Condensed Matter Seminar

Semiconductor and Graphene Quantum Dots

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We review recent theoretical and experimental results on both semiconductor and graphene quantum dots. We briefly describe lateral quantum dot molecules as building blocks of quantum circuits based on electron spin: artificial Haldane gap device, GHZ maximally entangled state, Berry's phase and e-e driven topological phases generators[1,2]. We next turn to localized spins in self-assembled quantum dots and discuss how these spins can be controlled optically.[3,4]. The locking of spin and orbital motion and emergence of tunable topologically protected chiral surface states in HgTe qdots will be described[5]. Finally, we describe one atom thick semiconductor quantum dots made of graphene and compare them with semiconductor quantum dots. We show how their electronic, optical and magnetic properties can be engineered by the size, shape, type of edge, topology and number of layers [6-10]. Preliminary comparison of theory with experiment on optical properties of colloidal qdots will be made[11].

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