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Spectral Peculiarities of Nonlinear-Dispersive Similariton

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We report the detailed studies on spectral broadening of nonlinear-dispersive similariton shaped in passive fiber, with an objective to develop a simple diagnostic technique of femtosecond pulses.

Similariton pulses with the distinctive property of self-similar propagation, attract the attention of researchers, due to prospective applications in ultrafast optics and photonics [1,2]. The self-similar propagation of the high-power pulse with parabolic temporal, spectral, and phase profiles was predicted theoretically in the 90's [3]. In practice, the generation of such parabolic similaritons is possible in active fibers [4-7]. Another type of similariton is generated in a conventional uniform and passive (without gain) fiber under the combined impacts of Kerr-nonlinearity and dispersion [8]. This nonlinear-dispersive similariton has only parabolic phase but maintains its temporal (and spectral) shape during the propagation, as well.

The bandwidth of nonlinear-dispersive similariton is given by the input pulse power, with varying coefficients given by the input pulse shape [8]. This property of nonlinear-dispersive similariton, is the subject of our detailed studies, aimed to measurement of pulse duration at the femtosecond time scale, as an alternative to the autocorrelation technique.

During our study we first found that the bandwidth of such a similariton is also conditioned by its energy and initial bandwidth. This makes possible to have a precise rule for retrieving the pulse duration, independently from the initial pulse shape. This rule is applicable for pulses with both symmetric and asimmetric temporal profiles. Additionally, the optimal lengths of the fiber and the areas of application of this rule have been ascertained.

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