Optical properties of graphene quantum dots

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We briefly review electronic and optical properties of graphite, graphene[1] and dichalgonides[2] and discuss their strength and shortcomings. We next discuss how one can engineer electronic, optical and magnetic properties of graphene by control of lateral size, character of the edge, sublattice symmetry, number of layers and carrier density. We describe gate controlled triangular graphene quantum dots (TGQD) with broken sublattice symmetry[3] and colloidal graphene quantum dots(CGQD)[4]. The broken sublattice symmery and zigzag edge in TGQDs leads to a shell of degenerate states at the Fermi level. The filling of this shell leads to nontrivial electronic, optical and magnetic properties controlled by e-e interactions. One of the examples include optical spin blockade and optical control of magnetization in carbon only material system [5]. We next discuss optical properties of colloidal graphene quantum dots with emphasis on band edge exciton and valley polarization[4].

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