Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Space group symmetry, spin-orbit coupling, and the low-energy effective Hamiltonian for iron-based superconductors VLADIMIR CVETKOVIC, OSKAR VAFEK, National High Magnetic Field Laboratory, Florida State University, Tallahassee, FL 32310 — Iron-based superconductors are multi-band semimetals with competing instabilities. This motivates us to use the method of invariants when constructing a low-energy effective theory for these materials. In the construction we use the space group which, being non-symmorphic, leads to peculiar consequences at the Brillouin zone corner, precisely where the low-energy states reside. Our model displays good agreement with the multiband tight-binding models. The spin-orbit coupling, significant in iron, is easily incorporated in our model. We predict its consequences. The nodal spin-density wave (SDW) is proven to be unstable toward any finite spin-orbit coupling. Both colinear or coplanar SDW are shown to induce magnetic moments on pnictogen atoms. The quasiparticle dispersion in the presence of an s-wave spin singlet superconducting order is studied. In the absence of spin-orbit coupling, our minimal model yields isotropic gaps on bothhole Fermi surfaces. The gap structure on the electron Fermi surfaces is determined by the ratio of pairing parameters. The presence of spin-orbit interaction results in the gap anisotropy on the hole Fermi surfaces and a qualitative change of the gap structure on the electron Fermi surfaces. [1] V. Cvetkovic and O. Vafek, Phys. Rev. 88, 134510 (2013).

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Date submitted: 15 Nov 2013 Electronic form version 1.4