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An energetically competitive τ_3 B_{1g} pairing in a $t-J_1-J_2$ model with orbital differentiated exchange couplings: implications for superconductivity in alkaline iron selenides RONG YU, Department of Physics, Renmin University of China, Beijing 100872, China, EMILIAN MARIUS NICA, QIMIAO SI, Department of Physics and Astronomy, Rice University, Houston, Texas 77005 — The pairing state in the alkaline iron selenides remains a challenge to our understanding. We address this issue in the incipient Mott picture based on the bad-metal behavior [1] of these materials. In conjunction with this picture, the multi-orbital effect is amplified, with two studied possibilities being the orbital-selective Mott transition [2] and the orbital-dependent pairing [3]. Here we carry out calculations in a five-orbital $t-J_1-J_2$ model, in which the orbital-dependent correlations are directly encoded in the exchange couplings. Specifically, we consider intra-orbital exchange couplings for d_{xz}, d_{yz}, and d_{xy} but allow varying the ratio $r_o = J_{xz,xz}/J_{xy,xy}$. For $r_o < 1$, we find a regime in the phase diagram where the leading pairing channel is an unusual τ_3 $s_{x^2y^2}^{B_{1g}}$. This state has a full gap on the Fermi surfaces at both the zone boundary and center, with the pairing function changing sign between the two electron pockets. We propose this pairing state as a viable candidate for superconducting alkaline iron selenides. [1] R. Yu et al.,Nat. Commun. 4:2783 doi:10.1038/ncomms3783 (2013). [2] R.Yu and Q.Si, Phys. Rev. Lett. 110, 146402 (2013). [3] R. Yu, J.-X. Zhu, and Q. Si, Phys. Rev. B 89, 024509 (2014).

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