Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Scaling between magnetic and lattice/nematic fluctuations in iron pnictides RAFAEL FERNANDES, University of Minnesota, ANNA BÖHMER, CHRISTOPH MEINGAST, JÖRG SCHMALIAN, Karlsruhe Institute of Technology — The origin of the tetragonal-to-orthorhombic transition in the iron pnictides, and its relationship to the magnetically ordered state, remains a subject of intense debate, with potential implications to the mechanism behind the unconventional superconducting state. Here we investigate the coupling between these two normal-state instabilities – magnetic and structural – by comparing their corresponding fluctuations in the tetragonal paramagnetic phase of $Ba(Fe_{1-x}Co_x)_2As_2$. We find for several doping compositions a robust scaling relation between shear modulus data – which probes the orthorhombic lattice fluctuations – and NMR spin-lattice relaxation rate data – which probes magnetic fluctuations. We explain this scaling using a theoretical model where the tetragonal symmetry breaking is triggered by an electronic nematic transition that emerges from degenerate magnetic fluctuations. Therefore, our results provide strong evidence that the structural transition in the iron pnictides is magnetically-driven.

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Date submitted: 14 Nov 2013 Electronic form version 1.4