Interaction nematicons in a bias-free liquid crystal cell

Yana Izdebskaya[a], Vladlen Shvedov[a,b], Anton Desyatnikov[a],
Wieslaw Krolikowski[a], Gaetano Assanto[c] and Yuri Kivshar[a]

*a Nonlinear Physics Centre and Laser Physics Centre, Research School of Physics
and Engineering, The Australian National University*
b Department of Physics, Taurida National University, Simferopol, 95007 Crimea, Ukraine
*c NooEL – Nonlinear Optics and OptoElectronics Lab – Department of Electronic Engineering,
INFN and CNISM, University "Roma Tre", Via della Vasca Navale 84, 00146, Rome, Italy*

We study propagation of spatial optical solitons in the unbiased nematic liquid crystal cell. We demonstrate surface-mediated interactions of these solitons. We consider two interaction geometries with plane of soliton propagation being either parallel or perpendicular to the cell boundaries. We show that the interaction is the weakest in the middle of the cell and becomes stronger as the solitons approach either boundary of the cell [see Fig.1]. The related physics of this process and its practical implication will be discussed in detail.
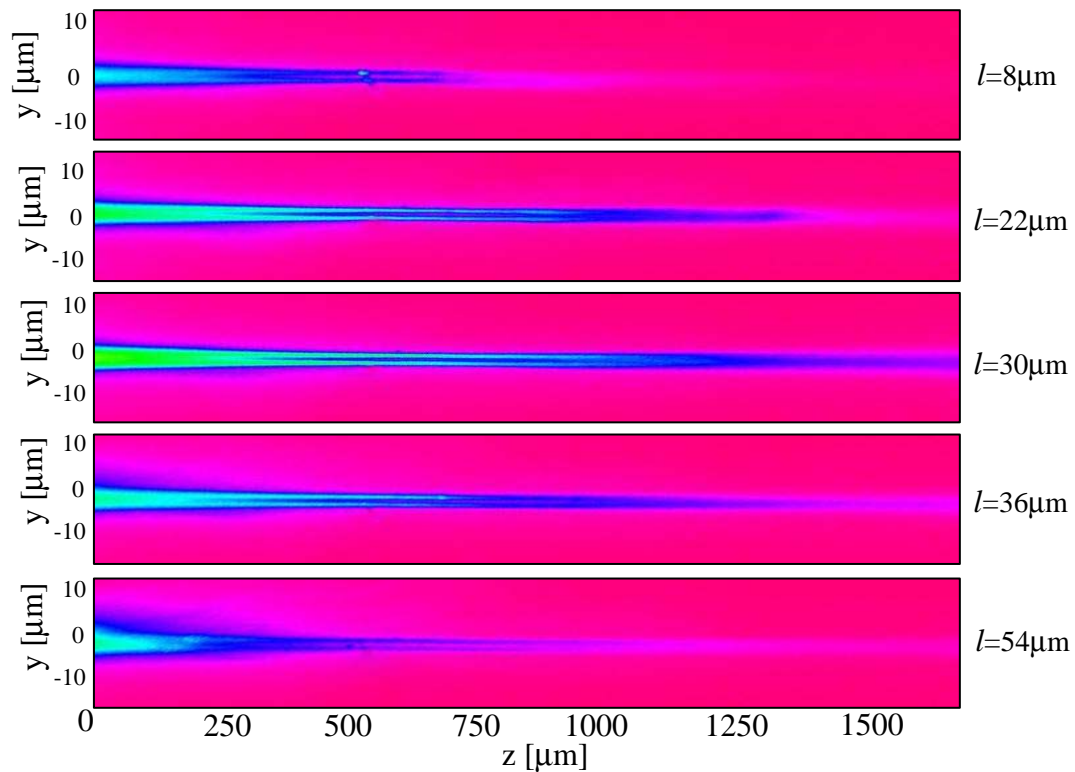
Figure 1 The dynamics of the two-soliton interaction as a function of their location with respect to the 65-mm-thick nematic liquid crystal cell boundaries. The parameter l denotes the distance between the plane of the solitons and the boundary of the cell. In this particular case the plane of soliton propagation is parallel to the cell boundaries.