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Dynamical Energy Gap Engineering in Graphene via an Oscillating Deformation DAWEI ZHAI, NANCY SANDLER, Department of Physics, Ohio University — Graphene is a fascinating material with various unusual electronic, mechanical and optical properties. One of its most intriguing aspects is the close relation between the electronic properties and mechanical deformations. Interestingly, the effects of deformations can be understood in terms of pseudo-magnetic fields, whose spatial distribution and intensity could be tuned via elaborate mechanical engineering. Previous results have shown that electromagnetic fields (lasers) can induce dynamical gaps in graphenes energy bands, transforming graphene from a semimetal to a semiconductor. However, the laser frequencies required to achieve these effects are in the THz regime, which imposes strong limitations for practical purposes. The aim of our study is to investigate whether dynamical energy gaps can be achieved with pseudo-electromagnetic fields via oscillating mechanical deformations. We show the existence of a dynamical gap in the energy band structure whose energy position is determined by the frequency of the oscillation, while its magnitude can be tuned by the geometry of the deformation. Because graphene flakes are relatively easier to deform, this dynamical-mechanical manipulation strategy appears as a promising venue to engineer electronic properties of graphene devices.

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