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Elastically Disordered Perfect Colloidal Crystals DENIZ KAYA, N.L. GREEN, Department of Chemical Engineering , C.E. MALONEY, Deparment of Civil and Environmental Engineering , M.F. ISLAM, Departments of Chemical Engineering, Materials Science and Engineering, Carnegie Mellon University, Pittsburgh, PA, 15213 — We use spherical microgel colloidal particles to study lattice dynamics in a three-dimensional crystal using optical microscopy. We find that the local bond length fluctuations vary by as much as 75% from bond to bond despite less than 2% fluctuations in the equilibrium bond lengths. We show how to calculate the low-energy eigenmodes and the density of states in the presence of the strong heterogeneity. We find that the lowest energy eigenmodes are dominated by a few long-wavelength planewaves, and the density of states shows Debye-like behavior at low energy. This work has been partially supported by the NSF through Grants DMR-0619424 and DMR-0645596, by ACS-PRF and Alfred P. Sloan foundation.

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