

Problem Set 4

Physics 266 Second Semester, AY 2024-2025

10 points per number

Due: 30 May 2025 (Friday)

Intensity distribution in the neighborhood of the focus (Section 8.8.2, Born & Wolf).

1. Plot the isophotes [contour lines of the intensity $I(u, v)$] in a meridional plane near focus of a converging spherical wave that is diffracted by a uniformly illuminated circular aperture (similar to Figure 8.41). Normalize the intensity to be equal to unity at focus.

Parameters: refractive index $n = 1.5$, wavelength $\lambda = 550$ nm, $a/f = 0.5$ where a is the aperture radius and f is the focal length.

2. Discuss briefly the salient features and implications of your results.
3. Plot the isophotes in a meridional plane near focus of a converging spherical wave that is diffracted by a uniformly illuminated circular aperture (like Figure 8.41). Normalize the intensity to be equal to unity at focus.

Parameters: refractive index $n = 1.5$, wavelength $\lambda = 550$ nm, $a/f = 0.75$ where a is the aperture radius and f is the focal length.

4. Cite differences in the (a) focal tolerance, (b) central spot diameter and intensity distributions (c) along the optical axis and (d) along the boundary of the geometrical shadow between isophote plot 1 ($a/f = 0.5$) and plot 2 (0.75).

END.