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Optical binding force acting on two optically trapped particles H.D. OU-YANG, MING-TZO WEI, Lehigh University — In addition to common optical manipulation setups such as an optical tweezers, the radiation forces generated by a laser can also induce chain-like arrangements of μ m-sized dielectric spheres through coherent multiple scattering, through a process known as optical binding (OB). Although the forces generated through OB are on the order of piconewtons, they are still sufficient to overcome other relevant interactions in the suspension such as Van Der Waals and gravitational forces and Brownian fluctuations. The OB force oscillates from attractive to repulsive as function of interparticle separation; as observed in theoretical models and optical fields found in systems such as counter propagating lasers in dual-beam optical-fibers. Using a dual optical tweezers setup, we have measured the inter-particle OB force from two 1.5 micron diameter polystyrene particles in suspension as a function of their separation by holding them in separate optical traps. Using a calibration scheme, we have isolated the OB force from the background of hydrodynamic and Brownian forces. Using experimental measurements and theoretical predictions, we also proved that by changing the respective polarizations between parallel and perpendicular orientations of the two traps, the OB force was the only force acting on the particles.

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