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Adatom Ordering and Tunable Band Gap in Graphene ANDREY SHYTOV, Exeter, D.A. ABANIN, Princeton, L.S. LEVITOV, MIT — The unique electronic properties of graphene make it an attractive candidate for future nano-electronics applicaitons. However, the gapless semi-metallic character of graphene band structure is a major obstacle for graphene electronics. This talk will describe a proposal to use controlled chemical adsorption of adatoms or molecules similar to that employed in a recent work on hydrogenated graphene[1], as a tool to open a band gap in this material. The gap is induced by Bragg scattering on a modulation resulting from adatom ordering. By comparing electron-mediated interactions[2] of different adatom configurations as a function of graphene doping, we find that a state can be realized in which adatoms reside on one of the two graphene sublattices. In such a state, owing to sublattice symmetry breaking, Dirac fermions acquire a band gap, which scales as a square root of adatom concentration. For realistic system parameters, we find that sublattice ordering can take place at temperatures as high as few hundred Kelvin. Our findings show that adatom adsorption provides a way to create a new semiconducting form of graphene with a tunable band gap.

[1]D. C. Elias et al., Science **323**, 610 (2009)
[2]A. V. Shytov, D. A. Abanin, L. S. Levitov, Phys. Rev. Lett. **103**, 016806 (2009), and to be published

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