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Laser Beam Shaping using Spatially Variant Polarization

Many applications, including optical data storage and photo lithography, require a laser beam wave front which has a uniform intensity over a small, desired shape. However, beams exiting a laser are typically Gaussian and need to be converted into a flat-top figure. As the size of the spot approaches the diffraction limit, traditional optical methods of beam shaping generally fail, resulting in a large intensity ripple. A novel technique was introduced where the polarization angle changes with spatial coordinates across the pupil of a lens. An optical system, whose spatially variant polarization angles were optimized using simulated annealing, demonstrated experimentally that this technique can produce a uniform intensity shape down to the diffraction limit. This improved result could lead to higher density optical storage or more closely packed integrated circuits.

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