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Phonon Softening and Instability of $MgCNi_3$; Phonon dispersion measurements HAWOONG HONG, MARY UPTON, AYMAN SAID, Argonne National Laboratory, HYUN-SOOK LEE, Pohang University of Science and Technology, SUNG-IK LEE, Sogang University, RUQING XU, University of Illiniois at Urbana-Champaign, TAI-CHANG CHIANG, University of Illinois at Urbana-Champaign — Inelastic x-ray scattering from a single crystal $MgCNi_3$ was carried to determine phonon dispersion on the three major axes. Our results agree qualitatively with the most recent theoretical calculation. The dispersion shows quite strong softening of the longitudinal acoustic (LA) modes toward zone boundaries along Γ-M and Γ-R. However, phonon instabilities predicted by earlier theories were not observed. Our results would motivate the rethinking of $MgCNi_3$ superconductivity based on unstable phonons.

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