To Verify the Inverse Square Law and Study for the Characteristics of Nuclear Radiations

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Abstract: The study and verify concept of the inverse square law and transformation function as a distance and gradient for intensity of radioactive radiation.

Keywords: *Square Law, Nuclear Radiations*

I. INTRODUCTION

The study the properties of radioactive particles emitted by the natural and artificial radioactive nuclides have added greatly to our knowledge of the structure and properties of atomic nuclei. At present the main interest that the information for emission gives about the theory its relation. The radioactive processes yield information about hundreds of nuclear species not limited to those with large masses; this is an important part of nuclear radiations. The emission of radioactive particles differs, the most characteristic feature of the spontaneous radioactive disintegration of a nucleus is the continues distribution energy of the emitted electrons. The continuous energy distribution leads as will be seen to few theoretical problems. These problems have been treated with considerable success only because of its relationship to the practical and conceptual problems of nuclear physics.

A. Theory

The velocity or momentum by means of deflection of path emitted by naturally radioactive nuclides may have energies smaller than 4 Mev. Suppose the kinetic energy of the particles will about 3 Mev there are smaller its mass but faster travels and penetrating it has a range in air over 1000cm and produces only about 4 ion pairs/mm of path. For in G.M counter gives count rate as a function of the transformation, and plotted on a logarithmic scale and it is decreases linearly. So that number of nuclear particles decreases exponentially with difference of distance to good approximations.

The activity does not decrease to zero as the distant becomes very large but practically constant which are called "background counts" (BC). There is always some radiation present which contributes to the counting rate even though it does not represent nuclear particles from the source.

The exponential form of the curve is accidental and also includes the effects of the continuous energy distribution. And the range R_g is the distances traveled by most energetic particles emitted is measurements are often units per square centimeter. In any case the curve approaches the background very slowly it is difficult to obtain good accuracy, and this kind of absorption curve is meet often. To avoid the difficulties of the visual and comparison methods have been developed in which the range of the nuclear particles. If the counting rate curve closely approximates a straight line over most of the distance with a small tail at the end of the curve.

Therefore nuclear particles may lose a large fraction of its energy, in a single collision straggling is much heavier particles and also scattered easily by nuclei and their paths are not straight. Consequently, even if a beam of nuclear particles is initially monenergistic, the straggling and scattering make possible of widely different path lengths and theory predicts. For high energy nuclear particles, when an electron passes through the electric (Colombo) field of a nucleus, it loses energy by radiation.

According Fermi theory, based on the neutrino hypothesis has succeeded in accounting for all features. Although it may, at first, seem strange and arbitrary. When a nucleus emits a nuclear particle now its charge changes by one unit, while its mass is practically unchanged. And the number of protons and electrons in the nucleus is increased by one, as well as number of neutrons is decreased by one. But positron emission the number of neutrons increased by one.

B. Objectives

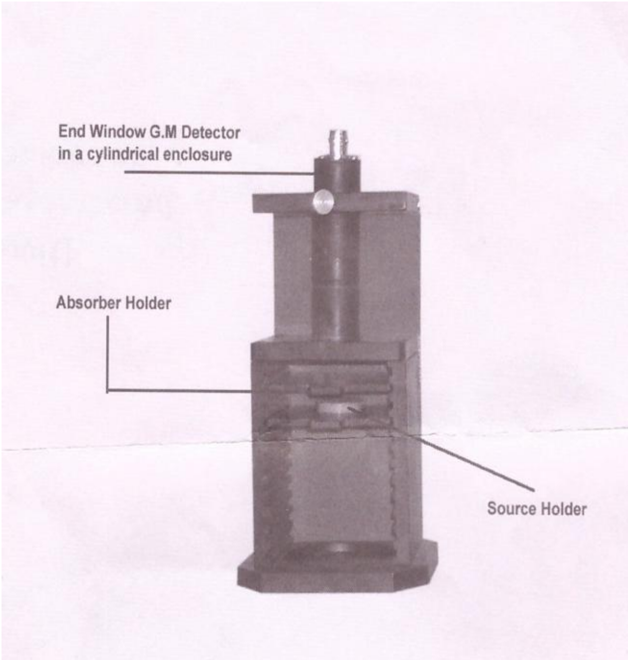
To Compute

- Net count rate with different distances.
- Product function.
- Count rate as function of quantity.
- Gradient function of nuclear-radiations.

