Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Ultrafast Critical Nematic Fluctuations and Giant Magnetoelastic Coupling in Iron Pnictide[1] AARON PATZ, TIANQI LI, SHENG RAN, Iowa State University and Ames Lab-USDOE, RAFAEL FERNANDES, School of Physics and Astronomy, University of Minnesota, JOERG SCHMALIAN, Karlsruhe Institute of Technology, Germany, SERGEY BUD'KO, PAUL CANFIELD, Iowa State University and Ames Lab-USDOE, ILIAS PERAKIS, University of Crete, Heraklion, JIGANG WANG, Iowa State University and Ames Lab-USDOE — A ubiquitous anisotropy in the normal state properties of many of the iron pnictides presents a crosscutting challenge important for understanding quantum magnetism and high-temperature superconductivity. Although an electronically-driven nematicity has been invoked, distinguishing this from spin and structural orders is challenging because they all couple together to break the same tetragonal symmetry. Here we use femtosecond-resolved polarimetry to reveal critical fluctuations of nematic correlation in unstrained Ba(Fe1-xCox)2As2. The ultrafast anisotropic response, which arises from the two-fold in-plane anisotropy of the refractive index, displays a characteristic two-step recovery absent in the isotropic response. The fast recovery appears only in the magnetically ordered state, whereas the slow one persists in the paramagnetic phase, with increasing relaxation time, indicative of critical nematic fluctuations approaching the structural transition temperature. The dynamics reveal a gigantic magnetoelastic coupling that far exceeds electron-spin and electron-phonon couplings, opposite to conventional magnetic metals.

[1]Supported by the NSF and THALES program NANOPHOS.

Aaron Patz
Iowa State University and Ames Lab (USDOE)

Date submitted: 15 Nov 2013 Electronic form version 1.4