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**The nodal crisis in Iron based superconductivity**[1] PIERS COLEMAN, T. TZEN ONG, Center for Materials Theory, Physics and Astronomy, Rutgers University — The recent observation of fully gapped high temperature superconductivity in an iron chalcogenide without a hole Fermi surface[1], combined with the observations that rule out a node-less d-wave state [2] constitute a "nodal crisis" in iron based superconductivity, for we do not understand how the underlying singlet state avoids the strong Coulomb interactions on the iron site without some kind of node within the superconducting condensate. In this work, we re-analyze the allowed symmetries of the superconducting condensate in the iron superconductors, taking into account both orbital symmetries between the $zx$ and $zy$ orbitals and the presence of two equivalent Fe sites per unit cell. We argue that the additional orbital degrees of freedom provide for a much richer class of pairing symmetries than normally considered. A particularly interesting possibility, is a p-wave, spin singlet, orbital triplet state that is a fully gapped iron analog of the B-phase of superfluid He-3. We will discuss this interesting possibility.
[1] Wang Qing-Yan et al, Chinese Phys. Lett. 29 037402 (2012).
[2] X.-P. Wang et al, Europhysics Letters 99, 67001 (2012).

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