Nonlinear dynamics of wave packets in $\mathcal{PT}$-symmetric optical lattices

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Abstract:

Nonlinear dynamics of wave packets in PT-symmetric optical lattices near the phase-transition point are analytically studied in one- and two- dimensional systems.We show analytically that when the strength of the gain-loss component in the PT lattice rises above the phase-transition point, an infinite number of linear Bloch bands turn complex simultaneously.For the 1D case, a nonlinear Klein-Gordon equation is derived for the envelope of wave packets. A variety of novel phenomena known to exist in this envelope equation are shown to also exist in the full equation including wave blowup, periodic bound states and solitary wave solutions. In 2D a novel equation is derived for the envelope dynamics, and wave packets exhibit pyramidal diffraction.