**TOY PROBLEM TO DEMONSTRATE FOURIER PTYCHOGRAPHY**

Open “phase\_retrieval\_spiral\_circregion.m”

Suppose there is an object with this intensity profile

A picture containing text, outdoor, sky, white

Description automatically generated

And this phase profile (black = 0, white = 2pi)



We now simulate the captured image at different illumination angles by taking the inverse Fourier transform of the corresponding section of the Fourier domain (see “Fou\_LR” folder to see how choosing sections of the Fourier domain works). The inverse transform will be complex and low resolution, but we are only capturing the real intensity (See “Intensity\_LR” folder).

The Fourier transform of these real intensity image will be 2 circles mirrored through the origin instead of occupying a single circular region like the Fourier domain of the complex image (see “Fourier\_LR\_real” folder)

The Gerchberg-Saxton algorithm works by taking low-resolution intensity image in “Intensity\_LR” along with the precise knowledge of how much their Fourier domain is shifted and reconstruct the above intensity and phase images.

**Diagram

Description automatically generated**

Reconstructed intensity and phase (red = 0 or 2pi, cyan = pi)

A picture containing text, outdoor, white, town

Description automatically generated Background pattern

Description automatically generated with medium confidence

The reconstructed image is very similar to the original one, except for where the phase changes abrupty.