# Lab Quiz for PHY324

Q1: What experiment are you doing?

Hall Effect

Q2: Summarize the physics elements in this experiment.

The main physical idea being studied in this lab is the Hall Effect. The Hall effect occurs when we place a magnet (magnetic field) near a conductor (or semi-conductor) that has a current flowing through it. This creates a voltage across the conductor, as the electrons that make up the current going through the conductor group up in a certain part of the conductor as a response to external magnetic field. There is then some connection between this voltage that is generated and external magnetic field that causes it.

Q3: Describe one major goal of the lab.

One major goal of this lab is to calculate the following parameters for both the silver and chromium conductors:

- Hall Coefficient
- Density of Charge Carriers
- Drift Velocity
- Conductive Mobility
- Electric Conductivity
- Sign of Charge Carriers

Q4: What do you measure directly in pursuit of the major goal described above?

One thing that will be directly measured in this lab is the Hall voltage, which is the aforementioned voltage that is generated within the conductor. This will be done using a HP multimeter.

Another thing that will be measured is the current being transmitted through the conductor. This will be measured using a HP multimeter.

The Electric Resistance will be measured for both silver and chromium.

A final thing that is to be measured is the strength of the magnetic field in which the Hall voltage values are being recorded at. This will be done using a Gaussmeter.

Q5: Outline how you get the answer to Q3 from the data collected as described in Q4. If you will graph data to achieve the goal in Q3 then explain what you will graph, what the trend-line will look like, and how it achieves the goal in Q3. Include any equations you will use to turn the data described in Q4 into the answer described in Q3.

Using the Hall voltage, we can find the electric field. With the current measurement we can obtain a current density, and we also have a fixed magnetic field measurement. Using these three measurements we can take Eqn. 13 in the handout and fit the data to find the Hall coefficient. We can do this by generating a plot of measured electric fields vs current density for various fixed values of magnetic field. Re-arranging Eqn. 13 we see that fitting this data should give us a linear relationship and the slope of the line will be the magnetic field strength times the Hall coefficient. Since we know the magnetic field strength, we can factor it our of the slope and obtain the Hall coefficient. Additionally, we can repeat this with various values of B in order to get multiple values of Hall coefficient.

Once we have the Hall coefficient, we can find all the parameters listed in Q2 using Eqn. 13, Eqn. 14, and Eqn. 15, respectively. Note that the needed conductivity needed will be computed using the four-wire method outlined in the lab manual. This will give us resistance which we can use to find current using Ohm's Law. With this we can find current density by dividing the current by the given cross-sectional area. This and knowing the E field can give us the needed electrical resistivity. This will yield the electrical resistivity, but we can simply take the inverse of this to get the conductivity.

Q6: Your TA asked you a/some question(s) about the equipment. Write the question(s) and answer(s) here.

Question: How does the Gaussmeter work?

The Gaussmeter works using the same Hall Effect that is being observed in this lab. This is because the Gaussmeter is essentially a Hall probe. The Gaussmeter sends a test current through the probe and the external magnetic field being measured causes the Hall effect to occur within it. The meter can then determine the strength of the external field based on the Hall voltage that is created within it.