

The Peregrine rogue waves induced by interaction between the continuous wave and soliton

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Based on the soliton solution on a continuous wave background for an integrable Hirota equation, the reduction mechanism and the characteristics of the Peregrine rogue wave in the propagation of femtosecond pulses of optical fiber are discussed. The results show that there exist two processes of the formation of the Peregrine rogue wave: one is the localized process of the continuous wave background, and the other is the reduction process of the periodization of the bright soliton. The characteristics of the Peregrine rogue wave are exhibited by strong temporal and spatial localization. Also, various initial excitations of the Peregrine rogue wave are performed and the results show that the Peregrine rogue wave can be excited by a small localized (single peak) perturbation pulse of the continuous wave background, even for the nonintegrable case. The numerical simulations show that the Peregrine rogue wave is unstable. Finally, through a realistic example, the influence of the self-frequency shift to the dynamics of the Peregrine rogue wave is discussed. The results show that in the absence of the self-frequency shift, the Peregrine rogue wave can split into several subpulses; however, when the self-frequency shift is considered, the Peregrine rogue wave no longer splits and exhibits mainly a peak changing and an increasing evolution property of the field amplitude.

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