Experiment 2: Statistics of Nuclear Counting

In this experiment, we will examine the statistical properties of radiation detection. You will take ≈ 50 one minute recordings with the Geiger counter. Each group will take their data with different counting rates to investigate how the standard deviation of the counts changes with total counts.

a) Take around 50 one minute recordings with your sample at an appropriate distance from the detector. We will call the i'th recording x_i.

Note: Parts b) and c) below can be done with the Excel spreadsheet.

b) Find the average number of counts, x_{ave} from the 50 values.

$$x_{ave} \equiv \frac{\sum_{i=1}^{50} x_i}{50} \tag{1}$$

c) Find the "experimental" standard deviation, σ_{exp}, of the number of counts.

$$\sigma_{exp} \equiv \sqrt{\frac{\sum_{i=1}^{50} (x_i - x_{ave})^2}{50}} \tag{2}$$

d) What is the reliability factor R for your data?

$$R \equiv \frac{\sqrt{x_{ave}}}{\sigma_{exp}} \tag{3}$$

Comment on your value of R.

e) Finally, make a graph of σ_{exp} (on the vertical axis) versus x_{ave} (on the horizontal axis) using your data and the data from the other groups in the class. Is there a power law relationship? If so, what is the power?

Report for Experiment 2

1. (6 points) Turn in your data and the excel calculation of your average and standard deviation of your 50 one minute recordings.

2. (2 points) Turn in your calculation for the reliability factor R, and discuss the significance of your value for R. Do you think your Geiger Counter is working properly?

3. (4 points) Make a graph of the class results of standard deviation vs. average number, and comment on the graph.