ISP220, spring 2018: Quiz #5; 5 pts

Quarks, Spacetime, and the Big Bang

Tuesday, February 13, 2018

Name: ______________________________ Student # ______________

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1. (total for the question: 5 pts) Broccoli from the text

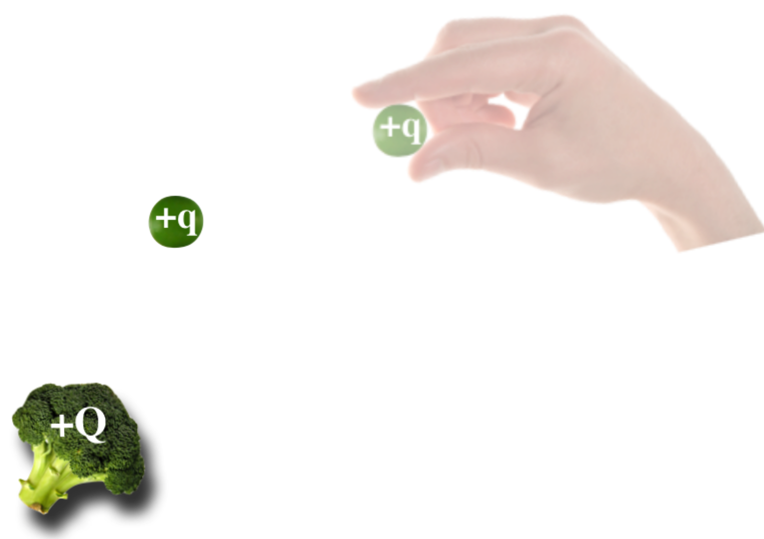

Figure 1: A positively charged...um...vegetable and a tiny test charge of $+q$.

Draw enough electric field lines due to the positively charged broccoli that the pattern is obvious and **draw the force vector** that the test charge experiences due to that electric field.

ISP220, spring 2018: In-Class Project #5; 15 pts

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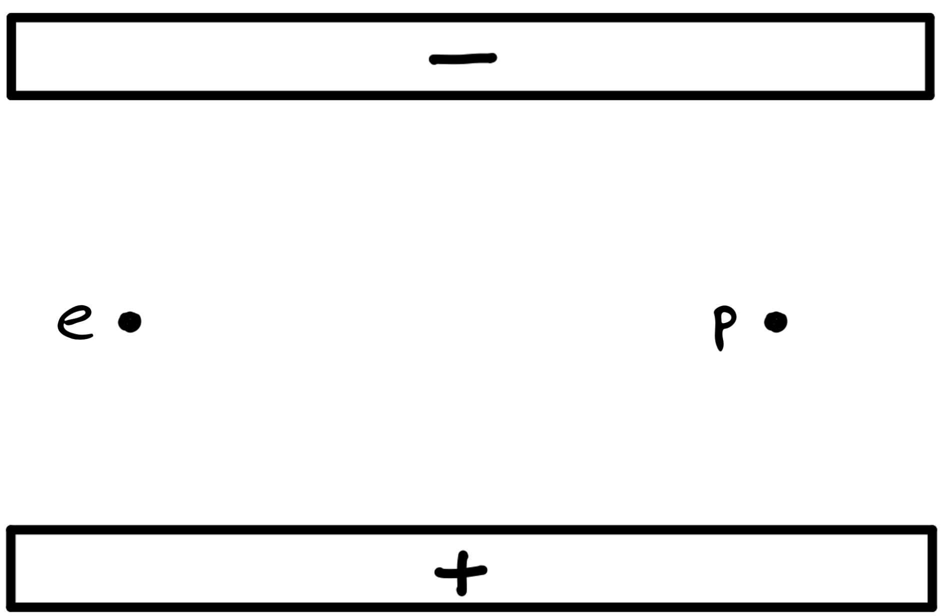

Figure 2: Neatly draw in a few electric field lines and label the collection with $\vec{E}$. See that electron sitting there? Draw in the force that it would feel between the plates and label it, $\vec{F}$. See the proton? Do the same thing for it. Is one more force than the other? Twice as much? The same? The force vector arrow lengths should indicate that.

