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Stacking defects and transport in bilayer graphene[1]

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Pristine bilayer graphene behaves in some instances as an insulator with a transport gap of a few meV. Intriguingly, however, some samples of similar mobility exhibit good metallic properties, with a minimal conductivity of the order of $2e^2/\hbar$. Here we propose an explanation for this dichotomy, which is unrelated to electron interactions and based on the reversible formation of boundaries between stacking domains ("solitons"). We argue, using a numerical analysis, that the hallmark features of the previously inferred insulating state can be explained by scattering on boundaries between domains with different stacking order (AB and BA). We furthermore present experimental evidence, reinforcing our interpretation, of reversible switching between a metallic and an insulating regime in suspended bilayers when subjected to thermal cycling or high current annealing.

[1]work done in collaboration with P. San-Jose, R. V. Gorbachev, K. S. Novoselov, and A. K. Geim