Computer Homework 14 Electric Flux

The charge density on a rod of length 1m centered on the origin and along the x axis is given by $\lambda = (1.0\mu\mathrm{C/m})\cos^2(\pi x/\mathrm{RodL})$ with RodL = 1m. Use the following template program to complete the task:

(1) Finish the electric field function E(r), which returns the electric field vector for a given position r.

(2) Plot the electric field line on x-y plane and up to a distance 1.5 m from the origin.

(3) If there is an imagined tube of radius R = 0.5 m and of length L = 1.4 m, find numerically the electric flux on all the surfaces of the tube.

(4) Integrate numerically over λ to find the total charge on the rod. Is the flux equal to the total charge divided by ε_0 ?

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from visual import *
epsilon0 = 8.8542E-12
k = 1.0 / (4*pi*epsilon0)
lamda0, RodR, RodL= 1E-6, 0.02, 1.0        # Charged Rod parameters
R, L = 0.5, 1.4                            # Tube radius and length

def E(r):                                  # Function to calculate the electric field vector at r
    return vector(0, 0, 0)

scene= display(title='charged rod',x=0, y=0, width=600, height=600, background=(0.5,0.5, 0) )
rod = cylinder(pos=(-RodL/2.0,0,0),axis=(RodL,0,0), radius = RodR ,color=color.yellow)
tube = cylinder(pos=(-L/2.0, 0, 0), axis = (L, 0, 0), radius = R, color = color.blue, opacity = 0.40)

# Plot Electric field line


# Calculate the flux on the surface of the tube
flux = 0

# Calculate the total charge on the rod
Q = 0

print 'flux =', flux, '      Q/epsilon0 = ', Q/epsilon0
```