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Three-dimensional arrays of sub-micron particles generated by an optical lattice BETTY SLAMA, RACHEL SAPIRO, GEORG RAITHEL, University of Michigan — Using an optical lattice formed by four laser beams, we obtain three-dimensional light-induced crystals of polystyrene spheres in an aqueous solution. The total power of the 1064 nm trapping laser ranges from 200 mW to 4 W. The overall diameter of the approximately spherical, densely filled light-induced crystals is of order 10 μm, the maximum packing density is about 40 %, and the maximum number of trapped particles is approximately 5000. The diameter of the trapped particles ranges from 190 nm to 500 nm. The polarization of the trapping lasers is employed to realize different lattice types of the laser-induced trapping potential. A series of tests is performed that demonstrate particle trapping in all three dimensions. For one case, the trapping force is measured, and good agreement with a simple model is found. Different methods for lattice manipulation and translation are demonstrated. Bragg scattering of a 532 nm probe laser beam is employed to verify the crystal structure. For particle diameters that are about the same as or larger than the lattice period, crystal geometries are observed that differ from the laser-induced lattice potential. Possible applications and future directions are discussed.

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