MAR17-2016-020077
Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Interplay between magnetism, superconductivity, and orbital order in iron-based superconductors – parquet renormalization group study

ANDREY CHUBUKOV, Univ of Minnesota

Magnetism and nematic order are the two non-superconducting orders observed in iron-based superconductors. To elucidate the interplay between them and ultimately unveil the pairing mechanism, several models have been investigated. In models with quenched orbital degrees of freedom, magnetic fluctuations promote stripe magnetism which induces orbital order. In models with quenched spin degrees of freedom, charge fluctuations promote spontaneous orbital order which induces stripe magnetism. I will talk about renormalization group (RG) approach, in which we treat magnetic and orbital fluctuations on equal footing. The new element in the approach, compared to earlier works, is the inclusion of the orbital character of the low-energy electronic states into analysis. I will analyze the RG flow of the couplings and argue that the same magnetic fluctuations, which are known to promote s^{+-} superconductivity, also promote an attraction in the orbital channel, even if the bare orbital interaction is repulsive. I analyze the RG flow of the susceptibilities and show that, if all Fermi pockets are small, the system first develops a spontaneous orbital order, then s^{+-} superconductivity, while a magnetic order does not develop down to $T = 0$. I will argue that this scenario applies to FeSe. In systems with larger pockets, such as $BaFe_2As_2$ and LaFeAsO, the situation is different and the leading instability is either towards a spin-density-wave or superconductivity. I argue that in this situation nematic order is caused by composite spin fluctuations and is vestigial to stripe magnetism.