Team calculates the role of buried layers in few-layer epitaxial graphene

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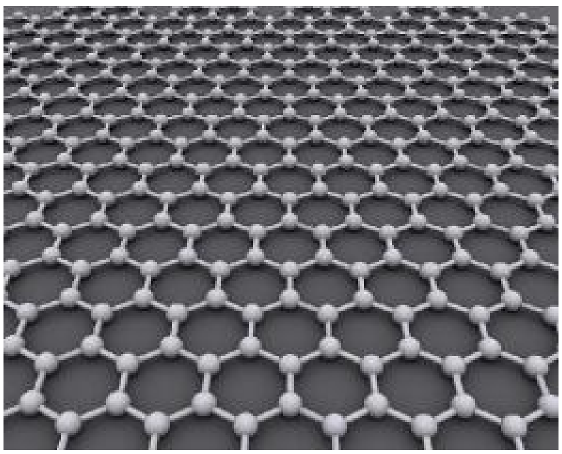

Made of a single sheet of carbon atoms, graphene can be spun at the fastest rate of any known macroscopic object. Image credit: Wikimedia Commons.

A CNST-led collaboration with the University of Maryland and the University of Texas has computed how electrostatic interactions between electrons in different layers of few-layer graphene affect the properties of the top layer [1].

Since graphene was first extracted from bulk graphite in 2004, it has been at the center of remarkable scientific advances and technological development.

A particularly promising material is graphene grown on the surface of

SiC crystals by sublimation of Si from the substrate, which typically grows in few-layer graphene sheets.

Unlike graphite crystals, these layers are rotated with respect to each other so that the atoms do not line up. This rotation has surprising consequences, as found in recent scanning tunneling microscopy measurements done at the CNST [2].

In high magnetic fields and at low temperatures, the top layer behaves in many ways like an isolated graphene sheet, but a sheet in which charge could transfer to the other layers.

The measurements also showed that at the highest fields in the study, the measured spectra had a gap that could not be explained by a simple single particle description of the system; electrons in the top layer were interacting with other electrons, either in the same layer or in the other layers.

Explaining several aspects of the experimental data, the latest calculations reveal how electrons transfer between layers, and how under the right conditions a "correlated state" might develop between the electrons in the top layer and other layers.

While additional experimental and theoretical research is needed to confirm this explanation, this work further demonstrates the variety of interesting phenomena that are emerging as the layers of graphene's scientific puzzle are peeled away.

More information:

[1] Landau levels and band bending in few-layer epitaxial graphene, H. Min, S. Adam, Y. J. Song, J. A. Stroscio, M. D. Stiles, and A. H. MacDonald, Physical Review B 83, 155430 (2011).

prb.aps.org/abstract/PRB/v83/i15/e155430

[2] High-resolution tunnelling spectroscopy of a graphene quartet, Y. J. Song, A. F. Otte, Y. Kuk, Y. Hu, D. B. Torrance, P. N. First, W. A. de Heer, H. Min, S. Adam, M. D. Stiles, A. H. MacDonald, and J. A. Stroscio, Nature 467, 185-189 (2010). www.nature.com/nature/journal/ … ull/nature09330.html

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