

论文

超短脉冲径向偏振光束的解析解及时空耦合效应

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摘要:

从超短脉冲光束的傍轴传输方程出发, 运用傅里叶变换和相关数学算符的对易性, 得到了超短脉冲径向偏振光束的解析表达式. 该解可适用于任意脉冲驱动的径向偏振光束. 基于该解析表达式并结合具体例子, 讨论了超短脉冲径向偏振光束在自由空间中的传输性质. 结果表明, 在传输过程中时空耦合主要体现在光束边沿的脉冲延迟. 这一效应导致了脉冲不同时间位置处横向光强分布随传输的变化, 以及脉冲前后沿关于束腰的不对称性. 本文的方法同样适用于得到超短脉冲方位角偏振光束的解析解和传输性质.

关键词: 超短脉冲 径向偏振 时空耦合

Analytical Solution and Spatiotemporal Coupling Effect for Ultra-short Pulsed Radially Polarized Beams

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Abstract:

Based on the propagation equation which governs the propagation of ultra-short pulsed beams, and by utilizing the Fourier transform technique as well as the commutation relation between two mathematical operators, the analytical solution for ultra-short pulsed radially polarized beams is obtained. This solution is applicable to radially polarized beams driven by any pulse. On the basis of the solution, the propagation properties of the ultra-short pulsed radially polarized beams are discussed. It shows that the pulse at the beam periphery is delayed compares to that around the beam center. This effect results in the the varying of transverse intensity distribution of the ultra-short pulsed radially polarized beam at different temporal positions during propagation, and the asymmetric intensity distribution of the vertical profile at the head and the trail of the pulse. The method used in this paper is applicable in obtaining the analytical solution and the propagation properties for the ultra-short pulsed azimuthally polarized beams.

Keywords: Ultra-short pulse Radially polarized beams Spatiotemporal coupling

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