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Phonon Instabilities in Ca(1.4)Sr(0.6)RuO4 ROB G. MOORE, UT, Knoxville, TN 37996, M.D. LUMSDEN, R. JIN, ORNL, Oak Ridge, TN 37831, J. ZHANG, FIU, Miami, FL 33199, D. MANDRUS, E.W. PLUMMER, ORNL and UT — Phonon instabilities in $Ca_{1.4}Sr_{0.6}$ RuO_4 are investigated by inelastic neutron scattering techniques. Sr_2RuO_4 is an unconventional p-wave superconductor with the same structure as La_2CuO_4, the parent compound of the high T_c superconductor $La_{2-x}Sr_xCuO_4$. By partial substitution of Ca^{+2} for Sr^{+2}, induced structural stresses create a complex phase diagram with exotic phases. La_2CuO_4 has a temperature dependent Σ_4 phonon instability, correlated with the tetragonal to orthorhombic structural transition. It is anticipated that $Ca_{1.4}Sr_{0.6}RuO_4$ will exhibit similar behavior as a precursor to its tetragonal to orthorhombic phase transition. Indeed the instability exists, but two anomalies appear in the spectra. A new phonon mode appears mimicking the dispersion of the Σ_4 phonon and a new Bragg peak appears incommensurate with the tetragonal unit cell. The origins and implications of the anomalies will be discussed. Work supported by NSF- DMR 0105232, NSF-DMR0346826, and DOE DE-FG02-04ER46125. ORNL, managed by UT-Battelle, LLC, for the U.S. Dept. of Energy under contract DE-AC05-00OR22725

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