

# Short pulse equations and localized structures in frequency band gaps of nonlinear metamaterials

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We consider short pulse propagation in nonlinear metamaterials characterized by a weak Kerr-type nonlinearity in their dielectric response. In the frequency "band gaps" (where linear electromagnetic waves are evanescent) with linear effective permittivity  $\epsilon < 0$  and permeability  $\mu > 0$ , we derive two short-pulse equations (SPEs) for the high- and low-frequency band gaps. The structure of the solutions of the SPEs is also briefly discussed, and connections with the soliton solutions of the nonlinear Schrodinger equation are presented.

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