Itinerant magnetic excitations in iron-based superconductors: from SDW metal to the superconductor

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Recent discovery of superconductivity in the iron-based layered pnictides with T_c ranging between 26 and 56 K generated enormous interest in the physics of these materials. In my talk I will analyze current experimental and theoretical evidences in favor of extended s-wave superconductivity. I will further discuss the selection of the stripe magnetic order in the unfolded BZ within itinerant description. Selecting one hole and two electron pockets we find that SDW order is highly degenerate if electron pockets are circular and interactions involved are between holes and electrons only. Repulsive charge interactions between two electrons as well as ellipticity of the electron pockets break the degeneracy and select metallic $(0,\pi)$ $[(\pi,0)]$ SDW state in the unfolded BZ — the same order as seen in the experiments. Next we analyze the evolution of the spin excitations from the parent antiferromagnetic phase to the superconducting phase and address in particular the coexistence phase of antiferromagnetism and superconductivity. Finally, we address the salient experimental features of the magnetic excitations in the spin-density-wave phase of iron-based superconductors. We show that ellipticity of the electron bands accounts for the anisotropy of the spin waves along different crystallographic directions and the spectral gap at the momentum conjugated to the ordering one.

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