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Use of Generalized Helical Modes of Light in Optical Trapping

STEVEN SUNDBECK, U.S. Naval Research Laboratory, ILYA GRUZBERG, Department of Physics and James Franck Institute, University of Chicago, DAVID GRIER, Department of Physics and Center for Soft Matter Research, New York University — Modes of light possessing topological defects may be focused to optical traps which have intriguing and potentially useful properties. Certain helical modes of light carry an orbital angular momentum. These modes of light may be focused to form circular traps known as optical vortices, which impart this angular momentum to trapped dielectric particles. Recently, experimental observations of the size dependence of optical vortices on the topological charge ℓ of the beam have led to the creation of more generalized optical traps from helical beams. These exotic topological traps can be designed in a variety of geometries and may be used to exert torques and forces noninvasively on colloidal and other microscopic systems. Examples of these exotic traps and a further theoretical understanding of the structure of these helical modes are presented.

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