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Magnetic degeneracy and hidden metallicity of the spin-density-wave state in ferropnictides

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Abstract

We analyze spin-density-wave (SDW) order in iron-based superconductors and electronic structure in the SDW phase. We consider an itinerant model for Fe pnictides with two hole bands centered at (0,0) and two electron bands centered at (0,π) and (π,0) in the unfolded Brillouin zone. A SDW order in such a model is generally a combination of two components with momenta (0,π) and (π,0), both yield (π,π) order in the folded zone. Neutron experiments, however, indicate that only one component is present. We show that (0,π) or (π,0) order is selected if we assume that only one hole band is involved in the SDW mixing with electron bands. A SDW order in such three-band model is highly degenerate for a perfect nesting and hole-electron interaction only but we show that ellipticity of electron pockets and interactions between electron bands break the degeneracy and favor the desired (0,π) or (π,0) order. We further show that stripe-ordered system remains a metal for arbitrary coupling. We analyze electronic structure for parameters relevant to the pnictides and argue that the resulting electronic structure is in good agreement with angle-resolved photoemission experiments. We discuss the differences between our model and J1 - J2 model of localized spins. © 2010 The American Physical Society.

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