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Diffraction of a Gaussian beam by a sinusoidal radial phase grating and effects of input parameters on radial carpet beams

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Abstract

In this work, the diffraction of a Gaussian beam by a radial phase grating with a sinusoidal profile is investigated theoretically. The results unambiguously confirm that this process leads to the generation of radial carpet beams. It is found that reducing the beam-waist radius of the incident beam affects the intensity of the main lobe, while simultaneously confining the side-lobe intensity along the radial direction. Moreover, the wavelength of the beam incident on the radial phase grating with a sinusoidal profile plays a decisive role in shaping the diffraction pattern. The analysis further reveals that even very small variations in the number of grating sectors significantly alter the phase arrangement, although the intensity pattern remains nearly stable. The self-healing property of radial carpet beams is found to depend on both the number of grating sectors and the size of the obstructed region. Specifically, increasing the number of sectors and decreasing the obstruction size reduces the beam's self-healing distance.

Keywords: Radial grating, Gaussian beam, Radial carpet beam, Phase amplitude, Self-healing

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