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Modeling of evolution and non-elastic interaction of solitary NLS envelop pulses in complex media

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Investigation of evolution and interaction of solitary waves and pulses (wave packets) is very actual problem in different fields of physics especially when the medium is non-uniform and its properties depend on time. In this case, as a model, we use the generalized non-linear Schrödinger (GNLS) equation, which describes the waves in a plasma, fiber and planar optical waveguides, taking into account the inhomogeneity and non-stationary of a propagation medium. Earlier we have showed analytically that the GNLS equation can have stable and quasi-stable solutions of the soliton and breather types and also unstable solutions which disperse with time. In this paper we study the evolution and interaction of the envelop solitons numerically. At simulation the Fourier Splitting Method for the GNLS equation was used and the specially developed implicit scheme of finite-difference method was used for investigation of soliton like structures propagation in non-uniform and non-stationary medium. Numerical modeling showed that inhomogeneity of medium changes the parameters of the envelop solitons such as their amplitudes, velocities and their quantity that is caused by their non-elastic interaction in inhomogeneous medium. Non-stationary medium changes a form of pulses and affects their spectral features. Changes of modulation of the parameters of medium make possible variation of character of non-elastic interaction at solitons attraction repulsion. Obtained results can be useful in numerous applications in plasma physics, nonlinear optics and in many other fields of physics.

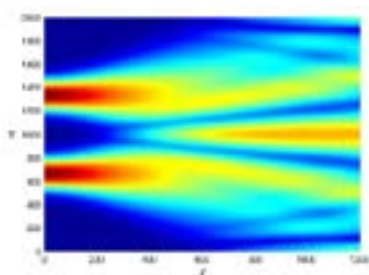


Figure 1: Evolution of double Gaussian envelop pulse in stationary medium with negative nonlinearity

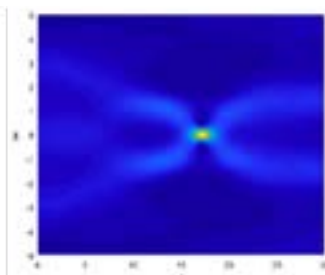


Figure 2: Interaction of three envelop pulses with formation of one strong pulse and its disintegration with time (negative nonlinearity)

Recent Publications

1. Belashov V Yu, Belashova E S and Kharshiladze O A (2018) Problem of stability of multidimensional solutions of the BK class equations in space plasma. *Advances in Space Research* 62:65-70.
2. Belashov V Yu, Belashova E S and Kharshiladze O A (2018) Nonlinear wave structures of the soliton and vortex types in complex continuous media: Theory, simulation, applications. *Lecture Notes of TICMI*. Tbilisi University Press 18:90.

Biography

Oleg A Kharshiladze is Associate Professor at Physics Department of Tbilisi State University. He is involved in International Scientific group, working on Analytical and Numerical analysis of Ionospheric and Magnetospheric processes (turbulence, shear flows, BBF and others).

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