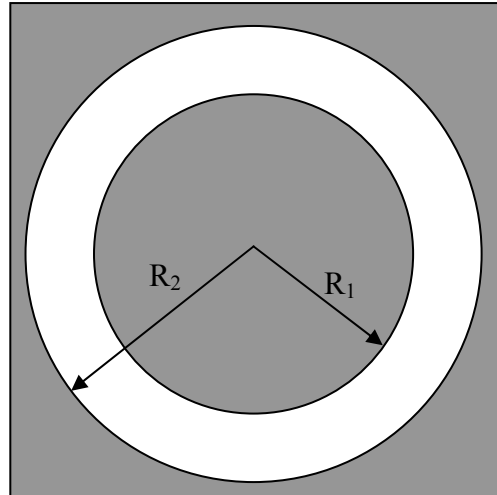


## OPTICS, 114210 - Homework Exercises

### E. Fresnel Diffraction

1. A mask contains an annular aperture which is transparent between radii  $R_1$  and  $R_2$ , and otherwise opaque. It is illuminated with a plane wave of wavelength  $\lambda$ . At what distances from the mask is the diffracted light intensity zero on the axis?



2. The "Fresnel-Arago bright spot" is observed on the axis of the diffraction pattern of a circular disc of radius  $R$  at distance  $z$ .

(a) If the disc is replaced by an elliptical plate with major and minor semi-axes  $R \pm \delta$ , for what value of  $\delta$  will the spot disappear?

(b) Would you expect to see a bright spot on the axis of the diffraction pattern of a square plate?

3. A plane wave, wavelength  $\lambda$ , is incident on a mask with a circular hole with radius  $R$ . What is the largest distance from the mask at which one sees a diffraction pattern with a zero at its centre?

4. A zone plate is used to focus X-rays in an X-ray microscope. Show that the focused spot size is approximately (i.e. order of magnitude) equal to the width of the outermost ring of the zone-plate.