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Search for Optical Binding with Shape Phase Holographic Optical Trapping YOHAI ROICHMAN, MARCO POLIN, ILIAS CHOLIS, DAVID GRIER, Center for Soft Matter Research, Physics Department, New-York University — Light scattered by an illuminated particle should repel that particle's neighbors through radiation pressure. Nearly two decades ago, Burns, Fournier and Golovchenko (BFG) proposed that the coherent superposition of scattered fields can lead to an attractive interparticle interaction, which they called optical binding. Their pioneering experimental observation has generated considerable interest, most of which has focused on developing the theory for the effect. Accurate measurements of the optical binding force in the BFG geometry have been lacking, however. The need to quantify optical binding forces is particularly acute for colloidal interaction measurements on linear optical traps. We present a new method to directly measure optical binding forces between colloidal spheres that exploits the ability of shape-phase holography to create linear optical traps with accurately specified intensity and phase profiles. Our ability to control the trap's phase profile makes possible precise discrimination between intensity- and field-dependent interactions, i.e. between radiation pressure and optical binding. The same novel technique that allows us to project holographic line traps also can be used to project two- and three-dimensionally structured ring traps, novel Bessel-beam traps, which we also will describe.

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