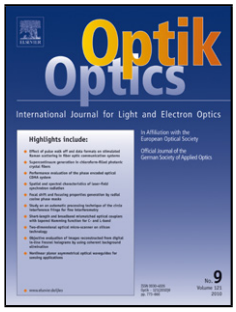

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Nonlocal logarithmic nonlinear optical soliton

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The propagation of optical beam in (1+2)-dimensional nonlocal logarithmic nonlinear media is studied. The numerical simulation shows that the intensity profiles of solitons undergo a gradual and continuous transition from a Gaussian-shaped function in the general nonlocal media to an approximately hyperbolic secant function in the local case. Due to the nonlocal effect, the stability of solitons increases with the increase of nonlocality degree. Concretely speaking, the quasi-stable solitons can be formed in local and weakly nonlocal (nonlocality degree $\alpha<0.5$) logarithmic nonlinear media. In general nonlocal case ($0.5\leq\alpha\leq1$), the completely stable solitons can be formed. In special case ($\alpha=1$), even the initial power increase largely, the solitons can still exist even the initial power has large change for the saturable nonlinear contract effect. However, when $\alpha=1.1$, the solitons cannot be formed at any initial power because nonlinear effect is too small to balance diffraction effect.

Key word: Nonlinear optics; nonlocal logarithmic media; optical soliton; saturable nonlinear effect

1. Introduction

In recent years, spatial optical solitons have drawn considerable attention both in experiment [1-3] and theory [4-19]. nonlocal spatial optical solitons have been a hot subject because of their incurring singular phenomena and unique physical properties. For example, G. Assanto discussed the routing of vortex beams [20]; and G. Liang investigated spiraling elliptic solitons in nonlocal nonlinear media [21]; Z. P. Dai considered the interactional solitons in nonlinear media with an exponential nonlocal response [22]; T. P. Horikis studied the nonlocal Ring dark and antidark soliton [23]; F. Maucher analyzed the stability of solitary waves in random nonlocal media [24]; B. K. Esbensen found the quadratic soliton in the nonlocal media with periodic response function [25].

However, the research mentioned above mainly confined to nonlocal Kerr media. In fact, nonlinearity can be divided into many categories, such as Kerr nonlinearity, mutation nonlinearity [26], competing nonlinearity [27, 28] and saturable (including logarithmic) nonlinearity [29-31]. A. E. Kaplan obtained the bistable soliton in mutation nonlinear media [26]. B. K. Esbensen investigated the anomalous interaction of solitons in nonlocal media with competing nonlinearities [27]. The nonlinear refractive index of nonlocal logarithmic nonlinear media, which is saturable with the intensity of light,