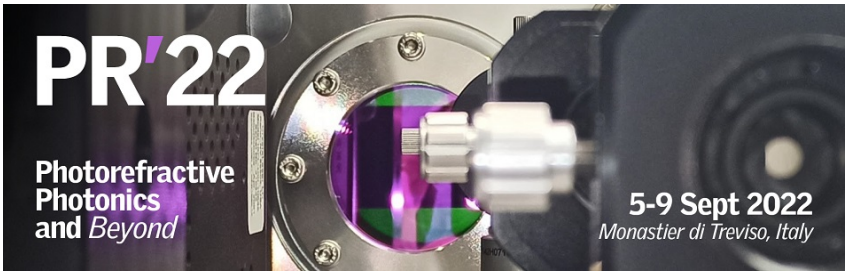

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Controllable waveguiding structures induced by diffracting Bessel beams in a nonlinear medium

Friday, 9 September 2022 11:15 (25 minutes)

Due to their unique profiles and fascinating propagating phenomena unconventional beams like Airy beams are good candidates for photo-inducing waveguiding structures in a photorefractive medium. Bessel beams (BBs) share similar features with Airy beams, such as diffraction-free, multi-lobes profiles, and self-trapping property under nonlinear conditions. Thus, several studies on waveguides induction using non-diffracting BBs under weak nonlinearity have been developed [1]. Instead, our recent work unveiled that diffracting BBs propagating under high nonlinear conditions provide more advantages and opportunities for the light-induction of waveguiding structures.
In our work, we experimentally and numerically demonstrate that only one single diffracting BB can induce complex 3D waveguides with up to 9 outputs in a biased photorefractive SBN crystal. By tuning parameters such as the incoming BB size, the applied electric field, the input beam power, and the background illumination, our optical platform enables all-optical control of the output intensity levels and tailors the stability of each channel.
Furthermore, we demonstrate that the truncation and the order of the incoming BB are also two crucial parameters for adjusting the number of inputs/outputs channels [2]. Finally, numerical results of two counter-propagating BBs are also presented. These results show advantages of using two BBs to obtain higher guiding efficiency, more complex waveguiding configurations and consequently further possibilities for all-optical interconnects.

References:
[1] F. Xin et al., Physical Review Applied 11, 024011 (2019).
[2] Y. Chai et al., Optics Express 29, 40231 (2021).

Primary authors: Dr MARSAL, Nicolas (Chair in Photonics, CentraleSupélec, LMOPS, F-57070 Metz, France); CHAI, Yue (Chair in Photonics, CentraleSupélec, LMOPS, F-57070 Metz, France); Prof. WOLFERSBERGER, delphine (Chair in Photonics, CentraleSupélec, LMOPS, F-57070 Metz, France)

Presenter: CHAI, Yue (Chair in Photonics, CentraleSupélec, LMOPS, F-57070 Metz, France)

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