Nonlinear Dynamics of Modulated Signals in Optical Fibers

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The nonlinear Schrodinger equation (NLSE) describes the nonlinear waves localization dynamics in weakly dispersive media, and it has been extensively studied in various contexts in nonlinear science [1,2]. A particular class of solutions of the NLSE that has recently attracted considerable attention is that of the solitons on finite background as their localization dynamics have been proposed as an important mechanism underlying the formation of extreme amplitude waves on the surface of the ocean [3,4]. Much of this work has also been motivated by an extensive parallel research effort research in optics that has shown how nonlinear optical fiber systems can be used to implement controlled experiments studying NLSE dynamics and freak waves in a purely optical context. Here, we review our recent numerical and experimental work on the localization dynamics of weakly modulated signals in optical fiber systems. We discuss the various regime of propagation and show that the transverse dynamics are governed by Akhmediev breather localization characteristics whilst the longitudinal evolution is described by Kuztnetzov-Ma soliton dynamics.

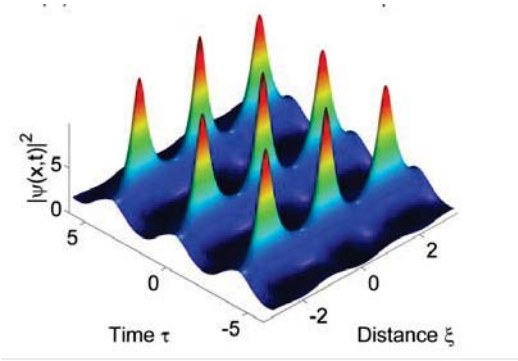

Fig. 1. Simulated evolution of a weakly modulated signal in a nonlinear optical fiber.

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