Nonlinear beam manipulation in coupled optical waveguides

Dragomir N. Neshev
Nonlinear Physics Centre, Research School of Physics, Australian National University,
Canberra, 0200 ACT, Australia
Tel: +61 2 61253792, email: Dragomir.Neshev@anu.edu.au

Abstract:

The arrays of coupled optical waveguides have become the preferred platform for studies on nonlinear localisation in periodic photonic structures and lattices. Due to their versatility one can engineer both the diffraction and nonlinear response of beams, opening new opportunities for direct observation of fundamental nonlinear phenomena of light localisation. This talk will review some of the recent advances in nonlinear beam manipulation in arrays of optical waveguides. In particular we will focuss on (i) light localisation in diffraction managed arrays [1], (ii) nonlinearity management in arrays with quadratic nonlinear response [2]; (iii) interplay between gain and nonlinearity in photonic lattices with a feedback [3].

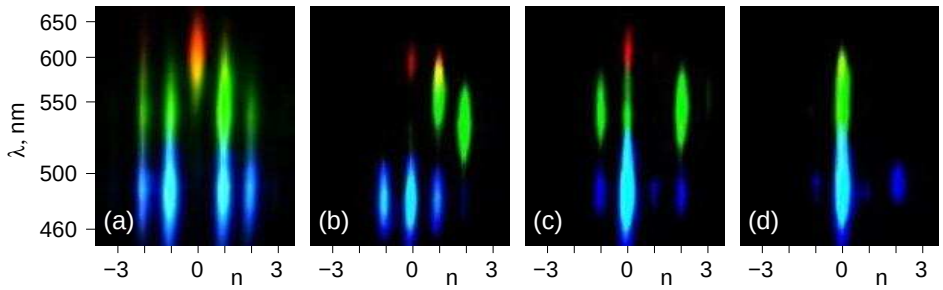

Figure 1: Measured spectrally-resolved output beam profiles. (a) Illumination time of 5 s, input power of 1 μW. (b-d) Illumination time of 35, 60, and 420 s, respectively; input power of 18.0 mW.

For example in Fig. 1 we show the formation of diffraction managed polychromatic solitons in periodically curved defocusing $LiNbO_3$ waveguide arrays. While in the linear regime the beam exhibits dynamic localisation for the yellow spectral components [Fig. 1(a)], in the nonlinear regime, it experiences asymmetric reshaping [Figs. 1(b,c)]. At even longer illumination times (high nonlinearity) we observe self-localization of all spectral components to a single waveguide. This is, to the best of our knowledge, the first experimental observation of diffraction-managed polychromatic soliton. These results suggest novel opportunities for engineered all-optical tuning of beams and in particular for spectral filtering of supercontinua.

References:

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