

**MAGNETIC INTERACTIONS, SUPERCONDUCTIVITY,
AND SPIN-RESONANCE PEAK IN IRON-BASED MATERIALS**

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Different mechanisms of superconductivity result in specific symmetries and structures of the gap in iron-based materials [1–4]. Weakly doped pnictides are antiferromagnetic metals and the most promising candidate for the theory of superconductivity is the spin fluctuation mechanism of Cooper pairing, in which the leading superconducting instability in a wide range of dopings is characterized by the extended s -wave gap having the opposite signs on hole and electron Fermi surface pockets – the so-called s_{\pm} state [4–7]. On the other hand, orbital fluctuations results in the s_{++} state with the gap having the same sign on all Fermi surface sheets [8]. By determining the gap structure, one can deduce the microscopic mechanism of superconductivity. In this respect, inelastic neutron scattering plays a special role since the imaginary part of the dynamical spin susceptibility $\chi(\mathbf{q}, \omega)$ measured there carries information about the gap structure in the superconducting state. That is, the sign-changing s_{\pm} gap leads to the formation of the spin resonance peak at or near the commensurate antiferromagnetic wave vector $\mathbf{q} = \mathbf{Q}$ connecting Fermi surface sheets with different signs of gaps on them [9,10].

Here we review the spin fluctuation mechanism of superconductivity and discuss the spin resonance in the superconducting state of iron-based materials. On the basis of the model gap function and the one calculated within the spin fluctuation theory of pairing, we show that the resonance peak shifts to higher frequencies with increasing the zero-amplitude gap magnitude. On the contrary, with increasing the gap anisotropy, it shifts to lower frequencies and lose some intensity [11–14].

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