LINEAR AND NON-LINEAR PHOTONIC ROGUE WAVES IN COMPLEX TRANSPARENT MEDIA

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Introduction. Ocean rogue waves (RW) -huge solitary waves- have for long triggered the interest of scientists. RWs emerge in a complex environment and it is still unclear if their appearance is due to linear or nonlinear processes. Recent works have demonstrated that RWs appear in various other physical systems such as microwaves, nonlinear crystals, cold atoms, etc.

Methodology and results. In this work we investigate optical wave propagation in strongly scattering random lattices embedded in the bulk of transparent glasses. In the linear regime we observe the appearance of RWs that depend solely on the scattering properties of the medium. Interestingly, the addition of nonlinearity does not modify the RW statistics, while as the nonlinearities are increased multiple-filamentation and intensity clamping destroy the RW statistics. Numerical simulations agree nicely with the experimental findings and altogether prove that optical rogue waves are generated through the linear strong scattering in such complex environments.

Figure 1. Linear and nonlinear laser beam propagation

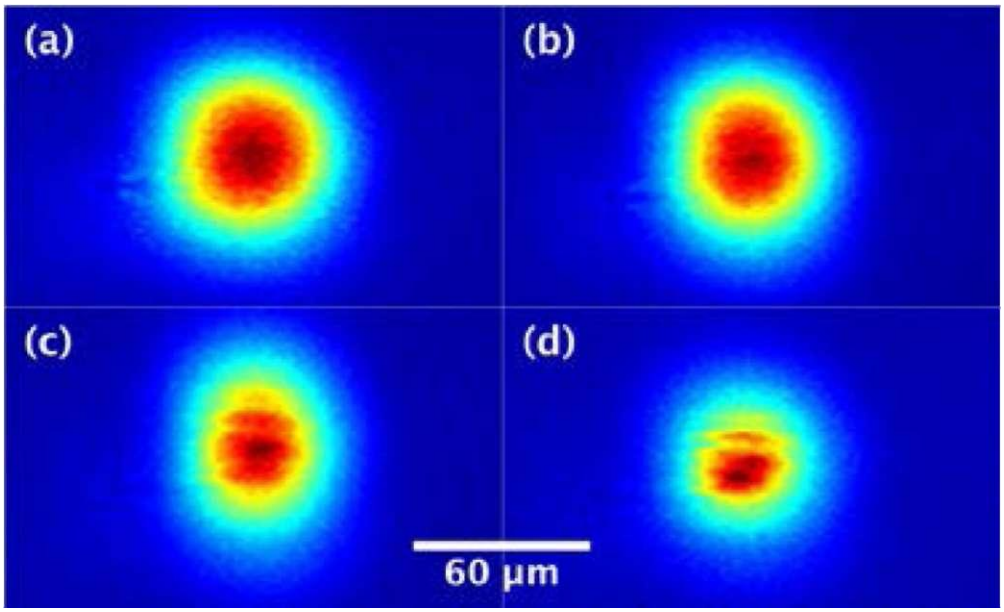

Figure 1 shows experimental results on the nonlinear propagation of an intense femtosecond probe beam in the bulk of a glass without any lattice. The total beam Kerr self-focusing can be clearly seen as the input laser power is increased from (a) to (d).