Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Spin-phonon coupling in iron arsenide superconductors[1] JENNIFER NIEDZIELA, DANIEL PARSHALL, KONSTANTIN LOKSHIN, U. of Tennessee - Knoxville, TN, ATHENA SEFAT, ORNL, Oak Ridge, TN, AHMET ALATAS, APS, Argonne National Laboratory, Darien, IL, TAKESHI EGAMI, U. of Tennessee - Knoxville, TN USA — In this work we present the results of an inelastic x-ray scattering experiment measuring the softening of the TA[110] phonon in $BaFe_2As_2$ as a function of temperature. Cooling through the structural transition temperature yields a softening of the phonon energy of the transverse acoustic mode nearly 1 meV from the value at room temperature at $\mathbf{q} = \mathbf{0.1}$. This phonon controls the structural phase transition, changing the symmetry from tetragonal to orthorhombic at the same temperature as the transition to long range antiferromanetic order. Even though the lattice distortion is minor, the anisotropy in the magnetic exchange constants is very large. We posit that this phonon mode couples to the orbital moment, and softening of this mode is required for the onset of long range antiferromagnetic ordering and the dramatic change in the exchange constants. This observation is suggestive that a mechanism of spin-phonon coupling is present in the pnictide systems, and is a possible contributor to the superconducting mechanism.

[1]The work was supported by Department of Energy Office of Basic Energy Sciences.

Jennifer Niedziela
U. of Tennessee - Knoxville, TN

Date submitted: 18 Nov 2010 Electronic form version 1.4