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On the internal d-wave structure of $s^{\pm}$ pairs in Iron-based Superconductors[1] TZE TZEN ONG, PIERS COLEMAN, Rutgers University, Department of Physics & Astronomy — A key issue in understanding the high temperature iron-based superconductors concerns the mechanism by which the paired electrons minimize their strong mutual Coulomb repulsion. Whereas electronically paired superconductors generally avoid the Coulomb interaction through the formation of higher angular momentum pairs, iron based superconductors involve s-wave ($s^{\pm}$) pairs with zero angular momentum. By taking account of the orbital degrees of freedom of the iron atoms, here we show that the $s^{\pm}$ pairs in these materials possess hidden d-wave symmetry, forming orbital triplets in which the the d-wave angular momentum of the pairs is compensated by the internal angular momentum of the orbitals. The recent observation of a gap with octahedral structure in KFe_2As_2 materials can be understood as a transition to a "high spin" configuration of the d-wave orbital triplets, through the alignment of the two angular momentum components of the pair.

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