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Interactions of Soliton in Weakly Nonlocal Nonlinear Media

Aklan N.A.B.^a , Faizar F.A.^a, Umarov B.A.^b Save all to author list^a Department of Computational and Theoretical Sciences, Kulliyah of Science, International Islamic University Malaysia, Pahang, Kuantan, 25200, Malaysia^b Department of Physics, Kulliyah of Science, International Islamic University Malaysia, Pahang, Kuantan, 25200, Malaysia**Abstract**

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Abstract

Solitary waves or solitons is a nonlinear phenomenon which has been studied intensively due to its application in solid-state matter such as Bose-Einstein condensates state, plasma physics, optical fibers and nematic liquid crystal. In particular, the study of nonlinear phenomena occurs in the structure of waves gained interest of scholars since their discovery by John Russell in 1844. The Nonlinear Schrödinger Equation (NLSE) is the theoretical framework for the investigation of nonlinear pulse propagation in optical fibers. Nonlocality can be found in an underlying transport mechanisms or long-range forces like electrostatic interactions in liquid crystals and many-body interactions with matter waves in Bose-Einstein condensate or plasma waves. The length of optical beam width and length of

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Flat top solitons on linear Gaussian potential

Umarov, B.A. , Aklan, N.A.B. , Rosly, M.R. *(2017) Journal of Physics: Conference Series*

The Soliton Interaction in Weakly Nonlocal Nonlinear Media on the External Potentials

Aklan, N.A.B. , Umarov, B.A. *(2017) Journal of Physics: Conference Series*

Aussian beam in highly nonlocal nonlinear medium

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response function are used to classify nonlocality in optical materials. The nonlocality can be categorized as weak nonlocal if the width of the optical beam broader than the length of response function and if the width of the optical beam is narrower than the length of response function, it is considered as highly nonlocal. This work investigates the interactions of solitons in a weakly nonlocal Cubic NLSE with Gaussian external potential. The variational approximation (VA) method was employed to solve non integrable NLSE to ordinary differential equation (ODE). The soliton parameters and the computational program are used to simulate the propagation of the soliton width and its center-of-mass position. In the presence of Gaussian external potential, the soliton may be transmitted, reflected or trapped based on the critical velocity and potential strength. Direct numerical simulation of Cubic NLSE is programmed to verify the results of approximation method. Good agreement is achieved between the direct numerical solution and VA method results. © Published under licence by IOP Publishing Ltd.

Author keywords

gaussian potential; nonlinear equation; nonlinear Schrödinger equation; numerical method; scattering; Soliton; variational method

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