The curious magnetic state in undoped iron pnictides

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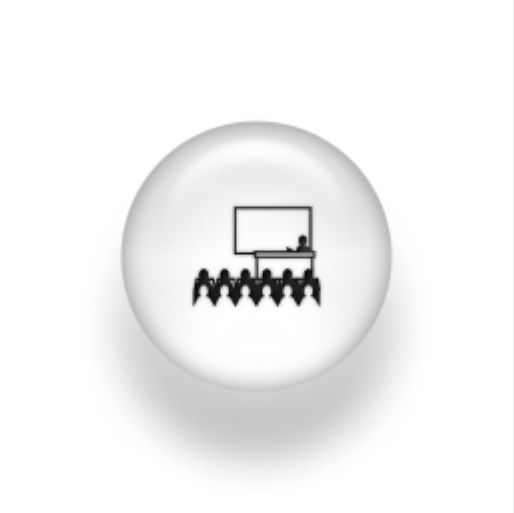

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ABSTRACT:
The recent discovered high temperature superconductors iron pnictides present a singular magnetism. The undoped compound is metallic with Q=(pi,0) columnar ordering instead of being a Mott insulator with Néel order as in cuprates. It has very low magnetic moment, lower than predicted in AB-initio calculations what is one of the big mysteries of these compounds since AB-initio usually underestimates the magnetic moment. There is big controversy in the literature over wether this low magnetic moment has to be understood from the weak or strong coupling point of view with no definitive answer. In our work we have calculated the mean field Q=(pi,0) magnetic phase diagram using a five orbital tight-binding model developed by us. (1) For intermediate values of the interaction, two different metallic regimes with low and high magnetic moments arise. Orbital ordering is concomitant with magnetism in both regimes. The low moment state is characterized by on-site antiparallel orbital magnetic moments. Its stability can be understood as a consequence of the anisotropic interorbital exchange between individual orbital magnetic moments. This metallic low moment state accounts for the small magnetization measured in undoped iron pnictides and it is consistent with a strong exchange anisotropy found in neutron experiments. It also reproduces a large zx weight seen around Gamma in ARPES experiments. (2)
References
(1) M.J. Calderon, B. Valenzuela, E. Bascones, Phys. Rev. B 80, 094531 (2009)
(2) E. Bascones, M.J. Calderón, B. Valenzuela, Phys. Rev. Lett. 104,227201 (2010)