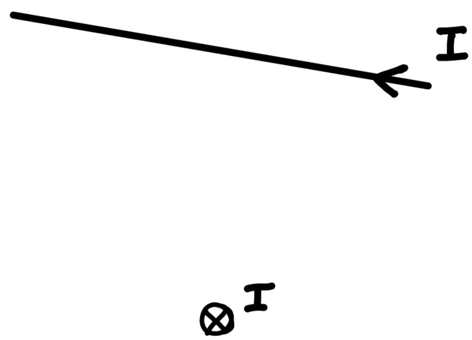

Figure 3: A current, I, is sketched in perspective on the top. A view of the wire from the back is shown on the bottom, so the current is *into the paper.* Draw in a few magnetic field lines in the bottom view. Label the magnetic field.

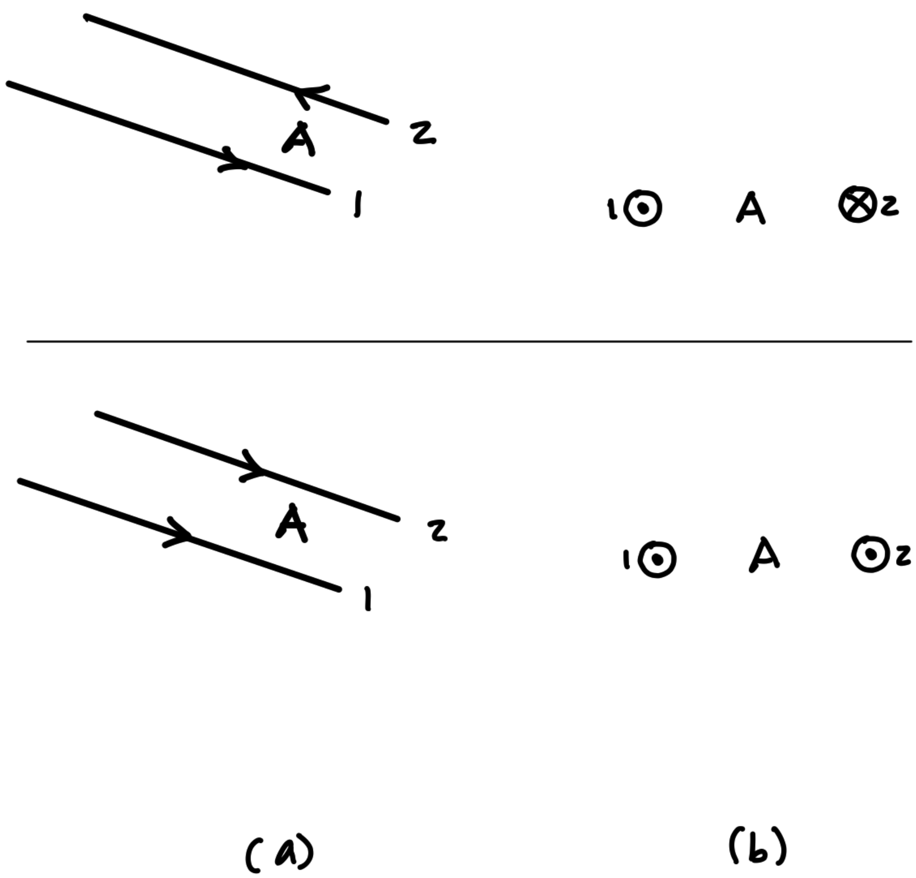

Figure 4: Just like the previous picture, in (a) there are now two sets of perspective views, each of two currents, I_1 and I_2 in which $I_1 = I_2$. In the top, 1 and 2 are in opposite directions. In the bottom, 1 and 2 are in the same direction (out). The right hand side shows the wires and currents from the end, in the top 1 out, 2 in and in the bottom, both out. Sketch the magnetic field for each wire in the right hand view, (b) **and** sketch the total magnetic field in region A with a single arrow in each. If it's zero, put a dot. Label the magnetic fields.

