Investigating the current running through a npn BJT transistor

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Abstract

In this experiment we varied the voltage supplied to the base of a npn BJT transistor, and measured the current running through the collector to form a data set which we fitted to the Ebbers-Moll equation. From this fit we calculated the thermal voltage (V_T) and saturation current (I_s). Both these paramaters have strong temperature dependence and from our fit we determined an experimental value for the boltzman constant of $k = 1.378 \times 10^{-23} \pm 8.4 \times 10^{-26} \frac{J}{K}$ for the silicon transistor and a value of k $= 5.6 \times 10^{-23} \pm 4.0000 \times 10^{-24} \frac{J}{K}$ for the germanium transistor.

1 Introduction

1.1 Physics Motivation

Broad physics motivation should be discussed briefly but meaningfully. Basic phenomena should be explained (or referred to) and prediction for experimental results clearly stated. Here and throughout the report appropriate references should be included [1, 2].

1.2 Historical context

You may want to relate what you are doing to first or previous work on this topic. Since you are doing an experimental work, the context should be on the experimental technique. For example, you may say that this was first done in a such and such way but later it was discovered that one can also do it another way. Your technique may be related to the first or none of the above.

2 Theoretical background

Provide some more theoretical details for your measurements. Give formulas and references which provide a specific theoretical context for your measurements.

3 Experimental setup

3.1 Apparatus

Ideas behind the particular technique should be briefly discussed. Enclose references. Sketches, pictures, and suitable schematics should be included and explained concisely. All major components of the system should be mentioned and their role clearly motivated. This section is not simply a list of components and it is not an instruction manual.

3.2 Data Collection

Data taking procedures should be described and various modes of data collection explained. Calibration procedures and relevant plots and numerical tables should be included. State clearly what measurements were taken for the final data analysis. Describe 'doing the experiment' so it would be helpful to other students in the future. This may need to include physics arguments *what* and *how* data should be collected.

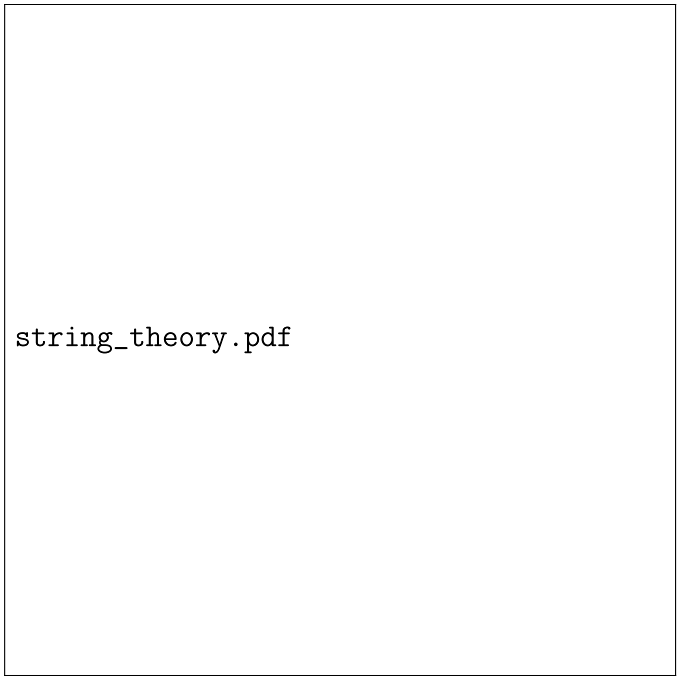

Figure 1: My Caption, in all its glory.

3.3 Data Analysis

This is the most important section of the report. Describe data analysis. Details! Perhaps include a figure and refer the reader to it! See Figure 1. Maybe you will need to include a table. See Table 1.

Describe calculations of the final results. Thoroughly address error analysis and discussion of measurement uncertainties. Remember: NO EXPERIMENTAL RESULT CAN BE QUOTED WITHOUT AN ERROR BAR! Do not forget about random or systematic uncertainties. Be sure to propagate errors correctly! Include a demonstrative graph when possible.

Make final assessment and interpretation after that. Discuss apparatus problems if any. Suggestions for lab setup or approach improvements are welcome!

centrifugal_force.pdf

4 Results

Clearly present the result of your analysis. Make sure you include the uncertainties. No experimental result can be quoted without an error attached to it.

Your results should be compared with predictions and other measurements.

5 Summary and conlcusions

Summarize briefly the results of the experiment. Acknowledge (i.e., thank for) contributions or help of your partner(s) and or others (TA, machine shop, software used, ...).

References

[1] R. Feynman, *QED*, Ch.7.

Run Period	POT (10^{20})	Predicted (No oscillations)		Selected (Far Detector)	
		Fully	Partially	Fully	Partially
I	1.269	426	375	318	357
II	1.943	639	565	511	555
Total	7.246	2,451	2,206	1,986	2,017

Table 1: Predicted and observed numbers of events classified in the Far Detector as fully and partially reconstructed charged current interactions shown for all running periods.

[2] R.Dalitz, Proc. Roy. Soc. (London) **A64**, 667 (1951)