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Localized states at zigzag edges of graphene multilayers and graphite steps EDUARDO V. CASTRO, J.M.B. LOPES DOS SANTOS, CFP and Departamento de Fisica, Faculdade de Ciencias Universidade do Porto, Portugal, N.M.R. PERES, Center of Physics and Departamento de Fisica, Universidade do Minho, Portugal, F. GUINEA, Instituto de Ciencia de Materiales de Madrid, CSIC, Cantoblanco, Spain, A. H. CASTRO NETO, Department of Physics, Boston University, USA — Among the uncommon features of graphene monolayer we find the presence of zero energy states localized at zigzag edges, leading to the self-doping phenomenon and inducing edge magnetization. Here we report the existence of zero energy surface states localized at zigzag edges of bilayer graphene and stacks with any number of layers. Working within the tight-binding approximation we derive an analytic solution for the wavefunctions of these peculiar surface states. It is shown that zero energy edge states in bilayer graphene can be divided into two families: (i) states living only on a single plane, equivalent to surface states in monolayer graphene; (ii) states with finite amplitude over the two layers, with an enhanced penetration into the bulk. The effect of edge states on the electronic structure and magnetic order of bilayer graphene nanoribbons is also studied. We show that edge states measured through scanning tunneling microscopy and spectroscopy of graphite step edges belong to family (i) or (ii) mentioned above, depending on the way the top layer is cut.

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