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Spin states in graphene quantum dots

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Graphene quantum dots [1,2], douple dots [3], rings [4] and nanoribbons [5] have been fabricated by electron beam lithography and dry etching. The orbital [1] properties of graphene quantum dots have been investigated in perpendicular magnetic fields and the details of the electron-hole crossover in graphene leads to a situation where electron (hole) states move down (up) in magnetic field opposite to what has been observed in standard semiconductor based quantum dots. Graphene quantum dots are thought to be good candidates for spin-based quantum information processing since spin-orbit interactions and hyperfine coupling are both expected to be weak. We investigated graphene quantum dots in the single-level transport regime in in-plane magnetic fields where orbital effects are expected to have a minor effect [6]. The g-factor is found to be $g \approx 2$ and the spin filling sequence of orbital levels can be understood in view of the strength of the exchange interaction which is independent of carrier density in graphene.

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