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Detection of Bessel-Gauss modes by the use of digital holography

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Abstract content
   (Max 300 words)

Bessel-Gauss beams are a class non-diffracting beams which are generated by illuminating a conical optical element with a Gaussian beam. They are constrained to exist for a finite propagation distance hence upon reaching the boundary of its non-diffracting region, they transform into a conical field depicted by an annular ring. The creation of these beams is easily achieved using a digital holographic approach, which involves programming a spatial light modulator (SLM) with an appropriate phase mask. An SLM is a diffractive optical element that is electronically addressed in order to modulate the phase of light, such that the incoming beam maybe altered accordingly to produce the desired output beam. Zero-order Bessel-Gauss beams are shaped using a phase mask with a conical phase while higher-order Bessel beams are achieved by introducing a spiral phase to the conical phase masks to specify the order of the beam. Detecting these beams involve carrying out a modal decomposition on the created beam. Mathematically, this implies executing the inner product of the Bessel-Gauss beam with an appropriate beam profile. The detection method is essentially the inverse of the creation process. Experimentally, this was realised using two SLM's where the first one created the Bessel-Gauss beam while the second contained a phase mask which created a beam profile to overlap with the Bessel-Gauss beam in order to extract the coefficients contained within the beam. During this process it was observed that higher-order Bessel-Gauss beams shift in their propagation distance which ultimately affected the results of the detection method. Here, we show the successful implementation of this detection method and we validate the observed shifts in propagation distance

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PhD

Main supervisor (name and email)
and his / her institution

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