Controlling Energy Gap of Bilayer Graphene by Strain

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Using the first principles calculations, we show that mechanically tunable electronic energy gap is realizable in bilayer graphene if different homogeneous strains are applied to the two layers. It is shown that the size of the energy gap can be simply controlled by adjusting the strength and direction of these strains. We also show that the effect originates from the occurrence of strain-induced pseudoscalar potentials in graphene. When homogeneous strains with different strengths are applied to each layer of bilayer graphene, transverse electric fields across the two layers can be generated without any external electronic sources, thereby opening an energy gap. The results demonstrate a simple mechanical method of realizing pseudoelectromagnetism in graphene and suggest a maneuverable approach to fabrication of electromechanical devices based on bilayer graphene.