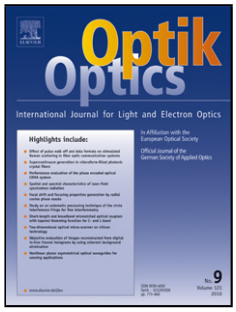

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Effect of thermal blooming on the beam quality of truncated laser beams

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Abstract: In this paper, it is found that the behavior of the effect of thermal blooming on the beam quality of truncated laser beams is quite different from that of untruncated ones. The beam spreading of truncated laser beams is less affected by thermal blooming than that of untruncated ones. There exists the oscillatory behavior of beam width versus the truncated parameter due to thermal blooming. When there exists the cross wind, under steady-state thermal blooming, the astigmatism of truncated laser beams is better than that of untruncated ones, and the centriod position is furthest away from the propagation axis for a certain value of the truncated parameter.

Keywords: Atmospheric optics; thermal blooming; truncated laser beams; beam quality

1. Introduction

When a high-energy laser beam propagates through the atmosphere, a fraction of the laser power is absorbed by the air along the propagation path. The absorbed power heats the air and alters the index of refraction of the path, in turn, which leads to spreading, bending and distorting of the laser beam. This self-induced effect is called thermal blooming, which is one of the most important nonlinear effects and severely limits the use to deliver high power density to selected targets [1-3]. Over the last decades, laboratory simulations of thermal blooming were carried out [4-6]. On the other hand, numerical simulations of thermal blooming were also investigated [7-10]. Recently, we studied the effect of thermal blooming on propagation of an Airy beam and a decentred laser beam through the atmosphere by using the numerical simulation method [9, 10].

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