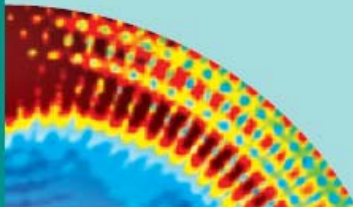


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**Sanchez-Curto, J, Graham S McDonald, Chamorro-Posada, P,
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Helmholtz solitons at nonlinear interfaces

Abstract

The reflection and refraction of spatial solitons at interfaces is studied in terms of the Non-Linear Helmholtz (NLH) equation. Previous paraxial studies have been restricted to vanishingly-small angles of incidence. Our novel approach employs the Helmholtz non-paraxial framework, which is associated with the off-axis evolution of relatively-broad optical beams. Oblique propagation effects play a central role in our analysis. Our formalism allows description of *incidence, transmission and reflection angles of any size, for the first time*. For moderate-intensity beams, we uncover two distinct parameter regimes where the transmitted and reflected solitons exhibit qualitatively different characteristics.

In our work, we propose an NLH equation for inhomogeneous media. This model is used to study the behavior of spatial solitons at the planar boundary separating two dissimilar Kerr media. *We report new analytical results, such as a compact generalization of Snell's law*. This description is valid for arbitrary angles of incidence, and involves a non-linear correction that arises naturally from a Helmholtz description of the problem. *Substantial modifications to paraxial predictions of the refraction and critical angles of an incident soliton beam are obtained*. Full numerical simulations have been used to test the validity of our theoretical predictions, where we find spectacular agreement.