CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
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Project Number
S1510

Project Title
The Franck-Hertz Experiment

Abstract

Objectives/Goals
The purpose of the Franck Hertz Experiment is to test the hypothesis that the energy absorbed by gaseous atoms when they are excited is quantized.

Methods/Materials
To test this hypothesis, a thyratron tube, filled with a small amount of the gas to be excited, is used, consisting of a cathode, a filament, to heat and "boil electrons off of" the cathode, a positively charged control grid, and an anode, which has a slight retarding voltage. As the grid potential is increased, the current at the anode is measured and plotted on the Y-axis of an X-Y scatter graph, and the corresponding voltage is plotted on the X-axis. This can also be done on an oscilloscope.

Results
The graph of Anode Current versus Grid Potential yields an up down profile of a peak, a dip, a higher peak, a dip, and so forth. Limitations on the thyratron tube's design inhibit the maximum grid potential which can be applied for a sustained period. However, utilizing the oscilloscope, a quick increase in grid potential yields 9 dips before the gas only ionizes, yielding a sharp, unchanging increase in anode current.

Conclusions/Discussion
As such, the hypothesis was correct. If gaseous atoms were excited in non-quantized amounts, a steady, linear increase in anode current would be seen, however, this graph of peaks and dips occurs because the current will at first increase as the voltage at the grid does, but the current then drops, because the electrons colliding with the gaseous atoms will have enough energy to excite them, and will no longer have enough kinetic energy to reach overcome the anode's retarding potential and reach the anode.

Summary Statement
The purpose of this experiment is to determine if gaseous atoms are excited in quantized amounts.

Help Received
Used electronics laborotory at Ribet Academy.