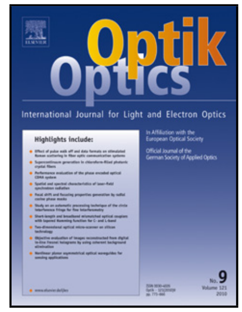
Accepted Manuscript




Title: Study on Intensity distributions of a BG beam with effect of tilt and astigmatism aberration in a turbulent atmosphere

Author: Y.P. Arul Teen P. Suresh T. Nathiyaa K.B. Rajesh T.V.S. Pillai

PII: S0030-4026(15)00689-0
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2015.07.137
Reference: IJLEO 55852

To appear in:

Received date: 29-6-2014
Accepted date: 22-7-2015

Please cite this article as: Y.P.A. Teen, P. Suresh, T. Nathiyaa, K.B. Rajesh, T.V.S. Pillai, Study on Intensity distributions of a BG beam with effect of tilt and astigmatism aberration in a turbulent atmosphere, *Optik - International Journal for Light and Electron Optics* (2015), http://dx.doi.org/10.1016/j.ijleo.2015.07.137

# Study on Intensity distributions of a BG beam with effect of tilt and astigmatism aberration in a turbulent atmosphere

**Y.P. Arul Teen, [1] P. Suresh, [2*], T.Nathiyaa, [3] K.B. Rajesh, [4] TVS. Pillai, [5]**
[1]Department of ECE, University College of Engineering, Nagercoil, Tamilnadu, India
[2] Department of ECE, National College of Engineering, Tirunelveli – 627151. Tamilnadu, India
[3] Department of Physics, Government Arts College, Salem-7, Tamilnadu, India
[4] Department of Physics, Chikkanna Government Arts College, Tiruppur, Tamilnadu, India
[5] Department of Physics, University College of Engineering, Nagercoil, Tamilnadu, India

***Corresponding author: *suresh3982@yahoo.co.in***

**Abstract:**
Using Fresnel-Kirchhoff diffraction integral equations, the intensity distributions of BG (Bessel-Gaussian beam) propagating in turbulent atmosphere is investigated in detail. The effect of tilt and astigmatism aberration on the intensity distribution of the BG beam with different topological charge, propagation distance and structural constant of atmosphere is evaluated numerically. It is observed that the effect tilt aberration for the BG beam with odd topological charge (m=1) is greater than the BG beam with even topological charge (m=2). We also noticed that, the effect of astigmatism aberration on the intensity distribution is found to be less than that of tilt aberration. It is also observed that the effect astigmatism aberration for the BG beam with even topological charge (m=2) is greater than the BG beam with odd topological charge (m=1). Hence the resultant intensity distribution of BG beam under the effect of tilt aberration plays a major role than that of astigmatism phase aberration in turbulent atmosphere.

**Keywords**: Bessel–Gauss beam; z-tilt aberration; Astigmatism aberration; Topological charge;

## 1. Introduction

Bessel–Gauss beam (BGB) was introduced by Gori et al. in1987 [1], and its optical implementation has attracted much attention [1-5]. An optical vortex occurs as a particular solution to the wave equation in cylindrical coordinates; the doughnut mode of a laser is an example of an optical vortex beam [6-8]. When an optical vortex is hosted within a Gaussian beam, the resulting beam exhibits an annular intensity profile with a dark core, whilst maintaining a helical phase structure. The effect of aberrations on the intensity profile in the focal volume of optical systems has been an area of interest for a long time. It is well known that the size and shape of the diffraction pattern depends on the property of the focusing system. A vast literature is available on the focusing property of optical systems afflicted with various types of aberrations [9-15]. The intensity distributions of vortex beams focused by an aperture system without or with aberration are being widely studied [16-20]. Rakesh et al. studied the focusing vortex beam with Gaussian background by an aperture system in presence of coma [16, 17], spherical aberration [18], astigmatism and defocusing [19, 20]. Liu and Lu [21] studied the propagation of Gaussian background vortex beams diffracted at a half-plane screen. Zhang et al. [22] discussed the propagation of partially coherent vortex beams in turbulent atmosphere. Wang et al. [23, 24] theoretically and experimentally investigated the beam-spreading of a vortex beam propagating in a turbulent atmosphere and found that the vortex beam is less affected by turbulence than anno-vortex one. Aksenov [25] studied the fluctuation of orbital angular momentum of vortex laser-beam in turbulent atmosphere. Tyler and Boyd [26] analyzed the