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# Pairing mechanism and gap symmetry in Fe-based superconductors with only electron or only hole pockets

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The pairing in moderately doped Fe-pnictides and Fe-chalcogenides is generally understood as being due to magnetically enhanced interaction between hole and electron pockets. Recently, however, superconductivity has been observed in $AFe_2Se_2$ (A = K, Rb, Cs), which contain only electron pockets, and in $KFe_2As_2$, which contains only hole pockets. In the talk, I review different (and sometimes conflicting) scenarios for the pairing in these systems and propose my own. I argue that the pairing condensate in systems with only electron pockets necessary contains not only a conventional intra-pocket component, but also inter-pocket component, made of two fermions belonging to different electron pockets. I analyze the interplay between intra-pocket and inter-pocket pairing depending on the ellipticity of electron pockets and the strength of their hybridization and show that with increasing hybridization the system undergoes a transition from a d-wave state to an $s^{+-}$ state, in which the gap changes sign between hybridized pockets. This $s^{+-}$ state has the full gap and at the same time supports spin resonance, in agreement with the data. Near the boundary between d and $s^{+-}$ states the system develops s+id state which breaks time-reversal symmetry. For systems with only hole pockets, I argue for $s^{+-}$ state in which the gap changes sign between hole pockets. I show that this state is qualitatively different from $s^{+-}$ state when both hole and electron pockets are present. I further show that the transition from one s-wave state to the other involves highly unusual s+is state which again breaks time reversal symmetry.