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Nonlinear Spatial Frequency Chirping Of Quadruple Gaussian Laser Beams Interacting with Narrowband Gap Semiconductors: Effect of Self Focusing

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Abstract

This paper investigates the nonlinear spatial frequency chirping (NSFC) of quadruple Gaussian (QG) laser beams interacting with narrowband gap semiconductors. The study focuses on the influence of self-focusing, a nonlinear optical phenomenon that can significantly alter the beam's propagation characteristics. The nonlinear Schrodinger equation (NLSE) is employed to model the beam propagation, incorporating the effects of self focusing. Numerical simulations are conducted to analyze the NSFC behavior under various conditions, including different beam intensities, semiconductor bandgaps, and initial beam profiles. The results demonstrate that self-focusing plays a crucial role in enhancing the NSFC effect, leading to a more pronounced spatial frequency spread. Additionally, the paper explores the impact of semiconductor bandgap on the NSFC, revealing that materials with narrower bandgaps exhibit stronger nonlinear interactions and consequently more significant NSFC. Overall, this study provides valuable insights into the nonlinear optical properties of quadruple Gaussian laser beams in narrowband gap semiconductors and highlights the importance of considering self-focusing in understanding the NSFC phenomenon.

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