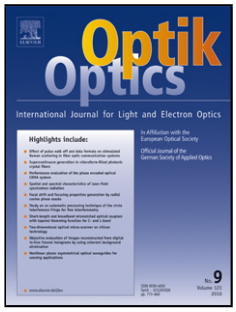

Title: Controlled generation and analysis of higher order quasi-non diffracting optical vortex lattices

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Controlled generation and analysis of higher order quasi-non diffracting optical vortex lattices

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Abstract: The interference method is considered to be one of the most important methods to create higher order optical vortex lattices. This paper reintroduces this method in a newer way to generate various high order quasi non diffracting optical vortex lattices. The definite numbers of plane waves are used to generate higher order topological charge at the center of optical vortex lattices. The tips of the wave vectors of these plane waves lie on the projected equivalent hexagonal ring in transverse Fourier plane along propagation direction. Initially six plane waves are used to form higher order optical vortex. As the numbers of plane waves increases, the wave vector at each side of hexagon also increases and the combination would be a multiple of six plane waves such as twelve, eighteen and twenty-four etc. Further, the initial phase relation among these waves contributes more to get various higher order topological charges at the center of optical vortex lattices. Using this controllable initial phase, the different types of lattices are generated.

Keywords*: Optical Vortex lattices, higher order topological charge, interference*

1. Introduction

From last two decades, the optical vortex has gained immense popularity in optics research because of its property of orbital angular momentum and its application in optical tweezers [1], optical spanner [2], optical trapping and optical manipulation of ultra cold atoms [3] and quantum communication [4]. In the field of nanostructure, the chiral nano-needle is also formed by transferring helicity of the incident beam to material. The chirality of nano-needle is controlled by the topological charge of optical vortex beam [5]. Numerous research and exploration in the field of optical vortex also provided a much newer application in the field of optical vortex array which has received much attention due to its wider application in the areas of optical testing [6] and optical solitons [7]. Recently, S.G. Reddy has generated speckles by scattering the optical vortex beam through ground glass plate. The paper also reported that speckles size varies with the order of vortex. For example if higher order optical vortex beam scattered through ground glass, the size of speckles will decrease and more speckle will be formed in a given area [8].