Physics Department Colloquium

"Magnetism in Graphene-based Nanostructures"

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Itinerant Magnetism is commonly associated with elements containing localized *d* or *f* electrons. In contrast, the elements containing diffuse *sp* electrons are *intrinsically* non-magnetic, but magnetism can be induced in *sp*-element materials *extrinsically* by defects and impurities. Recent first-principles calculations have predicted a family of novel magnetic graphene-based nanostructures (GBNs), including zero-dimensional (0D) nanodots, 1D nanoribbons and 2D nanohole superlattices. They all consist of the common structural feature of zigzag edges, which have highly localized edge states that give rise to a high density of states at the Fermi level rendering spin-polarization instability. The magnetic ordering among the zigzag edges is found to be consistent with the magnetism on a bipartite lattice as predicted from the Hubbard model by Lieb. Combining the Lieb's model with the underlying graphene lattice symmetry, we recently proposed a unified geometric rule for designing the magnetic GBNs. For example, applying the rule, we have predicted 0D FM nanodots with the highest possible magnetic moments and a new class of 2D crystalline "bulk" magnets: the graphene nanohole superlattices exhibiting long-range magnetic order with each nanohole acting like a super magnetic atom. Furthermore, we found that many of the zigzag edge-induced magnetic properties in GBNs exist also in nanopatterned graphite films. The possibility of engineering magnetic GBNs for storage media and spintronics applications will be discussed.

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Refreshments served, 3:30 in 219 JFB