Band antiferromagnetism in a two-band model for iron pnictides

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The study of (antiferro)magnetism in multi-band Hubbard models has received a strong push by the recently discovered Fe superconductors [1]. The ground states of many of these materials is characterized by an antiferromagnetic state with a small ordered moment. In this work we investigate a half-filled two-band Hubbard model using the Gutzwiller wavefunction [2, 3]. The tight-binding part of the model captures two distinct features of many iron-based superconductors: the Dirac points in the bandstructure and the typical Fermi surface topology.

We show how antiferromagnetism evolves in this model due to correlations and how the gain of energy by the antiferromagnetic order reduces the effects of the local correlations. The magnetism itself is determined by an effective energy scale $I_{\text{eff}} \simeq J + U/3$ and leads to a Stoner-like behavior. We show that, for intermediate to strong values of I, the size of the magnetic moment goes hand in hand with that of the local magnetic moment. For large correlations the model becomes an antiferromagnetic band insulator. The influence of the Dirac points is important as they delay the opening of the band gap.

References

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