5.13: Pentagram Diffraction Pattern

Establish mask geometry:

$$R = 2 \quad m = 1..5 \quad \Theta_m = \frac{2\pi m}{5} \quad x_m = R\sin(\Theta_m) \quad y_m = R\cos(\Theta_m)$$

$$R = 0.75 \quad m = 6..10 \quad \Theta_m = \frac{2\pi(m-0.5)}{5} \quad x_m = R\sin(\Theta_m) \quad y_m = R\cos(\Theta_m)$$

Fourier transform of position wave function (mask geometry) into the momentum representation: $m = 1..10$

$$d = .15 \quad \Phi(p_x,\, p_y) = \frac{1}{2\pi d\sqrt{10}}\left[\sum_{m=1}\left(\int_{x_m-\frac{d}{2}}^{x_m+\frac{d}{2}} exp(-ip_x x)dx \int_{y_m-\frac{d}{2}}^{y_m+\frac{d}{2}} exp(-ip_y y)dy\right)\right]$$

Display mask geometry and diffraction pattern:

$$N = 100 \quad \Delta p = 20 \quad j = 0..N \quad k = 0..N \quad px_j = -\Delta + \frac{2\Delta pj}{N} \quad py_k = -\Delta p + \frac{2\Delta pk}{N}$$

$$\text{Diffraction pattern}_{j,\,k} = (|\Phi(px_j,\, py_k)|)^2$$