Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Spin-liquid polymorphism in an underdoped iron-chalcogenide superconductor[1] IGOR ZALIZNYAK, Brookhaven National Laboratory, ANDREI SAVICI, MARK LUMSDEN, Oak Ridge National Laboratory, ALEXEI TSVELIK, Brookhaven Natl Lab, RONGWEI HU, Rutgers University, CEDOMIR PETROVIC, Brookhaven National Laboratory — We report neutron scattering measurements which reveal spin-liquid polymorphism in an 11 iron chalcogenide superconductor. It occurs when a poorly metallic magnetic state of FeTe is driven toward superconductivity by substitution of a small amount of tellurium with isoelectronic sulfur. We observe a liquid-like magnetic response, which is described by the coexistence of two disordered magnetic phases with different local structures whose relative abundance depends on temperature. One is the ferromagnetic (FM) plaquette phase observed in undoped, nonsuperconducting FeTe, which preserves the C4 symmetry of the underlying square lattice and is favored at high temperatures, whereas the other is the antiferromagnetic plaquette phase with broken C4 symmetry, which emerges with doping and is predominant at low temperatures. These findings suggest the coexistence of and competition between two distinct liquid states, and a liquidliquid phase transformation between these states, in the electronic spin system of $FeTe_{1-x}(S,Se)_x$. Our results shed light on many recent experimental data in unconventional superconductors. The phase with lower, C2 local symmetry, whose emergence precedes superconductivity, naturally accounts for a propensity to electronic nematic states.

[1]Work at BNL is supported by the Office of Basic Energy Sciences, US DOE, under Contract DE-SC00112704.

Igor Zaliznyak
Brookhaven Natl Lab

Date submitted: 05 Nov 2015 Electronic form version 1.4