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Holographic toolkit for optical communication beyond orbital angular momentum

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Abstract content
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Very recently, it was pointed out that orbital angular momentum (OAM) multiplexing alone does not increase the bandwidth of optical communication systems. Indeed in all work to date, multiplexing schemes based on OAM have not provided with a real bandwidth increment.

In this work, we demonstrate a new holographic tool to realise a communication link using a densely packed LG mode set incorporating both radial and azimuthal degrees of freedom. Moreover, we show experimentally that it is possible to multiplex/demultiplex over 100 spatial modes on a single hologram, written to a spatial light modulator, in a manner that is independent of wavelength. For this, a set of 35 optical modes multiplexed in 3 different wavelengths was experimentally generated to create a set of 105 information carriers. This modes were used as information carriers over a free space link to illustrate the robustness of our technique. The information was recovered by simultaneously detecting all different modes employing a single hologram. Using this approach we are able to transmit several images with correlations higher than 98%. Although our scheme is a proof-of-concept, it provides a useful basis for increasing the capacity of future optical communication systems.

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