C. Equipment

- Nuclear radioactive material.
- G.M. counting system with A.C. main chord.
- G.M. Detector (End window) stand
- PVC cylindrical enclosure with connecting cable.

D. Diagram



E. Procedure

- Set up the arrangement with power unit.
- Without source take about 5 readings and an average for preset time. Compute Background count (BC) about 25 counts per minute.
- Subtract the background counts from the counts per minute (Nc) to recorded corrected counts (N). And compute net count rate.
- Keep radioactive source in the source holder and adjust the distance from the detector end window.
- Keep the source holder and detector enclosed in a cylindrical shell by unscrewing.
- Set the operating voltage (say 500 v), and pressing 'START' button recorded counts per minute.
- Increase the distance in stepwise 0.5cm for each step recorded

Data I

Distance between source and window d in cm	Counts/min N	Corrected counts/min Nc=N-BC	Net Count rate R
3.5	4552	4527	75.86
4	3861	3836	64.35
4.5	3484	3459	58.06
5	3181	3156	53.01
5.5	2465	2442	41.08
6	2252	2227	37.53
6.5	1983	1958	33.05
7	1716	1691	26.98

Mean C=1230 rate per second cm^2

$1/d^2$	Product $C=RXd^2$	Log d	Log R	$R_{d=mean}$ value of C/d2	Gradient
816	929.28	0.544	1.88	100.4	1.2327
625	1029.6	0.602	1.8085	76.87	0.8769
493	1175.71	0.6532	1.7636	60.74	0.8577
400	1242.67	0.6989	1.7244	49.2	2.6763
330	1325.25	0.7403	1.6136	40.66	1.0396
278	1351.19	0.7781	1.5743	34.16	1.6046
236	1396.36	0.8125	1.5191	29.11	1.7076
204	1396.36	0.845	1.4311	25.1	

Calculation:

1. The transformation function R_d =mean value of c /d^2

a) 1230/12.25=100.40
b) 1230/16=76.87
c) 1230/20.25=60.74
d) 1230/25=49.20
e) 1230/30.25=40.66
f) 1230/36=34.16
g) 1230/42.25=29.11
h) 1230/49=25.10

2. Gradient

1. $$\text{Gradient} = \frac{\log R_2 - \log R_1}{\log d_2 - \log d_1} = \frac{1.8085-1.8800}{0.6020-0.5440} = 1.2327$$

2. $$\text{Gradient} = \frac{\log R_3 - \log R_2}{\log d_3 - \log d_2} = \frac{1.7636-1.8085}{0.6532-0.6020} = 0.8769$$

3. $$\text{Gradient} = \frac{\log R_4 - \log R_3}{\log d_4 - \log d_3} = \frac{1.7244-1.7636}{0.6989-0.6532} = 0.8577$$

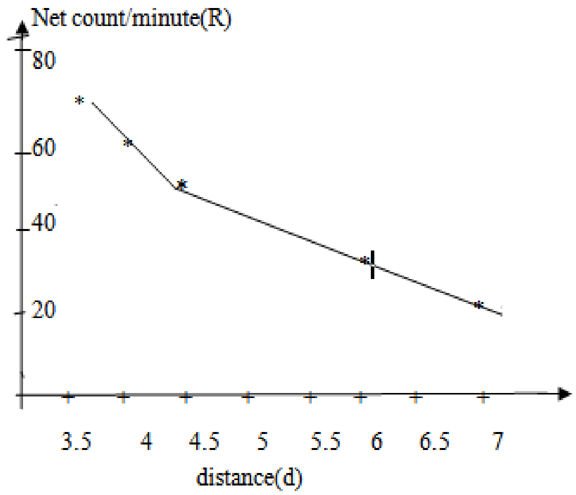
4. $$\text{Gradient} = \frac{\log R_5 - \log R_4}{\log d_5 - \log d_4} = \frac{1.6136-1.7244}{0.7403-0.6989} = 2.6763$$

