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Propagation of orbital angular momentum carrying beams through a perturbing medium

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Abstract

The orbital angular momentum of light has been suggested as a means of information transfer over free-space, yet the detected optical vortex is known to be sensitive to perturbation. Such effects have been studied theoretically, in particular through turbulence. Here we demonstrate a simple apparatus to introduce turbulence-like distortions to optical fields propagating over a long path. We create vortex beams and observe their propagation through a heated spinning pipe, known to mimic the two primary atmospheric aberrations, namely tip–tilt and defocus. We use a digital decomposition tool to modally resolve the distorted vortex beam into its azimuthal components to observe the impact of the medium on the detection of the encoded vortex charge. Such techniques are useful in studies of free-space optical communication with orbital angular momentum.