Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Quasi-one-dimensional phonon anomaly in the narrow-gap semiconductor $FeSb_2$ IGOR ZALIZNYAK, CEDOMIR PETROVIC, RONGWEI HU[1], Brookhaven Natl Lab, ANDREI SAVICI, OVIDIU GARLEA, BARRY WINN, Oak Ridge Natl Lab — $FeSb_2$ has a variety of unusual properties, ranging from the temperature-induced electronic paramagnetism to one-dimensional (1D) metallic conductivity at temperatures below $\sim$ 300 K and down to $\sim$ 30 K, where it becomes insulating, and to giant thermoelectric power factor. While it is generally acknowledged that these properties result from the tight balance between strong covalent hybridization, electronic correlation and the tendency to band delocalization, what exactly are the mechanisms leading to these unusual behaviors remain unclear. In particular, it is a matter of current debate, whether the giant thermoelectric figure of merit observed in $FeSb_2$ is explained by purely correlated-electronic mechanism, or it results from peculiar interaction of electrons with the lattice vibrations - such as the phonon drag effect. Here we present the inelastic neutron scattering survey of the phonon spectra in $FeSb_2$. It reveals phonon dispersions of one-dimensional character, which mirror the 1D metallicity along the $b-$axis, and the quasi-one-dimensional magnetism observed in the insulating sister material $CrSb_2$. Phonon dispersions undergo dramatic changes in the temperature range where electronic paramagnetism emerges, indicating strong coupling to electrons.

[1]Present address: Department of Physics, University of Maryland

Igor Zaliznyak
Brookhaven Natl Lab

Date submitted: 15 Nov 2013 Electronic form version 1.4