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Orbital-selective pairing: a $\tau 3$ B1g pairing candidate state for the alkaline iron selenides. RONG YU, Renmin University of China, EMILIAN M NICA, QIMIAO SI, Rice University — The iron-based unconventional superconductors are inherently multi-orbital systems and show remarkable variation in the Fermi-surfaces and pairing symmetries. In the alkaline iron selenides cases, ARPES experiments indicate fully gapped superconducting states, which suggests s-wave pairing, while neutron-scattering studies show resonances in the spin-spectrum with wave vectors across the electron Fermi pockets, suggesting d-wave pairing. We propose a novel superconducting state composed of a direct product of an s-wave form factor and a rotational symmetry-breaking orbital matrix in the $d_{xz/yz}$ sectors [1]. It belongs to the B_{1g} representation of the $\mathrm{D_{4h}}$ point group, allowing for the overall change in sign between the pairing field at the electron pockets close to the 1-Fe BZ edge. While it supports a spin resonance, it also produces a fully gapped quasi-particle spectrum, making it a candidate pairing state for the alkaline iron selenide compounds. Our results also show how such a state can become energetically competitive in the regime of quasi-degeneracy between the s and d-wave pairing states. In a broader context, this pairing provides an alternative to the $s+id$ to reconstruct the degenerate pairing states, while preserving the time-reversal symmetry. We discuss possible analogs in other multi-band strong-coupling superconductors such as the heavy fermions. [1] "Emergent superconducting state from quasi-degenerate s− and d−wave pairing channels in iron-based superconductors," E. M. Nica, R. Yu, and Q. Si, arXiv:1505.04170v1 (2015).

Emilian Nica
Rice Univ

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