

# Structured light exercise

The challenge is to create a structured light beam that consists of a series of petals around the azimuth. You should be able to change a parameter, say  $L$ , and change the number of petals. **If you would like a hint, turn the page.**

## Experimental parameters:

The set-up in the laboratory is shown schematically in Figure 1. The salient details are:

- Incoming Gaussian beam of  $1/e^2$  width  $w = 4.92$  mm
- The SLM is phase-only with  $1080 \times 1920$  pixels of pitch  $8 \mu\text{m}$ .
- The camera is positioned away from the  $0^{\text{th}}$  diffraction order at a position of  $X = 2$  mm and  $Y = -2$  mm.

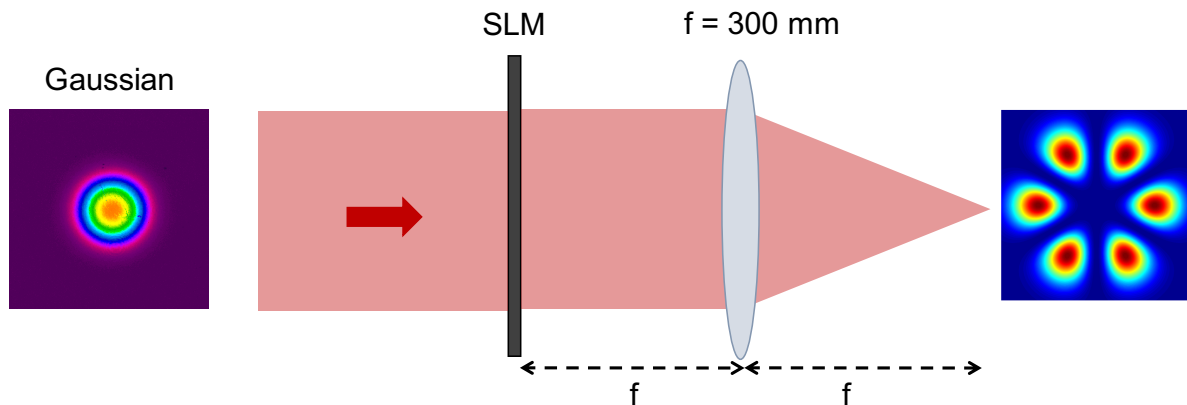


Figure 1: The laboratory set-up with the desired mode set to the created shown in the far-field plane of the SLM.

## Instructions on how to upload the holograms:

1. Create your hologram (Make sure hologram values are between 0 and 255 as a grayscale image)
2. Save your hologram as an image with name 'holo\_\*.png', where \* represents your name (no spaces or special characters)
3. Copy (upload or drag) your image file in (you'll need a gmail account):  
<https://drive.google.com/open?id=1lg3om2aFEmCND6lgDFqi259GyM7FhJ-v>

## Hint:

You can think about the petals as azimuthally varying peaks and troughs. This will result from the sum of two vortex beams of opposite handedness, shown in Figure 2. Because the SLM is phase-only we can add the two azimuthal phases and then take the argument ( $\arg[ ]$ ) to get the phase-only approximation. But, we also need to add the grating. The grating moves the beam off at an angle and so has the form of a plane wave with phase  $k_x x + k_y y$ . Try to draw a simple ray picture to find the unknown values for the spatial frequencies. The period of the gratings in X and Y should be approximately  $160 \mu\text{m}$  (about 20 pixels), with the Y grating negative. The SLM hologram must be the mod of all these functions together.

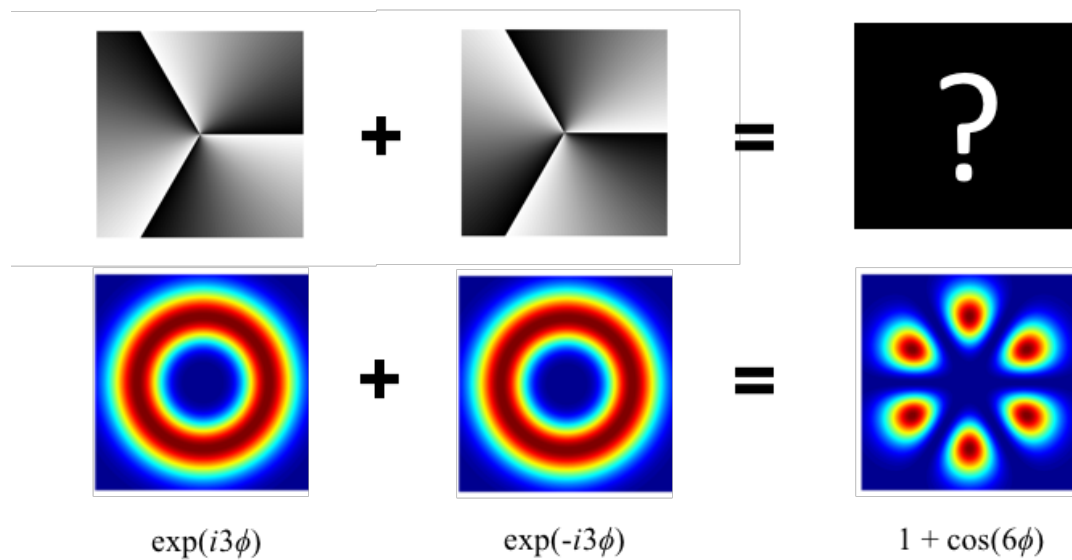


Figure 2: Hint as to how to think about it.