Fe-based superconductors: role of the magnetic impurities

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Superconductors with different gap symmetries behave differently being subject to the disorder. It is especially important to determining this exact behavior in the Fe-based materials where both the order parameter symmetry and the mechanism of superconductivity are unknown. Here we analyze how the magnetic disorder affects the low-energy properties of the two-band $s_{\pm}$ and s_{++} models. In a standard case, T_c is suppressed approximately following the Abrikosov-Gor'kov trend. There are, however, few exceptional cases with the saturation of T_c for the finite amount of impurities: 1) $s_{\pm}$ superconductor with the purely interband impurity scattering potential or with the unitary impurities, 2) s_{++} state with the interband scattering only. We show that the latter unusual behavior is due to the $s_{++} \to s_{\pm}$ transition similar to the $s_{\pm} \to s_{++}$ transition caused by nonmagnetic impurities [1]. Since this transition goes through the gapless regime, there should be clear signatures in the thermodynamics of the system. Therefore, it may manifest itself in optical and tunneling experiments, as well as in a photoemission and thermal conductivity on Fe-based superconductors and other multiband systems.

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