PHY153

J. Kiryluk

05/07/2020

1. Final project (python code)

   Part 2: Today (50% of final project score) Due: Friday May 15, 2020

   [Part 1: Past Homework 0423Ex1.py (50% of final project score)]

2. Extra/Optional: Latex and Pandas (posted on blackboard)

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Data analysis of a Geiger plateau experiment (FIG. 1)

Write a code that:

1) Reads the data (voltage, counts per min) from 0507_data.txt file.
https://blackboard.stonybrook.edu/bbcswebdav/pid-5384319-dt-content-rid-42801574_1/courses/1204-PHY-153-SEC01-47443/0507_data.txt
and plots counts per min versus voltage with uncertainties on the number of counts per min (assuming Poisson statistics).
2) Locates the "plateau" of the GM tube (i.e. find V_TH0) by performing a a series of straight line fits assuming: Rate(V) = b + a*V *in 3 different Tube voltage ranges* RangeI=(V1; V2), RangeII=(V2 ; V3), and RangeIII=(V3, V4) . Fit parameters are a and b.
3) Makes plots which superimpose data and individual fitted lines: Rate(V) = b + a*V in RangeI, RangeII and RangeIII. The number of plots should equal number of rows in TableI.

For each fit quantify its quality (Sm/NdF and corresponding probability p-value). See Table I.
Select a set of fit results for a given set of (V1,V2,V3 and V4) that produces the best chi2 (i.e. "good" Sm value) in range II , where the data must follow a straight line. V_TH0 = V2 of the best fit is the GM ``**threshold voltage**", i.e. the voltage at the beginning of the GM plateau. What is the value of V_TH0 and ***slope*** **(fit value and its uncertainty, rounded)** of the plateau.
Write your answers (and interpretation of results) as part of your code (print statement).
Use Table I format to summarize your results obtained in 2) . Table I should be created in Word/Latex or a software of your choice.
Results in Table I should be reproducible by running the code.

Complete analysis of data must be done in Python script (your_name_final.py) and submitted by email to: Joanna.Kiryluk@stonybrook.edu by 05/15/2020. All figures (data and fit results plots) must be created in Python script and included as part of your submission. TableI should be included as part of your submission. **YOUR CODE MUST RUN WITHOUT ERRORS!**

Academic integrity is expected of all students at all times, whether in the presence or absence of members of the faculty. Understanding this, I declare that I shall not give, use, or receive unauthorized aid in this examination. I have been warned that any suspected instance of academic dishonesty will be reported to the appropriate office and that I will be subjected to the maximum possible penalty permitted under University guidelines.

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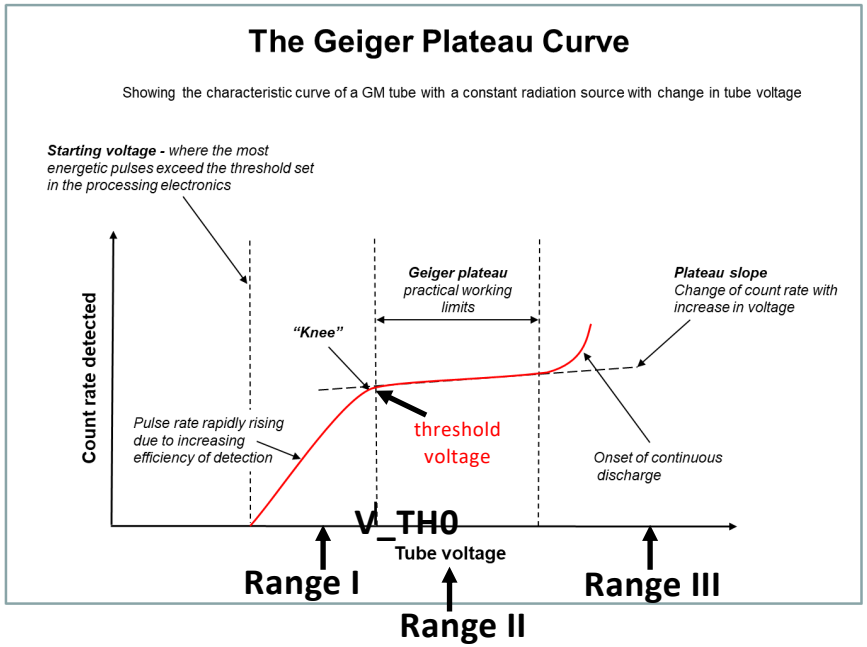
Fig. I



Source: Wikipedia
https://en.wikipedia.org/wiki/Geiger–Müller_tube

Table I

Fit number	Range I (V1, V2) a1*V+b1		Range II. (V2, V3) a2*V+b2		Range III. (V3, V4) a3*V+b3	
	V1, V2	a1, b1, Sm1, ndf1, pvalue1	V2, V3	a2,b2, Sm2, ndf2,pvalue2	V3,V4	a3,b3, Sm3, ndf3,pvalue3
1.						
2.						
3.						
4.						
…						
…						
n						

Final answer format : (V1,V2,V3,V4)

Range I: (V1,V2), a1*V + b1, a1+/-σa1, b1 +/-σb1, Sm1, ndf1, pvalue1
Range II: (V2,V3), a2*V + b2, a2+/-σa2, b2 +/-σb2, Sm2, ndf2, pvalue2
Range III: (V3,V4), a3*V + b3, a3+/-σa3, b3 +/-σb3, Sm3, ndf3, pvalue3

Slope and intercept: results should be properly rounded.

Selections example code with logical conditions

```
import numpy as np

v = np.linspace(500, 800, 100)
TH1, TH2 = 600, 760

boolV = np.logical_and(v >= TH1, v < TH2)
v_cut = v[boolV]
```