Abstract Submitted
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Deterministic Prediction/Validation of Tilted Optical Vortex Trajectories by Treating Light as a Two-Dimensional, Compressible Medium[1] MARK LUSK, Colorado School of Mines, JASMINE ANDERSEN, ANDREW VOITIV, MARK SIEMENS, University of Denver, W. M. KECK INVESTIGATION OF TOPOLOGICAL FLUIDS OF LIGHT TEAM — We quantify the motion of optical vortices by treating light as a two-dimensional, compressible medium. The field of an optical vortex can be unwound with the background field used to construct two vortex velocity components. One is proportional to the gradient of the optical phase and is parallel to the local streamlines of the background velocity field. The other, though, is a functional of the local intensity of the optical field. This second contribution is particularly important for predicting trajectories associated with the nucleation and annihilation of vortex doublets, where vortices can be severely tilted. The approach is implemented for settings with analytic solutions for both the field and the trajectories. The predicted vortex velocities are shown to be tangent to the analytic trajectory, a validation of the theory and methodology. Our experimental implementation gives comparable vortex trajectories. The role of optical fluid compressibility has important implications for understanding and controlling the motion of optical vortices. Two-dimensional Bose-Einstein condensates should exhibit vortex tilt as well. If so, accounting for it in the same way will allow their vortex paths to be anticipated.

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