Ph 213 Hand-In Problem 2 Spring 2020

You want to trap a single piece of antimatter. You decide to start small and work with a positron.

You have a hoop of charge of radius R and total charge -Q. You place a positron at the center of the hoop and give it a slight nudge in the direction of the central axis that is normal to the plain of the hoop. Due to the negative charge on the hoop, the positron oscillates back and forth.

**Step 1:** Clearly show how to use integration to find the z-axis E-field of a ring charge.

**Step 2:**  Place a positron a small distance above the plane of the ring and calculate the period of oscillation.

Complete the next two steps computationally in VPython. Computationally means that you only use empirical formulas such as Coulombs Law and not derived formulas such as what you found in Step 1.

**Step 3:** Use VPython to find the force on a positron a distance d=0.13mm above a center of a ring of R=5.2cm and charge Q=-3.7⋅10-9C. Use this result as a reasonableness test for this HIP. Include a printout of your program with what you turn in.

**Extra Credit:**

**Step 4:** Keep using this program to find the period of oscillation of the positron in this scenario. As always, compare this to your analytically predicted value in Step 2. E-mail your program to me at [mulderg@linnbenton.edu](mailto:mulderg@linnbenton.edu). Make sure that you put “HIP2 Extra Credit” in the subject line of your message.

The main goal of this chapter is to learn how to find the electric field from a distribution of charges. The main strategy to do this includes:

* Draw a picture that includes everything given and a “dq” – the “dq” is usually best placed NOT at an end or midpoint.
* At the point in question, clearly draw the dE from the dq. Include other important quantities such as r, dx, theta, dEx, dEy, etc…
* Using the definitions of either “linear charge density”, “surface charge density” or “volume charge dentistry” turn the dq into something over which we can integrate. (for example a dx, or a dxdy, or a ρdρdθ)
* Set up your integral and integrate.