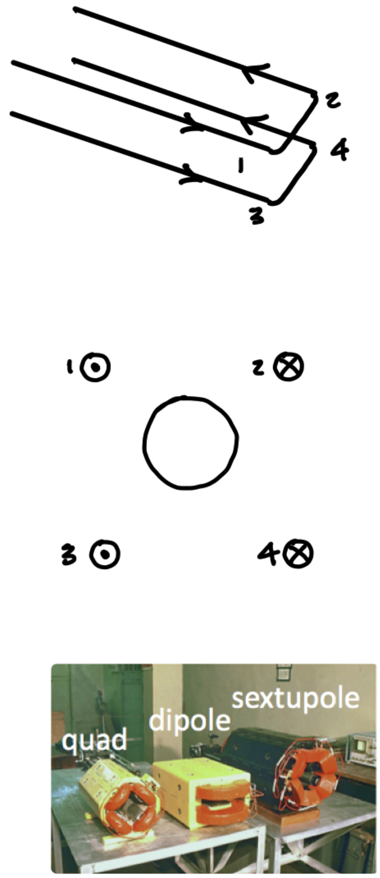

Figure 5: The top view is like the previous picture, except now the 4 wires are connected into two circuits. One pair is above the other. 1 and 2 are in the same plane and 3 and 4 are in the same plane below. The middle view shows the ends of the wires in a cross section of the perspective view, in which currents 1 and 3 are out and 2 and 4 are in. In that middle view, sketch the magnetic field that results from each wire. This is like a dipole magnet as shown in the bottom picture. The middle magnet has orange coils of wires that carry the current loop in the top and and another loop in the bottom. The yellow encasement is iron that helps to keep the magnetic field confined. The beam pipe would go right between the two orange “U”s. In our drawing, the circle represents a cross section of a beam pipe through the magnet.

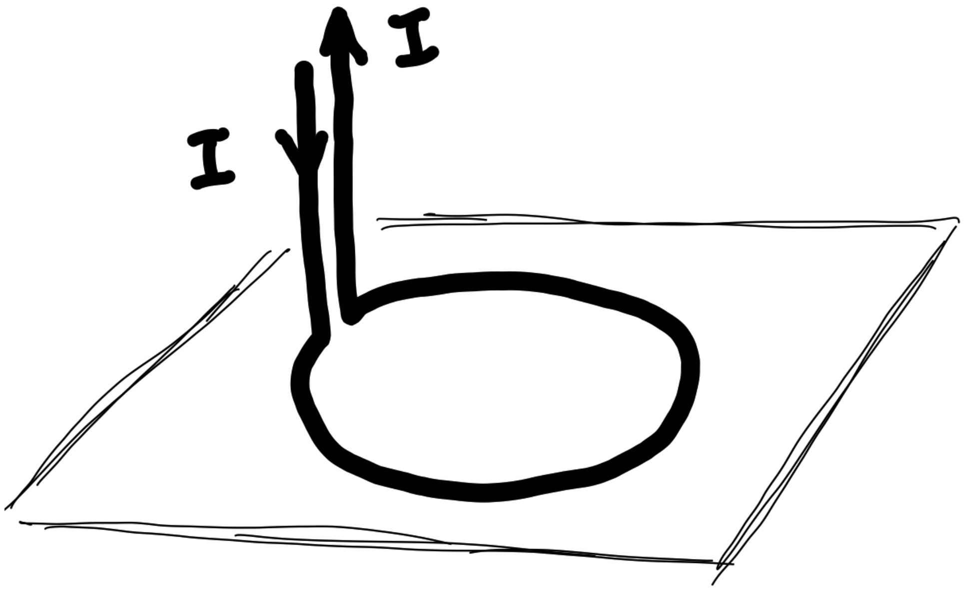

Figure 6: This is meant to be a 3 dimensional view of a wire coming down vertically to a plane where it makes a loop and then goes back up again. Draw the magnetic field lines in the loop.

