TRANSFORMATION OF HOLLOW-GAUSSIAN BEAM
BY AN ABCD OPTICAL SYSTEM COUPLED WITH OPTICAL
SYSTEMS OF ANNULAR APERTURE BASIS

L. Ez-zarly1, M. Boustimi2, H. Nebdi1, A. Belafhal1

1Laboratory of Nuclear, Atomic and Molecular Physics
Department of Physics, Faculty of Sciences, Chouaib Doukkali University,
P. B.: 20, 24000 El Jadida, Morocco
2Physics Department, College of Applied Sciences, Umm Al-Qura University,
P.O. Box : 715 , Makkah 21955, Saudi Arabia.
* Corresponding author. E-mail: belafhal@gmail.com
Received: 09 February 2014; revised version accepted: 28 June 2014

Abstract

Based on the generalized Collins-Huygens diffraction integral, and by means of the expansion of a hard aperture function into a finite sum of complex Gaussian functions a main approximate analytical expression of hollow-Gaussian light, propagating through a paraxial ABCD optical system coupled with an annular aperture, is devoted in this paper. The corresponding closed-forms of the transformation of a hollow-Gaussian beam (HGB) by an unapertured ABCD optical system, and by this last coupled with a circular aperture or circular black screen are also treated in this work as particular cases of the principal finding. After propagating in optical systems cited above, it is observed that the HGB will be transformed into a Laguerre-Gaussian beam. From these results, we found the previous study concerning the propagation of pure Gaussian laser light through the above optical systems. Using the analytical expressions, the transverse intensity distribution of propagation characteristics in the annular aperture, and in black screen are discussed and investigated numerically in detail in this work.

Keywords: Hollow-Gaussian beams; ABCD optical system; Annular aperture; Circular aperture; Black screen.