Beam shaping with hybrid optical elements for optical communication links

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Abstract:

Social, economic or cultural data must be transmitted from one point to another safely and secure. The photons are excellent candidates for optical communication since they can propagate over long distances but with very low loss, due to decoherence mechanism in free space. One can exploit many degrees of freedom of light in order to encode the information: time-bin, time-frequency, path encoding, amplitude, polarization, spatial structure - orbital angular momentum (OAM). Large alphabets (high capacity) and high security can be achieved when the information is encoded with OAM. Optical vortices which carry OAM propagate in straight line, so in case of obstacles between the transmitter and the receiver the information transfer is affected. On the other hand, Airy beams represent accelerating beams with curved trajectory and have been a subject of great interest for self-acceleration, self-healing, non-diffraction properties and robustness in case of the atmospheric turbulence during propagation. A promising solution for optical communication to preserve the information when are present line-of-sight obstacles (between transmitter and receiver) can be considered in bendable optical vortices (AOVs). These hybrid beams encompass both functions for OAM degree of freedom (to achieve high information capacity) and curved trajectory (to avoid obstacles). In this work, the generation of curved light beams is achieved by phase profile engineering with hybrid optical elements in order to improve free space optical communication. This approach has the big advantage that passive optical elements are not influenced by temperature and permits the implementation of compact optical systems. The investigation of encoding, propagation and decoding of AOV states will be investigated for a free space optical link.

Biography:

Dr. Rebeca Tudor has B. Sc and M. Sc degrees in engineering, from the Faculty of Electronics, Telecommunications and Information Technology, POLITEHNICA University, Bucharest, majoring in "Microelectronics, Optoelectronics and Nanotechnologies" (2011), respectively "Microsystems" (2013). She obtained her doctorate in Physics – Optics in 2018 at the Faculty of Physics, University of Bucharest, Romania. Dr. Rebeca Tudor is scientific researcher at National Institute for Research and Development, IMT Bucharest, Romania, being part of the Laboratory of Micro and Nanophotonics since 2013. Her expertise is in the field of simulation, design, manufacturing and characterization of optical elements for optical and quantum communications. Also, Dr. Tudor is currently the director of postdoctoral grant of the Ministry of Research, Innovation and Digitization, CNCS – UEFISCDI, PN-III-P1-1.1-PD-2021-0399 *Investigation of hybrid optical beams for optical and quantum communication (HYQOM)*. Dr. Tudor is the winner of the PATRIOTFEST 2019 edition (competition organized by the Romanian national security institutions).