MAR14-2013-008937

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Study of the Nematic State of Pnictides using the Spin Fermion model with Spin, Orbital, and Lattice Degrees of Freedom

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The anisotropic behavior of the resistivity above the Neél temperature in several iron-pnictides has been explained in terms of a nematic phase whose origin is currently under heated debate. In some scenarios the leading role is attributed to the magnetic degrees of freedom while in others the orbitals act as triggers, and the lattice is always assumed to be a follower. To analyze these issues a three-orbital (xz, yz, xy) Spin-Fermion model was studied via Monte Carlo simulations [1,2]. Our main result is that in order to reproduce the experiments, including a separation between the structural critical temperature (T_S) and the magnetic Neél temperature (T_N) both the lattice-orbital and lattice-spin couplings are needed. In general, the Neél temperature increases with the spin-lattice constant while the separation between the structural and the Néel transition temperatures is controlled by the orbital-lattice coupling [2,3]. Experimental results for the anisotropic behavior of the resistivity, the ARPES orbital spectral weight varying temperature, and the neutron scattering weights at (π,0) and (0,π) are captured by the numerical simulations [2]. Calculations of the nematic susceptibility, which is proportional to the elastorresistivity coefficient m_{66}, will be presented [3] and contrasted against experimental results by the Stanford group.

[1] S.Liang et al., Phys.Rev.Lett.109, 047001 (2012).
[2] S.Liang et al., Phys.Rev.Lett.111, 047004 (2013).
[3] S.Liang et al., in preparation.