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Hydrodynamic Coupling Among Colloidal Spheres in a Holographic Optical Trap Array MARCO POLIN, Department of Physics and Center for Soft Matter Research, New York University, KOSTA LADAVAC, Dept. of Physics, James Franck Institute and Institute for Biophysical Dynamics, The University of Chicago, STEPHEN QUAKE, Department of Applied Physics, California Institute of Technology, ALAN SOKAL, Department of Physics, New York University, DAVID GRIER, Department of Physics and Center for Soft Matter Research, New York University — Hydrodynamic couplings play a key role in colloidal suspensions, but have proven a very challenging ground for both theoretical and experimental study.In recent years, manipulation of mesoscopic objects using optical tweezers proved to be an invaluable tool for isolated study of hydrodynamic interactions. Previous works showed results compatible with standard approximations, but being limited to systems of two beads were unable to address superposition effects. We report direct measurements of many-body hydrodynamic interactions among colloidal spheres localized in arrays of optical traps with varying lattice constants.These measurements are made possible by the introduction of statistically optimal methods for calibrating the optical trap arrays while simultaneously measuring the trapped spheres' hydrodynamic radii. Analyzing the dispersion of the arrays' normal modes provides direct insights into nature of many-body hydrodynamic coupling, and particularly into the validity of the widely exploited approximations for assessing this coupling.

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