Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Dynamical Energy Gap Engineering in Graphene via Oscillating Out-of-Plane Deformations[1] NANCY SANDLER, DAWEI ZHAI, Department of Physics and Astronomy, Ohio University — The close relation between electronic properties and mechanical deformations in graphene has been the topic of active research in recent years. Interestingly, the effect of deformations on electronic properties can be understood in terms of pseudo-magnetic fields, whose spatial distribution and intensity are controllable via the deformation geometry. Previous results showed that electromagnetic fields (light) have the potential to induce dynamical gaps in graphenes energy bands, transforming graphene from a semimetal to a semiconductor [1, 2]. However, laser frequencies required to achieve these regimes are in the THz regime, which imposes challenges for practical purposes. In this talk we report a novel method to create dynamical gaps using oscillating mechanical deformations, i.e., via time-dependent pseudo-magnetic fields. Using the Floquet formalism we show the existence of a dynamical gap in the band structure at energies set by the frequency of the oscillation, and with a magnitude tuned by the geometry of the deformation. This dynamical-mechanical manipulation strategy appears as a promising venue to engineer electronic properties of suspended graphene devices. [1] Syzranov et al. Phys. Rev. B 78, 045407 (2008). [2] Oka et al. Phys. Rev. B 79, 081406(R) (2009).

[1]Work supported by NSF-DMR 1508325.

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Date submitted: 06 Nov 2015 Electronic form version 1.4