Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Quantum Phase Transitions Inside the Superconducting Dome of the iron-based Superconductors SAURABH MAITI, University of Florida, RAFAEL FERNANDES, University of Minnesota, PETER WOELFLE, Karlsruhe Institute of Technology, ANDREY CHUBUKOV, University of Wisconsin-Madison
— In several iron-based superconductors, a nematic transition from the tetragonal to the orthorhombic phase precedes the onset of long-range magnetic order. As doping increases, both the nematic and magnetic ordered states are suppressed, and the two transitions lines cross separately the superconducting dome. In this talk, we discuss the fate of these two instabilities inside the superconducting dome. Using a microscopic electronic model in which nematicity arises from magnetic fluctuations, we show that both ordered states are able to coexist with superconductivity for a wide range of parameters. As the temperature is lowered below Tc, the two transitions merge, giving rise to a single simultaneous first-order nematic-magnetic transition at T=0. The changes in the magnetic spectrum caused by the coexistence with superconductivity makes this quantum phase transition weakly first-order, allowing strong fluctuations to existence in its vicinity. Our results are consistent with experimental findings in $Ba(Fe_{1-x}Co_x)_2As_2$ and $BaFe_2(As_{1-x}P_x)_2$, which indicate the existence of a single quantum phase transition inside the superconducting dome.

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Date submitted: 15 Nov 2013 Electronic form version 1.4