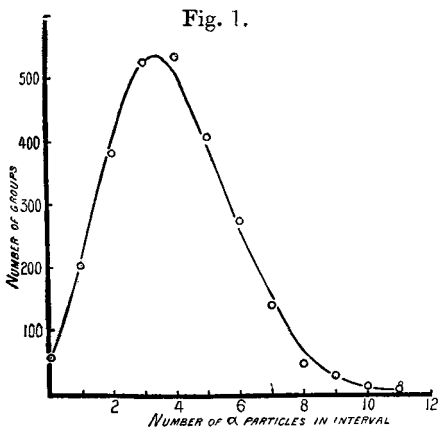


Number of α particles. } I. II. III. IV. Sum Theoretical values. }	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Number of α particles.	Number of intervals.	Average number.
I.	15	56	106	152	170	122	88	50	17	12	3	0	0	1	0	3179	792	4.01
II.	17	39	88	116	120	98	63	37	4	9	4	1	0	0	0	2334	596	3.92
III.	15	56	97	139	118	96	60	26	18	3	3	1	0	0	0	2373	632	3.75
IV.	10	52	92	118	124	92	62	26	6	3	0	2	0	0	1	2211	588	3.76
Sum	57	203	383	525	532	408	273	139	45	27	10	4	0	1	1	10097	2608	3.87
Theoretical values. }	54	210	407	525	508	394	254	140	68	29	11	4	1	4	1			

For convenience the tape was measured up in four parts, the results of which are given separately in horizontal columns I. to IV.

For example (see column I.), out of 792 intervals of $1/8$ minute, in which 3179 α particles were counted, the number of intervals giving 3 α particles was 152. Combining the four columns, it is seen that out of 2608 intervals containing 10,097 particles, the number of times that 3 α particles were observed was 525. The number calculated from the equation was the same, viz. 525. It will be seen that, on the whole, theory and experiment are in excellent accord. The difference is most marked for four α particles, where the observed number is nearly 5 per cent. larger than the theoretical. The number of α particles counted was far too small to fix with certainty the number of groups to be expected for a large value of n , where the probability of the occurrence is very small. It will be observed that the agreement between theory and experiment is good even for 10 and 11 particles, where the probability of the occurrence of the latter number in an interval is less than 1 part in 600. The closeness of the agreement is no doubt accidental. The relation between theory and experiment is shown in fig. 1 for the results given in Table I., where the \circ represent observed points and the broken line the theoretical curve.



The results have also been analysed for $1/4$ minute intervals. This has been done in two ways, which give two different sets of numbers. For example, let A, B, C, D, E represent the number of α particles observed in successive $1/8$ minute intervals. One set of results, given in Table A, is obtained by adding A + B, C + D, &c. ; the other set, given in Table B,

TABLE A.

Number of particles. } 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	Whole number of scintillations.	Whole number of intervals.	Average number in one interval.	
I.	0 3 4 7 17 35 42 60 71 49 46 22 19 11 2 5 1 2 0 0 0 0	3182	396	8.04
II.	0 2 3 6 19 33 34 56 32 34 27 24 11 7 5 3 1 1 0 0 0 0	2330	298	7.82
III.	0 0 6 8 25 39 39 51 42 38 26 17 11 6 5 2 1 0 0 0 0 0	2373	316	7.51
IV.	0 1 7 11 14 30 40 47 48 36 27 18 8 4 1 0 1 1 0 0 1 0	2214	294	7.53
Sum	0 6 20 32 75 137 155 214 193 157 126 81 49 28 13 10 4 4 0 0 1 0	10099	1304	7.74

TABLE B.

I.	0 2 4 9 21 35 46 56 68 48 35 30 15 12 6 8 0 0 0 0 1 0	3180	396	8.03
II.	0 1 5 7 21 27 38 46 40 38 28 16 12 9 3 5 0 1 0 1 0 0	2333	298	7.83
III.	0 0 5 12 32 38 32 41 36 50 32 14 11 6 5 1 0 0 0 0 0 1	2371	316	7.50
IV.	0 0 3 18 25 26 35 44 36 37 36 15 6 8 2 0 1 0 2 0 0 0	2210	294	7.52
Sum	0 3 17 46 99 126 151 187 180 173 131 75 44 35 16 14 1 1 2 1 1 1	10094	1304	7.74
Sum of Tables A & B } Theoretical values. }	0 9 37 78 174 263 306 401 373 330 257 156 93 63 29 24 5 5 2 1 2 1 1.1 9 34 88 170 263 339 372 363 312 242 170 110 65 36 19 9 4 1.8 .72 .28 .10	20193	2608	7.74

by starting $1/8$ minute later and adding B + C, D + E, &c. The results are given in the appended Tables. In the final horizontal columns are given the sum of the occurrences in Tables A and B and the corresponding theoretical values.

In the cases for $1/4$ minute intervals, the agreement between theory and experiment is not so good as in the first experiment with $1/8$ minute interval. It is clear that the number of intervals during which particles were counted was not nearly large enough to give the correct average even for the maximum parts of the probability curve, and much less for the initial and final parts of the curve, where the probability of an occurrence is small. However, taking the results as a whole for the $1/8$ minute and the $1/4$ minute intervals, there is a substantial agreement between theory and experiment, and the errors are not greater than would be anticipated, considering the comparatively small number of intervals over which the α particles were counted. We may consequently conclude that the distribution of α particles in time is in agreement with the laws of probability and that the α particles are emitted at random. As far as the experiments have gone, there is no evidence that the variation in number of α particles from interval to interval is greater than would be expected in a random distribution.

Apart from their bearing on radioactive problems, these results are of interest as an example of a method of testing the laws of probability by observing the variations in quantities involved in a spontaneous material process.

University of Manchester,
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