

论文

拉盖尔高斯径向偏振光高数值孔径聚焦特性

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摘要:

光波在高数值孔径聚焦下焦点区域光强分布呈现出的特殊性质已经被应用到光学显微成像、微粒控制、光存储等领域中.本文基于矢量Deby衍射理论研究了TM₀₁模拉盖尔高斯径向偏振光经高数值孔径聚焦下焦点区域光强分布.通过调节入瞳半径与光束束腰之比,发现拉盖尔高斯径向偏振光光斑由明亮尺寸小光斑变化成环形中空光斑,并且通过光瞳滤波器可以实现对焦点区域光强和暗斑尺寸的调制,使焦点中心暗斑光强由0变化到1.通过合适的复光瞳滤波器参量选择,在焦区产生了多个三维“光笼”,这使得能够更有效地束缚微粒,而且可以一次控制多个微粒,对捕捉折射率低于周围环境的微粒具有重要的应用价值.

关键词: 拉盖尔高斯径向偏振光 高数值孔径 光瞳滤波器 微粒捕捉

Focusing Characteristics of Laguerre-Gaussian Radially Polarized Beam Through High Numerical Aperture

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Abstract:

For the focusing of the optical system with high numerical aperture, the light intensity distribution in the focal region will show some special characteristics, which can be used in many fields, such as microscopy, particles trapping, data storage etc. Based on the vectorial Deby theory, the focal light intensity distributions of TM₀₁ mode Laguerre-Gaussian radially polarized beam through the optical system with high numerical aperture were studied. By adjusting the ratio of the pupil radius versus beam waist, the focal light spot changed from small bright spot into dark ring spot. Moreover, by the pupil filter, the light intensity distribution in the focal region and the focal dark spot size could be modulated, which could make the intensity of dark area change from 0 to 1. And, by choosing the parameters of pupil filter purposefully, several 3D optical cages could be produced in the focal region, which made particle trapping more efficiently. Moreover, several particles can be trapped at one time, which has great practical value in trapping particles with refractive indices lower than that of surrounding medium.

Keywords: Radially polarized Laguerre-Gaussian beam High numerical aperture Pupil filter

Particles trapping

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