Lecture 5: Introduction to E2, Geiger-Műller Counter

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(1882-1945)

Physics 3719
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Experiment #2

• Goal: Confirm that the Binomial, Poisson, and Gaussian probability distributions describe counting experiments in the appropriate limits.

• Equipment: Geiger-Müller detector, various radioactive sources.

• Procedure
  - Week 1: Find operating point for your detector.
  - Weeks 2, 3: perform counting experiments.
Geiger-Müller Detector

Noble gas, e.g. Neon

Cathode (- HV)

Anode (+ HV)

Ionizing particle
Geiger-Műller: Properties

- Ionizing radiation produces a negative pulse at the anode.
- The size of this pulse is independent of where particle hits(!)
- Pulse size increases with anode-cathode voltage difference.
Pulse at Anode

- Negative (why?) pulse produced at anode.
- Need to convert this into something we can easily count!
GM Tube

Diagram

COUNT
\bar{A} \rightarrow \bar{A}

RESET
\bar{B} \rightarrow \bar{B}

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Observe analog pulse here!
One Shot Comparator
Geiger-Műller Counter: Equipment Schematic

- "Comparator" compares GM analog output with threshold voltage
- Outputs digital signal (T/F) if $V_{GM} > V_{TH}$
- Scaler counts T's
GM Lab: Week 1

- Work in teams of 2
- Familiarize yourself with apparatus
- Observe analog signal, one-shot output using oscilloscope
- Create a “plateau curve” for your apparatus, and determine the operating point...
Plateau Curve

![Diagram of Plateau Curve]

- **Spontaneous Ionization**
- **Knee**
- **OP**
- **Plateau**

*Rate (counts/second) vs. Voltage (Vs)*

*V1, V2, Vs (Volts)*