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Order-Parameter Anisotropies in the Pnictides - An Optimization Principle for Multi-Band Superconductivity CHRISTIAN PLATT, Institute for Theoretical Physics and Astrophysics, University of Wuerzburg, RONNY THOMALE, Department of Physics, Princeton University, WERNER HANKE, Institute for Theoretical Physics and Astrophysics, University of Wuerzburg — Using general arguments of an optimization taking place between the pair wave function and the repulsive part of the electron-electron interaction, we analyze the superconducting gap in materials with multiple Fermi-surface (FS) pockets, with application to two proto-type (P-based and As-based) ferropnictides. The main point of our work is to show that the SC state, its gap and, in particular, its anisotropy in momentum space is determined by an optimization, which balances the interplay between the attractive interaction in the sign-reversing $s_{\pm}$-channel and the Coulomb repulsion. This Coulomb repulsion, as discussed below, is unavoidable in a multi-band SC situation: it appears because of a kind of frustration in the $s_{\pm}$-channel, when more than two FS-pockets are involved in setting up the pairing interaction. On the basis of functional Renormalization Group (fRG) calculations for a wide parameter span of the bare interactions and for the different FS topologies applying to these two characteristic Fe-based superconductors, we show that the symmetry of the gap and the nodal versus nodeless behavior is driven by this optimization requirement.

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