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Spin-orbital frustrations and anomalous metallic state in iron-pnictide superconductors FRANK KRUGER, Dep. of Physics, Univ. of Illinois at Urbana-Champaign, SANJEEV KUMAR, JAN ZAANEN, JEROEN VAN DEN BRINK, Instituut-Lorentz, Universiteit Leiden — We develop an understanding of the anomalous metal state of the parent compounds of recently discovered iron based superconductors starting from a strong coupling viewpoint. On the basis of an intermediate-spin ($S = 1$) state for the Fe^{2+} ions, we derive a Kugel-Khomskii spin-orbital Hamiltonian for the active t_{2g} orbitals. It turns out to be a highly complex model with frustrated spin and orbital interactions. We compute the classical phase diagrams and provide an understanding for the stability of the various phases by investigating the spin-only and orbital-only limits of the full Hamiltonian. The experimentally observed spin-stripe state is found to be stable over a wide regime of physical parameters and can be accompanied by three different types of orbital orders. Of these the orbital-ferro and orbital-stripe orders are particularly interesting since they break the in-plane lattice symmetry; a robust feature of the undoped compounds. We also compute the magnetic excitation spectra for the $S = 1$ Heisenberg model, treating orbital correlations as static. The stable orbital-stripe state provides an explanation for the observed strong reduction of magnetic moment.

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