Plasma Globes and E&M Fields

Purpose: The purpose of this lab is to find the relationship between E&M field strength and distance for a plasma globe. The frequency of the plasma globe will also be determined.

Investigate the field strength at various distances from the plasma globe:

1) Obtain the radius of the globe, either by calculation, measurement, or both.
2) Set the multi-meter or oscilloscope to AC voltage so that up to 20 volt can be read.
3) Make a data table which has distance from the center of the globe in meters in one column and voltage in volts in the other column.
4) Using the lead of the multi-meter or the probe of the oscilloscope as an antenna, place the tip of the probe/lead very near the surface of the globe without actually touching the glass.
5) Move the antenna away from the globe in 5 cm intervals. Take a voltage reading at each distance until you reach about the .4 meter mark. You may need to adjust the scale on your meter/oscilloscope to get accurate readings.
6) Enter data into the computer or calculator. Plot a graph with distance on the x-axis and voltage on the y-axis. Plot the data points.
7) Use the Afit a curve@ function to evaluate the curve of your graph.

If using Excel,

1) Click on the actual line of your graph.
2) Select **Trendline** which is under the **Insert** menu.
3) Select the type of curve that you feel your data line may be.
4) Before clicking **OK**, select **Options** which is the folder behind the **Type** folder.
5) Select the two options that start with the words **Display** and click **OK**.
6) The computer will match find the best match for your curve. If the curve that the computer draws does not fit your graph repeat steps 1 -5, selecting a different type of graph.

Questions:

Does this curve fall into any general pattern you may have seen before?

Should the center of the globe be considered at the geometric center of the globe or should the center be thought of as starting on the outside of the inner ball?

Calculate the frequency of the plasma globe:

1) The frequency is independent of the amplitude of the wave on the oscilloscope. Therefore the probe may be placed at any distance from the globe.
2) Count the number of divisions on the scope which span 1 complete cycle of the wave. The time/div knob may be adjusted so that only one full wave is on the screen. Note: The level knob may be turned to stop the wave from drifting.
3) Multiply this number by the scale which is read off the time/div knob. This will give you the period, T, of the wave, that is the time taken to complete on cycle.
4) Find the frequency of the wave by using $f = 1/T$.

8 2001 Brian M. Wargo