

Polarisation structuring of broadband light

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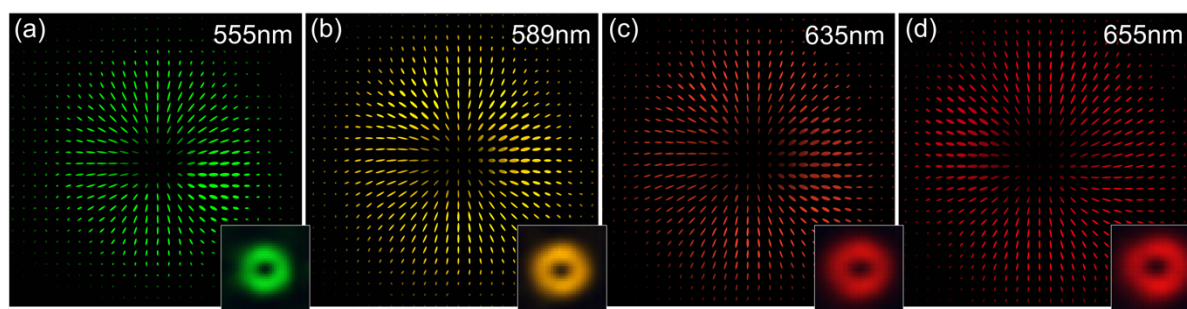
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Figure 2 features a CCD image of the Fourier plane of LC-SLMs 1 and 2, without the second aperture in place. This result displays the desired vector beam in the lower center position, as well as the unwanted chromatically dispersed orders A and B which are only reflected (not modulated) by LC-SLM 1.

The Stokes measurements found in figures 3, 4 and 5, e.g.



were generated by first taking 7 CCD images of the different polarisation states by placing a linear polariser (LP) and quarter waveplate (QWP) before the CCD when applicable:

1.bmp

Measurement 1: Raw beam (no LP, no QWP)

This CCD image was used as the inset of each of the Stokes maps in figures 3,4 and 5.

2.bmp

Measurement 2: Horizontal position [LP Hz, no QWP]

3.bmp

Measurement 3: Vertical position [LP Vert, no QWP]

4.bmp

Measurement 4: Diagonal position [LP Hz+45°, no QWP]

5.bmp

Measurement 5: Anti-diagonal position [LP Hz-45°, no QWP]

6.bmp

Measurement 6: LH circular position [LP Hz, QWP Hz]

7.bmp

Measurement 7: RH circular position [LP Vert, QWP Vert]

Next, equations 6, 7 and 8 were used, similar to reference

K. J. Mitchell, S. Turtaev, M. J. Padgett, T. Cizmar and D. B. Phillips, "High-speed spatial control of the intensity, phase and polarisation of vector beams using a digital micro-mirror device," Opt. Express 24 (25), 29269-29282 (2016)

to process the Stokes measurements into

A: Semi-major Axis length (Pmaj)

B: Semi-Minor Axis length (Pmin)

Psi: orientation of major axis (ψ)

H: Handedness (h)

These are also included in each map's folder, their filenames corresponding to the dates they were taken e.g. *A_x19d120417.txt* was the 19th measurement on the 12th April 2017.

To generate the polarisation maps, each pixel represented was used to construct an ellipse of dimensions [A,B, ψ , h].

Measurements Folders:

- Folder name: Fig 2
File name: **CCDimage1.png**
Description: A CCD image of the Fourier plane of both LC-SLMs, as depicted in Figure 1.
- Folder name: Fig 3
Folder description: Circular and Linearly polarized vector beam Stokes polarisation maps in the Fourier plane of both LC-SLMs.
- Folder name: Fig 4
Folder description: Radially and Azimuthally polarized vector beam Stokes polarisation maps in the Fourier plane of both LC-SLMs.
- Folder name: Fig 5
Folder description: Poincaré "Lemon" and "Star" beam Stokes polarisation maps in the Fourier plane of both LC-SLMs.

For each Stokes polarisation ellipse map, the approximate colour of the inset image (1.bmp) found by the colour CCD was used to recolour the individual ellipses.

Lastly, in order to additionally depict the intensity of the generated vector beams within the Stokes polarisation map, the inset raw images (1.bmp) were upscaled and added as a semi-transparent overlay to each coloured Stokes map.