ordinary differential equations and similar chains of discrete mappings. A numerical analysis suggests that these chains with suitably chosen parameters exhibit chaotic attractors of arbitrarily high dimensions.

Non-linear dynamics of open Bose-Einstein condensates

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We consider dynamics of a quasi 1D Bose-Einstein condensate (BEC) loaded into an off-resonant leaky cavity or a quantum optical lattice [C.Maschler et al., Eur. Phys. J. D 46, 545 (2008)]. This implies that quantum features of the optical potential are taken into account. Our main concern is the influence of nonlinearity due to atom-atom interactions on the dynamics of BEC. Using positive P representation the evolution of the system is analyzed and numerically solved to demonstrate considerable dependence of the cloud broadening on the atom-atom scattering length. This result is compared with earlier results [T. Yu. Ivanova et al., Phys. Rev. A 84, 043602 (2011)] for harmonically trapped BEC subjected to a generic quantum measurement of its center-of-mass position.

Self-localized states in lasers with external feedback

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Dissipative solitons have long demonstrated their potential for information processing applications. Because of their compactness and extensive use in the information and telecommunication industry, the case of solitons observed in Vertical Cavity Surface Emitting Lasers (VCSEL) is particularly interesting. Different types of transverse localized states have been observed in a number of different configurations. Here we review the latest results on the existence and dynamics of dissipative solitons in lasers with frequency selective feedback.

Generation and interactions of optical-terahertz solitons in quadratically nonlinear media

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We discuss the possibility of generation of optical-terahertz solitons by optical rectification in quadratically nonlinear media. The bound state of an optical laser pulse and a terahertz few cycle pulse becomes possible due to Zakharov-Benney resonance. The conditions of soliton stability in bulk medium are determined by

variational approach. We also consider the regimes of nonelastic collisions of co-propagating solitary waves in such system. The pulse group velocity and frequency can be changed during the interaction. The effects of pulse reflection, tunneling, blocking and trapping are found by variational approach and numerical simulations.

From optical rogue waves to optical transistors

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We demonstrate that nonlinear wave interaction between fundamental solitons with surrounding dispersive waves in a nonlinear optical fiber leads to intermittent giant waves with all signatures of rogue waves. The main mechanism is based on the concept of an optical event horizon and is naturally given in the supercontinuum process. Using this mechanism in a deterministic way makes an all-optical control of light pulses possible. This can be done in a very efficient and versatile manner with the opportunity to overcome the main limitations for realizing an optical transistor.

Optical information transmission by femtosecond quasidiscreate spectral supercontinuum with 70 TBit/s rate

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Physical principles of encoding and data transmission by quasidiscrete spectral supercontinuum obtained by the interference of phase-modulated light pulses with superbroadened spectra are discussed. The possibility of ultrafast data transmission at the rate of 70 Tbit/s is demonstrated experimentally.

A rigorous physical approach to a proper analysis of wave propagation in planar and fiber waveguides

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There are some fundamental problems in classical analytic methods for light propagation in planar and fiber waveguides, due to an improper use of plane wave terms and complex-valued functions. Such problems could be rigorously solved with the help of real domain new parametric wave functions and solutions