



University of
Salford
MANCHESTER

Black and grey soliton refraction at interfaces

Sánchez-Curto, J, Chamorro-Posada, P and McDonald, GS

Title	Black and grey soliton refraction at interfaces
Authors	Sánchez-Curto, J, Chamorro-Posada, P and McDonald, GS
Publication title	Technical Digest: National Photonics Conference, Photon 10, Southampton, 2010
Publisher	Institute of Physics (IoP)
Type	Conference or Workshop Item
USIR URL	This version is available at: http://usir.salford.ac.uk/id/eprint/18267/
Published Date	2010

USIR is a digital collection of the research output of the University of Salford. Where copyright permits, full text material held in the repository is made freely available online and can be read, downloaded and copied for non-commercial private study or research purposes. Please check the manuscript for any further copyright restrictions.

For more information, including our policy and submission procedure, please contact the Repository Team at: library-research@salford.ac.uk.

Black and grey soliton refraction at interfaces

J Sánchez-Curto¹, P Chamorro-Posada¹ and G S McDonald²

¹ ETSI Telecomunicación, Universidad de Valladolid, Spain

² Materials & Physics Research Centre, University of Salford, UK

Dark Kerr soliton refraction at planar boundaries is analysed and simulated *for the first time*.

A new generalisation, consisting of a simple law for refraction of all spatial Kerr solitons, is derived. Earlier, we analyzed *bright* spatial soliton refraction at nonlinear interfaces using Helmholtz theory [1], which preserves the full inherent angular content of the problem. Our findings have now been generalized to a law that describes the behaviour of *both bright and dark* soliton refraction at nonlinear interfaces (see Figure 1).

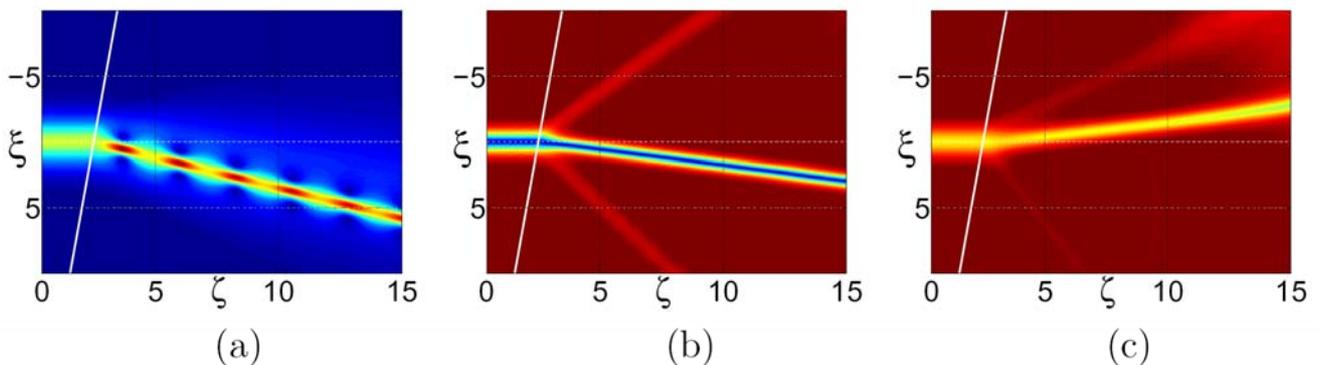


Figure 1: Surface plots of soliton refractions at an interface (white lines). Each interface shown arises from a fixed change in linear and nonlinear refractive indices. Refraction of: (a) bright, (b) black and (c) gray solitons is simulated and analysed.

Spatial soliton refraction at interfaces has traditionally been studied in terms of the paraxial Nonlinear Schrödinger Equation, which limits the validity of results to vanishingly small angles of incidence. This restriction is removed in a Helmholtz nonparaxial framework, in which a Nonlinear Helmholtz (NLH) equation describes the evolution of a broad beam (when compared to the wavelength) propagating at arbitrary angles.

Grey soliton refraction is found to exhibit the most complex features; analysis predicts a sensitive dependence on the soliton greyiness parameter. Excellent agreement between analysis and simulations will be reported; quantitative predictions will be verified through presentation of a series of simulation results. For example, investigations reveal that variation of only the greyiness parameter can result in a transition from external to internal refraction regimes.

References

- [1] Sánchez-Curto J, Chamorro-Posada P and McDonald G S, *Opt. Lett.* **32**, 1126–28 (2007)
Sánchez-Curto J *et al.*, *J. Opt. A: Pure & Appl. Opt.* **11**, art. no. 054015 (2009)
- [2] Sánchez-Curto J, Chamorro-Posada P and McDonald G S, Dark Kerr soliton refraction at interfaces, *accepted for Opt. Lett.* (2010)