

Opti 380A – Intermediate Optics Lab I – Fall 2009

Post-Lab Questions for Lab 12: Diffraction

Post-lab questions are due at the beginning of lecture on the Monday following your lab.

- 1.) Describe the image of an isolated distant star as observed from a simple telescope with a round primary mirror, which is also the aperture of the telescope. Assume that the telescope is “perfect”, where the observed image is affected only by diffraction. How does the aperture diameter D of the telescope affect the image?

- 2.) A 1mm diameter round hole is illuminated by an on-axis collimated laser beam with $\lambda = 500\text{nm}$. Determine distances from the aperture where zero and maximum on-axis irradiance is observed within the range 0.1m to 0.5m. Sketch the cross-section of each pattern at these locations.

- 3.) The irradiance of a round-hole Fraunhofer diffraction pattern is called the “Airy disk”. Mathematically, it is a somb^2 function, and it is a very important pattern to understand when working with optical systems. Consider the round aperture stop of a camera as the diffracting aperture. The camera images two distant point sources, like car headlights from a long distance. Each point source creates an Airy pattern in the image plane of the camera, in a way similar to the lens system used in the experiments. Assuming that the source points are far enough away to qualify for Fraunhofer diffraction, at what distance from the camera will the two points no longer be resolved? Assume that the effective diameter of the stop is D and that the distance from the stop to the image plane is f . State any other assumptions that you make.