PHYS542 Homework 10 Supplement

3. Kirchoff's Approximation for Complementary Scatterers A monochromatic plane wave polarized along the y-axis is normally incident from $z < 0$ onto a two-dimensional conducting scatterer confined to the $z = 0$ plane. Use Kirchoff's approximation but do not use the Fraunhofer approximation.

(a) Let the scatterer be a conducting disk of radius a. Find $\mathbf{E_{disk}}(0, 0, z > 0)$

(b) Let the scatterer be an infinite conducting sheet with a circular aperture of radius a centered on the z-axis. Find $\mathbf{E_{ap}}(0, 0, z > 0)$.

(c) Confirm that

$$\mathbf{E_{ap}} = \mathbf{E_{inc}} - \mathbf{E_{disk}}$$

. Explain why Babinet's principle is not the reason for this.