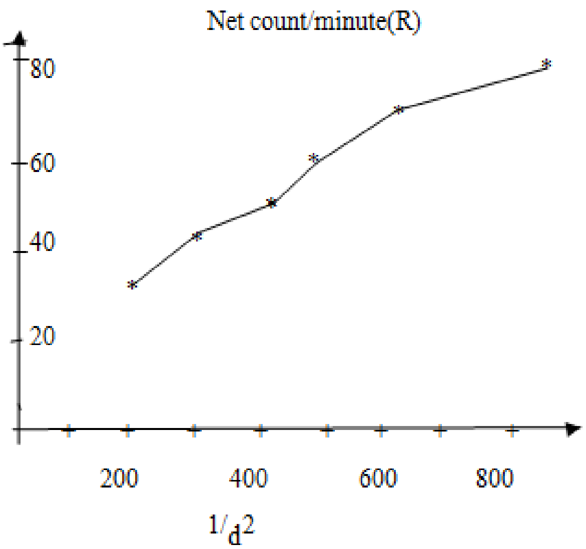
5. $$\text{Gradient} = \frac{\log R_6 - \log R_5}{\log d_6 - \log d_5} = \frac{1.5743-1.6136}{0.7781-0.7403} = 1.0396$$

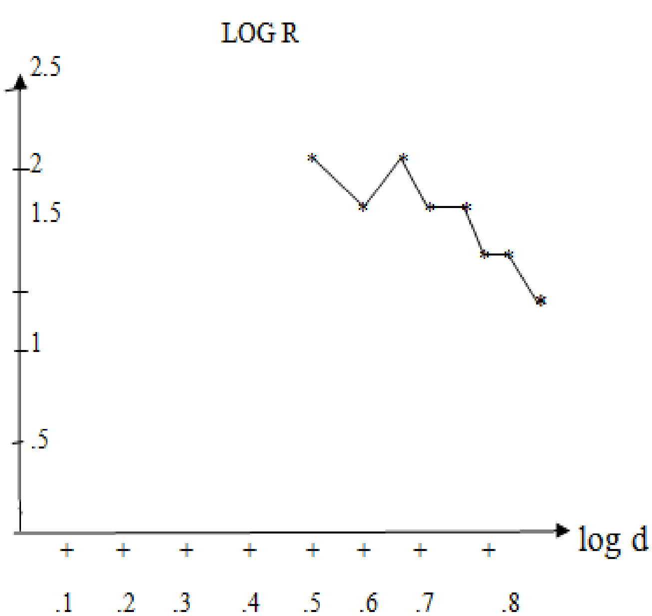
6. $$\text{Gradient} = \frac{\log R_7 - \log R_6}{\log d_7 - \log d_6} = \frac{1.5191-1.5743}{0.8125-0.7781} = 1.6046$$

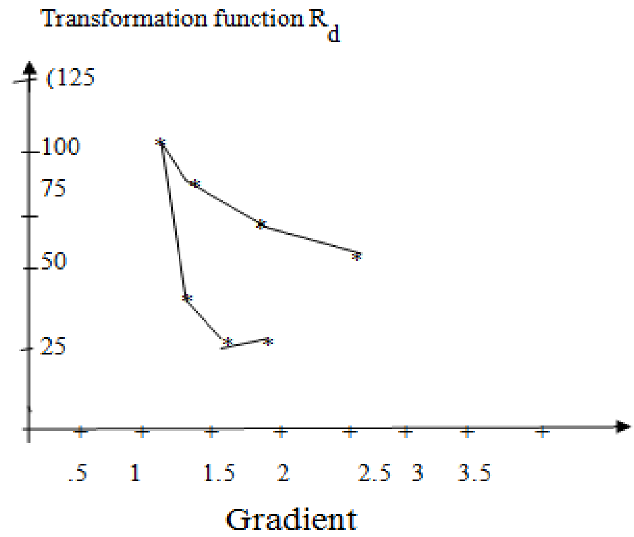
7. $$\text{Gradient} = \frac{\log R_8 - \log R_7}{\log d_8 - \log d_7} = \frac{1.4311-1.5191}{0.8450-0.8125} = 1.7076$$

Graph :









CONCLUSION

Form experimentally verified the inverse square law. Then numbers of measurements are and observed values, for different count rates and distances, transformation function. All these parameters depend on radiations of nuclear sources but not dimension. To postulate the existence of an undetected particle, this hypothesis has lead to a great deal of experimental and theoretical work. It is also found that the measured value is precise (exact).

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