Helmholtz solitons: A new angle in nonlinear science

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The ubiquitous nonlinear Schrödinger (NLS) equation models soliton propagation in many different scenarios. In a nutshell, the NLS equation describes the slow modulation of the envelope of a linear wave when propagating in a weakly nonlinear medium. Within the context of spatial optical solitons, for instance, *slow* refers to the paraxial approximation which permits to derive the NLS equation from the more general nonlinear Helmholtz (NLH) equation [1] for the envelope of an optical beam which propagates along a definite axis, or infinitesimally close to it, and which is broad when compared to the wavelength, thus, preserving the weakly nonlinear nature of the propagating disturbance.

Restrictions on the propagation angle can be released using the NLH equation which restores the spatial symmetry required when angular considerations are fundamental such as in the collisions of solitons or when they impinge on a nonlinear interface [1]. A detailed account of recent progress in the field [1] plus new results will be presented, including exact soliton solutions and analytical and numerical investigations of their properties.

References

[1] Chamorro-Posada P. et al. *Phys. Rev. E* **74** 036609 (2006), Sánchez-Curto J. et al. *Opt. Lett.* **32** 1126 (2007), Christian J.M. et al. *J. Phys.A: Math. Gen* **40** 1545 (2007).