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Tuning the orbital angular momentum in optical vortices CHRISTIAN SCHMITZ, KAI UHRIG, JOACHIM SPATZ, JENNIFER CURTIS, Max-Planck-Institute for Metals Research, Dept. of New Materials and Biosystems, D-70569 Stuttgart, Germany — Optically-driven micromachines rely upon the precise definition of the intensity distribution and the angular momentum content of the controlling light fields. One such manipulation tool is the optical vortex (OV), which employs orbital angular momentum to spin particles around a ring of light. The orbital angular momentum of an OV is tuned by changing the helicity of its electric field's wavefronts or by tuning the input power. However, changing wavefront helicity has the undesirable effect of altering the vortex diameter. Thus, making complex patterns of OVs with fixed sizes but adjustable rotational frequencies is difficult. We introduce a new class of OVs with an additional independent tuning parameter to overcome these limitations. With these OVs, it is possible to smoothly increase particles' rotational frequency without changing the radius or power. We show that this tunability can be extended to groups of OVs with similar or different radii, allowing for complete flexibility to construct optical micromachines, or large arrays of OVs for parallel assays of biomolecules and cells.

Christian Schmi
Max-Planck-Institute for Metals Research, Dept. of New Materials and Biosystems, D-70569 Stuttgart, Germa

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