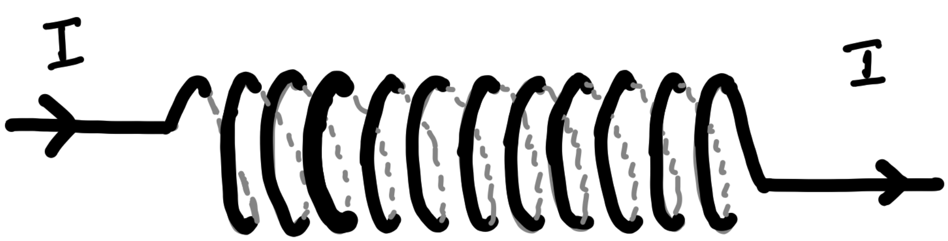

Figure 7: This is called a solenoid and is essentially many individual current loops side by side so that the field from each loop adds to the others. Draw the magnetic field lines for the solenoid. It's a good way to create a uniform magnetic field over a long distance.

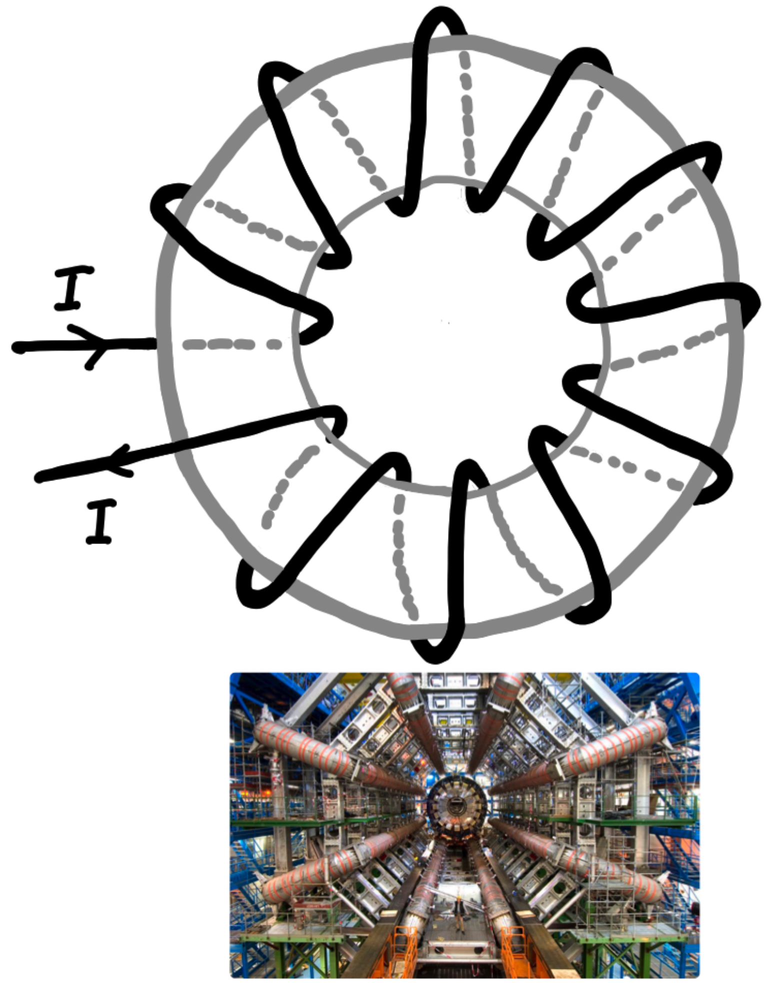

Figure 8: This is called a toroid. It's essentially a solenoid that is bent into a circle. It's a good way to create a field perpendicular to particles emanating from the center. The picture at the bottom is the (famous) ATLAS detector air toroid.