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Statistical Mechanics of Hydrodynamically Coupled Colloidal Spheres in Optical Vortices YAEL ROICHMAN, New York University, DOV LEVINE, Technion, Israel Institute of Technology, DAVID G. GRIER, New York University — Optical vortices are ring-like optical traps created by strongly focusing a helical mode of laser light. Colloidal particles trapped in an optical vortex are driven around its circumference by the vortex's orbital angular momentum flux. A set of such circulating spheres may be viewed as a system of perpetually sedimenting particles. Like sedimenting spheres, colloid in a vortex experience a uniform body force. They also interact with each other hydrodynamically. Unlike sedimenting spheres, those in an optical vortex remain in the field of view indefinitely and can be studied in great detail. In addition, the circulating colloid can be subjected to a nonuniform static potential energy landscape created by varying the intensity of light around an optical vortex's circumference. This elegant model system allows us to study the effect of hydrodynamic coupling on the mutual sedimentation of several particle with varying sizes. We find that sedimentation of a bidispered mixture of colloids forms stable couples of particles as opposed to the less stable structure of monodipersed particles sedimenting. We also demonstrate that fluctuations in the particles' trajectories can be used to gauge their system's departure from equilibrium.

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