On the superconducting symmetry of Fe-based systems
-Impurity effects and microscopic magnetic behavior-

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In the study of superconductivity of Fe-based systems, it is important to carefully examine whether the high transition temperature $T_c$ is related to their multiband nature (or to the orbital degrees of freedom). The key issue is to clarify the symmetry of the superconducting order parameter $\Delta$, because sign reversal between the order parameters $\Delta_\Gamma$ and $\Delta_M$ on two disconnected Fermi surfaces around $\Gamma$ and $M$ points, respectively, in the reciprocal space of the tetragonal lattice ($S_\pm$ symmetry) can be directly connected with the magnetic mechanism, while non-existence of the sign reversal ($S_{++}$ symmetry) suggests a novel mechanism related to the orbital degrees of freedom. To investigate this, we have adopted three physical quantities for experimental studies, all of which are sensitive to the relative signs between $\Delta_\Gamma$ and $\Delta_M$, namely, (1) effects of nonmagnetic impurities on $T_c$, (2) magnetic excitation spectra $\chi''$ as well as phonon behavior, and (3) NMR spectra and $1/T_1-T$ curves. Here, on the basis of results of these studies, possibility of the novel mechanism (related to the orbital degrees of freedom) is argued.