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Strongly non-Gaussian statistics of optical soliton parameters in multichannel transmission due to delayed Raman response AVNER PELEG, Department of Mathematics, The University of Arizona,Tucson, AZ 85721, USA — We study the effects of delayed Raman response on soliton dynamics in optical fiber transmission systems with multiple frequency channels. Taking into account the quasi-random nature of pulse sequences in different channels and the collision induced energy exchange we show that soliton propagation in a given channel under many collisions with solitons from other channels is described by a perturbed stochastic nonlinear Schrödinger equation with weak disorder in the linear gain coefficient. As a result, the soliton amplitude becomes a random variable with a lognormal distribution. The cross frequency shift is also lognormally distributed and the self frequency shift is a random variable that is not self-averaging. We conclude that this disorder is potentially more harmful than other types of disorder that are usually considered in optical fiber transmission. Our predictions are in very good agreement with extensive numerical simulations employing importance sampling.

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