CORE-CM SEMINAR
Michigan State University

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Teaching Nanomagnets New Tricks

Semiconductor nanostrcutures doped with magnetic impurities provide an intriguing playground to control magnetic ordering. An important manifestation of such ordering is the formation of a magnetic polaron (MP). It can viewed as a cloud of localized magnetic ion spins, aligned through an exchange interaction with a confined carrier spin and is typically considered a low-temperature phenomenon in bulk semiconductors. However, recent experimental advances in colloidal nanocrystals and epitaxially grown quantum dots show robust signatures of MPs that can persist up to room temperature and lead to effective internal fields up to 100 tesla [1]. These highly tunable semiconductor nanostructures, allowing versatile control of the number of carriers, their spin, and the effects of quantum confinement, offer novel possibilities for magnetism, inaccessible to bulk structures. We suggest how magnetic ordering can be controlled even at a fixed number of carriers [2], enhanced by heating [3], and present in closed-shell systems [4]. We expect that doping quantum dots with magnetic impurities (typically, Mn) may open unexplored opportunities to study the nanoscale correlations [5]. Through Mn-carrier exchange interaction, molecular-like correlations can be enhanced, imprinted on Mn spins, and thus observed. We propose experiments to verify our predictions.

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[2] R. M. Abolfath, A. G. Petukhov, and I. Zutic, Phys. Rev. Lett. **101**, 207202 (2008).
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[4] R. Oszwaldowski, I. Zutic, A. G. Petukhov, Phys. Rev. Lett. **106**, 177201 (2011).
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Thursday, October 9, 2014
12:00 PM
BPS 1400
Prof. John McGuire - Host