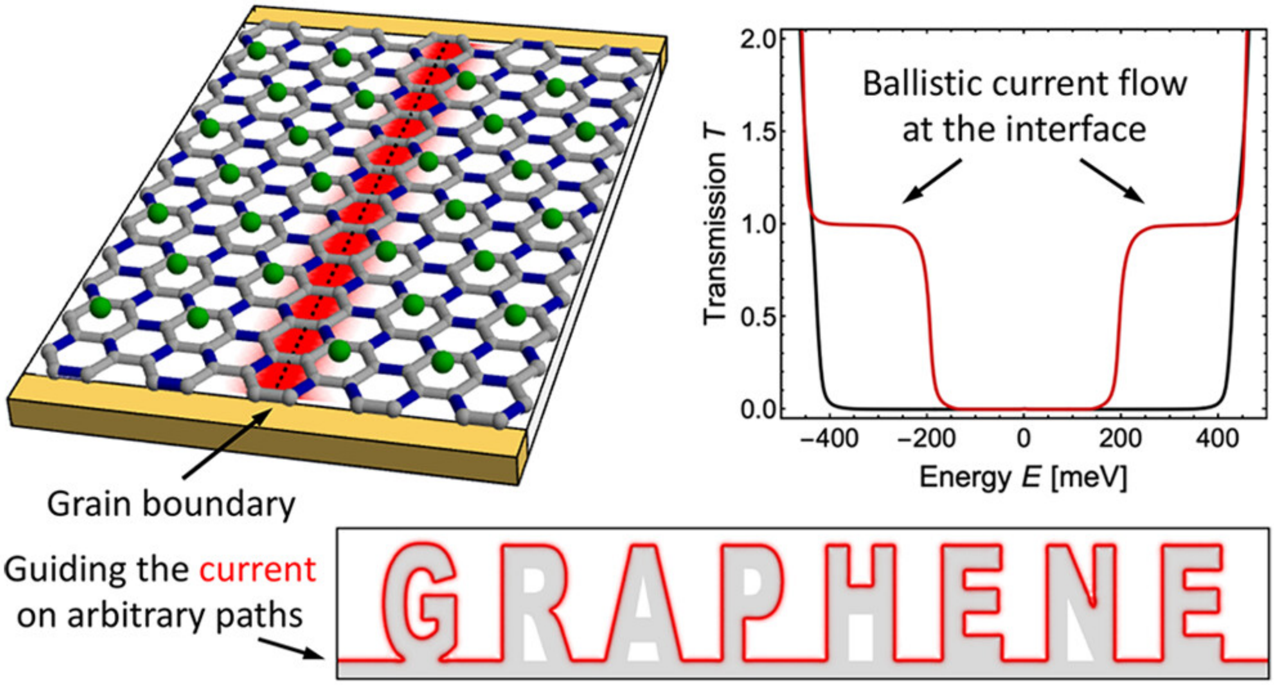
Controlling the current flow in graphene: solitons by Kekulé-O distortions and edge states in TBLG

Prof. Dr. Thomas Stegmann

Universidad Nacional Autónoma de México, Cuernavaca



We present some strategies to control the electronic current flow in graphene. In the first part of the talk, we demonstrate how the engineering of Kekulé-O distortions can be used to guide the current on atomically thin pathways. A grain boundary in these distortions separates the system into topologically distinct regions and induces a ballistic domain-wall state. The state is independent of the orientation of the grain boundary with respect to the graphene lattice and permits guiding the current on arbitrary paths. Our findings are explained by a generalization of the Jackiw-Rebbi model. An atomic model supported by DFT calculations demonstrates that the system can be realized by decorating graphene with Ti atoms. In the second part of the talk, we discuss the current flow in twisted bilayer graphene (TBLG) at a twist angle of 1.689°. Using a combination of Molecular Dynamics and Tight-binding calculations, we find two superlattice gaps in the energy spectrum of the bulk that emerge close to the Fermi level from the atomic rearrangement of the carbon atoms. Nanoribbons made of 1.689°-TBLG show edge localized states within the superlattice gaps that carry current bidirectional through the system.