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Topologically protected states at stacking boundaries in bilayer graphene MARTA PELC, Donostia Intl Phys Ctr and Centro de Física de Materiales, CFM-MPC CSIC-UPV/EHU, San Sebastian, Spain, WLODZIMIERZ JASKÓLSKI, Institute of Physics, Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University, Toruń, Poland, LEONOR CHICO, Instituto de Ciencia de Materiales de Madrid (ICMM), Consejo Superior de Investigaciones Científicas (CSIC), Madrid, Spain, ANDRES AYUELA, Donostia Intl Phys Ctr and Centro de Física de Materiales, CFM-MPC CSIC-UPV/EHU, San Sebastian, Spain
— Recent experiments [Nature 520, 650 (2010)] confirm the existence of gapless states at domain walls created in gated bilayer graphene with the stacking change from AB to BA. The significance of these states is due to their topological protection, valley-polarization and contribution to conductance along the domain wall [Phys. Rev. B 92, 085433 (2015)]. Current theoretical models predict the appearance of such states only at domain walls which preserve the sublattice order. We show that the appearance of the topologically protected states in stacking domain walls can be much more common in bilayer graphene, since they can also emerge at grain boundaries with atomic-scale topological defects. We focus on a bilayer system in which one of the layers contains a line of octagondouble pentagon defects that mix graphene sublattices [Nanoscale 8, 6079 (2016)]. We demonstrate that gap states are not only preserved, but also, their number changes by inverting the gate polarization, yielding an asymmetric conductance along the grain boundary under gate reversal. This effect should be detectable in transport measurements and could be exploited in electrical switches.

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