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Spatially multimode four-wave mixing for optical mode transformation[1] ONUR DANACI, CHRISTIAN RIOS, RYAN GLASSER, Tulane Univ — Spatially non-Gaussian states of light have applications to a variety of optical communications schemes and quantum optical experiments. Most methods used to generate such spatial modes either require linear optical elements that lead to significant attenuation, or rely on spatial-light modulators that are susceptible to damage at high optical powers. Here we demonstrate the ability of non-degenerate, non-collinear four-wave mixing (4WM) to generate non-Gaussian spatial modes of light, in which an input optical mode is amplified and converted to a particular spatial mode. Simultaneously, a second optical mode is created that propagates in a separate spatial direction, with a similarly non-Gaussian spatial profile. We show that the two resultant output non-Gaussian modes are well-approximated by modeling the 4WM interaction as a gain-aperture medium. Additionally, we combine this modeling with the phase-matching conditions imposed by the nonlinear 4WM process, and show that the resultant mode profiles agree with the experimental data, for both the output mode profiles, as well as their spatial Fourier Transforms. These results show that amplifying media may be used as a form of spatial mode conversion for optical states.

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