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Creation, characterization and analysis of propagation invariant vector flat-top beams

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Laser beams structured to have a uniform peak intensity profile (flat-top) have become ubiquitous and a topic of interest in many research fields. However, such beams alter their intensity profile as they propagate in free space. This problem can be overcome by generating vector flat-top beams. Here, we present theoretical simulations and demonstrate experimentally the creation of propagation invariant vector flat-top beams. By utilizing the spatial light modulator's polarization dependent efficiency, we coaxially superimpose a Gaussian and donut beam with orthogonal polarization states. We employ a classical and quantum toolkit to characterize and analyse the vector state of the resulting vector flat-top beam during propagation. As an example, we demonstrate the adaptability of these beams in an optical tweezer system however these beams can be of impact in a wide range of applications.

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