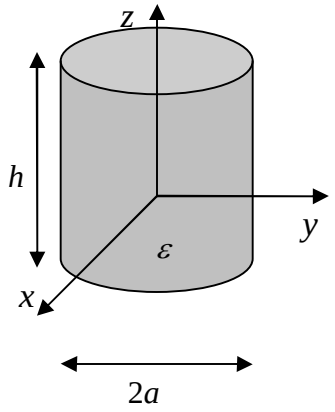
EM Scattering

Homework assignment 1

Problem 1:

An incident wave travels in free space (dielectric constant ε_0, permeability μ_0, wave number $k = \omega\sqrt{\varepsilon_0\mu_0}$) and impinges upon a dielectric cylinder with the radius a, height h, and the relative dielectric constant ε_d. The axis of the cylinder lies on the z-axis.

- Use the Born approximation to calculate the scattered electric and magnetic fields in the far-field zone in any direction $\hat{k}_s$ when the incident plane wave is moving in the +z direction ($\hat{\boldsymbol{k}}_i = \hat{\boldsymbol{z}}$) and the incident electric field is polarized along $\hat{\boldsymbol{x}}$. Take the amplitude of the incident electric field to be E_0.
- Repeat this calculation for the case where $\hat{\boldsymbol{k}}_i = \hat{\boldsymbol{x}}$ and the incident electric field is polarized along $\hat{\boldsymbol{z}}$.



Problem 2:

Using the Born approximation calculate the scattering cross section from a dielectric sphere with the dielectric constant ε_d whose radius a is much smaller than the wavelength in vacuum. Next, compute the scattering cross section by using the optical theorem and compare the results.