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Spin Ordering and Fluctuations in Magnetic Quantum Dots[1]
JAMES PIENTKA, RAFAL OSZWALDOWSKI, IGOR ZUTIC, JONG HAN, University at Buffalo, ANDRE PETUKHOV, South Dakota School of Mines & Technology — The presence of magnetic impurities in quantum dots can lead to unconventional ordering in carrier and impurity spins [1-3]. While, due to its simplicity, it is tempting to use the mean field approximation for such systems, we explain critical problems of that description and an essential role of spin fluctuations. We consider two different situations of singly and doubly occupied magnetic dots that correspond to the formation of magnetic polarons [4,5] and bipolarons [1,2]. The two cases reveal qualitatively different manifestations of finite size effects on spin ordering and the removal of spurious phase transitions at the mean field level. Using both analytical and Monte Carlo methods, we elucidate the interplay of spin ordering and fluctuations in these systems.

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