Orbital Magnetism in graphene bulk and nanostructures

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We study the magnetic response of finite and bulk graphene structures due to orbital motion of the charge carriers. Besides a semiclassical approach we use exact quantum mechanical calculus within the Dirac formalism to derive different analytic expressions for the magnetic susceptibility of extended systems at various field regimes. This allows us to study on the one hand edge effects which are accessible through our semiclassical treatment but also to gain profound knowledge of the importance of bulk effects in finite systems. In order to provide an independent confirmation of the theory we also perform numerical calculations on graphene nanostructures based on a tight-binding approximation.