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Femtosecond time-resolved optical studies of collective modes in $\mathbf{La_{1-x}Ca_xMnO_3}$ YUHANG REN, Physics & Astronomy, Hunter College of the City University of New York, DAIMIAN WANG, MARIANO TRIGO, Physics, The University of Michigan, VENIMADHAV ADYAM, QI LI, Physics, The Pennsylvania State University, ROBERTO MERLIN, Physics, The University of Michigan —
We report on time-resolved ultrafast optical measurements on a $La_{1-x}Ca_xMnO_3$ (LCMO) single crystal (x= 0.3) and thin film (x= 0.33). The differential reflectivity shows coherent GHz oscillations due to the excitation of longitudinal acoustic (LA) phonons. The wavelength dependence of the period of such oscillations allows us to determine the sound velocity and elastic constant. Above T_C, the measured GHz sound velocity is more than 40% larger than the sound velocity in the MHz range as determined by ultrasound measurements. The data is explained by a possible existence of polaron liquid state. Also the differential polarization shows coherent magnons in LCMO. We determine the magnetic anisotropy and spin stiffness constants from the magnetic-field dependence of the frequency of the spin waves.

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