Phononic, magnetic, and inter-band Raman scattering in $K_{0.75}Fe_{1.75}Se_2$ superconductor\textsuperscript{1} ALEXANDER IGNATOV, PHIL LUBIK, Department of Physics & Astronomy, Rutgers University, Piscataway, NJ 08854, USA, R.H. YUAN, W.T. GUO, NAN-LIN WANG, Beijing Natl Lab for Condensed Matter Physics, CAS, Beijing 100190, China, GIRSH BLUMBERG, Department of Physics & Astronomy, Rutgers University, Piscataway, NJ 08854, USA — We have analyzed collective excitations in $K_{0.75}Fe_{1.75}Se_2$ single crystal ($T_c \sim 32$ K) by polarized Raman scattering in the energy shift range of 20-8000 cm\textsuperscript{-1}, the temperature range of 10-300 K, and laser excitation energies from 1.8 to 3.0 eV. Seven $B_g$ and nine $A_g$ phonon modes are observed at 300K. Below $\sim 150$ K an extra $A_g$ mode appears at 165 cm\textsuperscript{-1}. The amplitudes of the $A_g$ modes at $\sim 67$, 112, and 124 cm\textsuperscript{-1} are reduced, while the amplitude of 183 cm\textsuperscript{-1} $A_g$ mode is enhanced by factor of five as temperature decreases from 300 to 40 K. Magnetic scattering bands at 1000-2000 cm\textsuperscript{-1} consist of at least three distinct peaks each, implying different Fe-Fe AFM exchange coupling constants for underlying structure. Inter-band transitions are observed at $\sim 3700$ and 4600 cm\textsuperscript{-1} at 300 K in the $A_g$ and $B_g$ channels, respectively. Below 140 K these excitations are hardened to $\sim 4040$ and 4820 cm\textsuperscript{-1}.

\textsuperscript{1}Research at Rutgers was supported by the U.S. DOE, office of BES, Division of Materials Science and Engineering under award DE-SC0005463.