

PHY 4210-01 Senior Lab
Lab M-1: Magnetic Field Mapping

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Abstract

words words words abstract

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1 Objective of the Experiment

words words words objective

2 Theory of the Experiment

3 Hall Effect in P-Germanium

3.1 Task 1

The Hall voltage dependence on the current was determined while holding the magnetic field and the temperature at a constant. Please note that the manual called for the constant magnetic field to be held at 250 mT, we kept our constant magnetic field at 144 mT in order to avoid reaching the maximum amperage on the coils. The corresponding coil current was 4 A.

3.1.1 Data Analysis and Results

There is a linear relationship between the Hall Voltage and the current, which is shown by the following equation, where α is the proportionality constant:

$$U_H = \alpha * I$$

The obtained proportionality constant was determined to be 0.943 V/A, and the obtained R^2 value was 1.

3.1.2 Conclusion

3.2 Task 2

The sample voltage as a function of the positive magnetic field induction was determined. The control current was held at a constant 30 mA. The change in resistance is to be compared to an increasing field strength.

3.2.1 Data Analysis and Results

The resultant graph shows a non-linear and quadratic change in the resistance as a function of the increasing induced magnetic field strength. The determined R^2 value was 0.978 representing a well-fit data line.

3.2.2 Conclusion

3.3 Task 3

3.3.1 Data Analysis and Results

3.3.2 Conclusion

4 Hall Effect in N-Germanium

4.1 Task 1

The Hall voltage dependence on the current was determined while holding the magnetic field and the temperature at a constant. Please note that the manual called for the constant magnetic field to be held at 250 mT, we kept our constant magnetic field at 144 mT in order to avoid reaching the maximum amperage on the coils. The corresponding coil current was 4 A.

4.1.1 Data Analysis and Results

4.1.2 Conclusion

4.2 Task 2

4.2.1 Data Analysis and Results

4.2.2 Conclusion

4.3 Task 3

4.3.1 Data Analysis and Results

4.3.2 Conclusion

4.4 Task 4

4.4.1 Data Analysis and Results

4.4.2 Conclusion

4.5 Task 5

4.5.1 Data Analysis and Results

4.5.2 Conclusion

5 Hall Effect in Pure Germanium

5.1 Determining Band Gap in Pure Ge

5.1.1 Data Analysis and Results

5.1.2 Conclusion

6 Hall Effect in Pure Zinc

6.1 Determining Hall Constant in Pure Zn

6.1.1 Data Analysis and Results

7 Appendices

7.1 Appendix A: Data

7.2 Appendix B: Source Code