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Phonon Dispersion and Elastic Properties of Two-Dimensional Soft Particle Colloidal Crystals and Glasses[1] TIM STILL, Department of Physics and Astronomy, University of Pennsylvania, Philadelphia PA 19104, USA, KE CHEN, Beijing National Laboratory for Condensed Matter Physics, Chinese Academy of Sciences, China, PETER J. YUNKER, CARL P. GOODRICH, SAMUEL SCHOENHOLZ, ANDREA J. LIU, A.G. YODH, Department of Physics and Astronomy, University of Pennsylvania, Philadelphia PA 19104, USA — We investigate phonon dispersion relations and associated mechanical properties of two-dimensional colloidal glasses and crystals composed of soft, thermoresponsive microgel particles whose temperature-sensitive size facilitates in-situ variation of particle packing fraction. The phonon modes were measured using particle tracking and displacement covariance matrix techniques. Measurements of the hexagonal crystal served to check our methodology and, as expected, the observed phonon dispersion was largely in agreement with theoretical expectations. Measurements of phonon dispersion in the glassy colloids, as a function of packing fraction above the jamming transition, permitted study of the scaling of bulk and shear moduli as a function of packing fraction. We performed numerical simulations and were able to recover the experimental findings. Moreover, the obtained shear moduli are in good agreement with rheological measurements.

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