Lab #3B - EOM

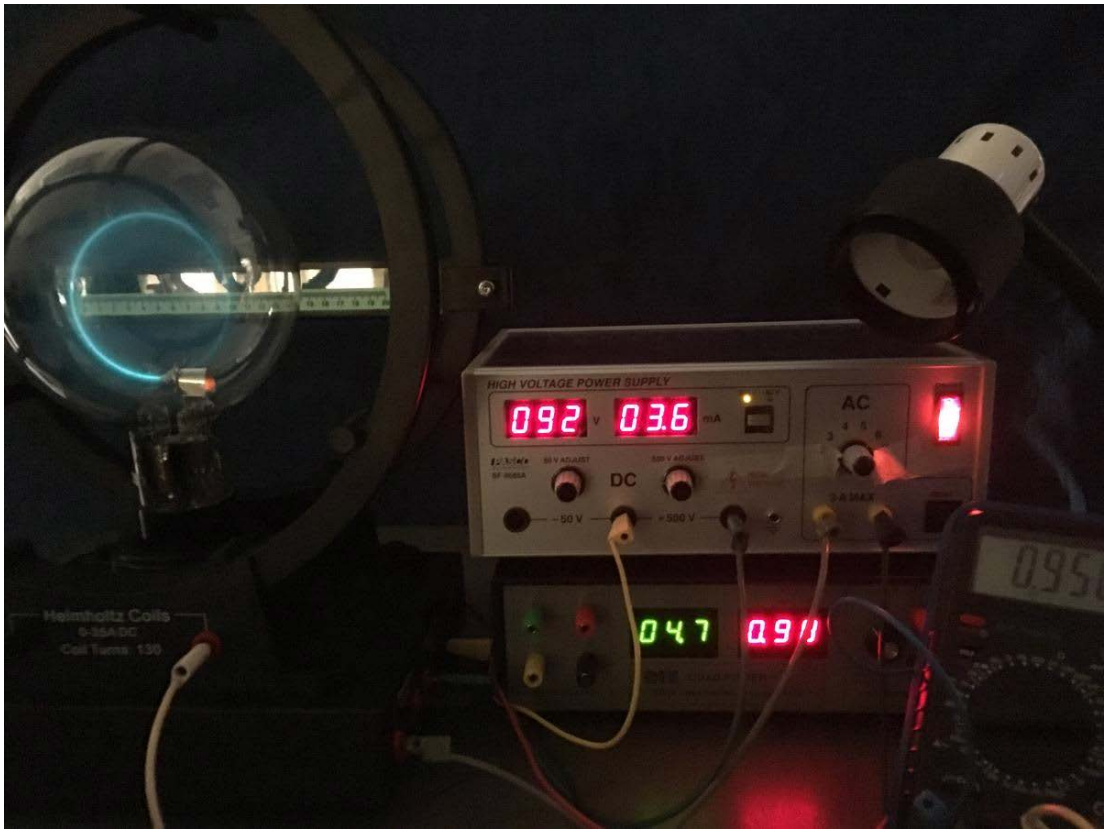
Lab #3A (*Digital Storage Oscilloscope*) is set up in Rockefeller 402 while Lab #3B (*E/M for the Electron*) is set up in Rockefeller 403. Midway through the 3 hour lab period, you will switch rooms to work on the other experiment.

Note that you must hand in a full paper for this experiment.

Section D

The Helmholtz coils are new as of Spring 2017. Please follow the instructions carefully so as to not damage the $4500 equipment (just the tube costs $1600)

Don't touch any of the electrical connections for this experiment! Do not touch the AC knob on the Pasco high voltage power supply. The DMM and power supplies are connected properly. The only adjustments you must make are to turn the power on for the DMM and Elenco (TE Quad Power) and Pasco power supplies and to adjust the coil current (*Elenco or TE Quad Power controls*), and high voltage settings (*second knob from the left on the Pasco supply, labeled "500 V ADJUST"*). To turn on the Elenco (or TE Quad Power) power supply, simply rotate the voltage adjustment knob on the far right slightly CW from the OFF position.



Section D.2

The new EOM tubes operate under certain specific conditions. You must **be particularly careful not to exceed 2.5 A** of current through the Helmholtz Coils. Also, do not keep a current > 2 A running through ANY of the setups longer than you need to take a set of data. After you finish your readings, be certain the coil current is below 2 A, or, better yet, off.

Section D.3

Do not exceed 200 V.

Section E.1. Helmholtz Coil Current

To simplify checking the class's work, your TA may ask you to enter your data into Origin in some specific format. For example, he or she may ask that you enter it in columns A - G as:

I_c, D (*diameter of the beam*), R, $\delta(I)$, $\delta(R)$, $1/R$, $\delta(1/R)$

where the δs refer to your error estimates of the quantities in parenthesis.

Warning! You probably measured the beam diameter in cm but the formula you will use assumes SI/MKS units. If you convert your beam diameter data directly to m, you can avoid any further problems. If you didn't, then read on. For your plot of $1/R$ *vs* I_c, do you know how to convert cm^{-1} to m^{-1}? You can do this before plotting the data or you can plot it in cm and convert the slope, your choice. Certainly, 1 m = 100 cm but you may have to think a little about how to convert the inverse units. If you have doubts, ask your TA for assistance.

Warning! A common mistake is plotting the inverse diameter, $1/D$, of the beam path rather than the inverse radius, $1/R$.

Warning! The $10V$ that appears in Eq. 7a is 10 times the voltage (*10 times 300 volts*) and not 10 volts (10 V).

Section E.2. Beam Voltage

To simplify checking the class' work, your TA may ask you to enter your data into Origin in some specific format. For example, he or she may ask that you enter it in columns A - I as:

V, D (*diameter of the beam*), R, $\delta(V)$, $\delta(R)$, $V^{-1/2}$, $\delta(V^{-1/2})$, $1/R$, $\delta(1/R)$

where the δs refer to error estimates of the quantities in parenthesis. In this case, the values in column H come from SET COLUMN VALUES col(D)/(2*col(A)^1.5) and the values in column I come from SET COLUMN

VALUES col(E)/(col(C)^2) . You can copy and paste these formulae directly into Origin, but only if you use the worksheet layout described here.