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The Capture of Electrons by swiftly moving Alpha-Particles

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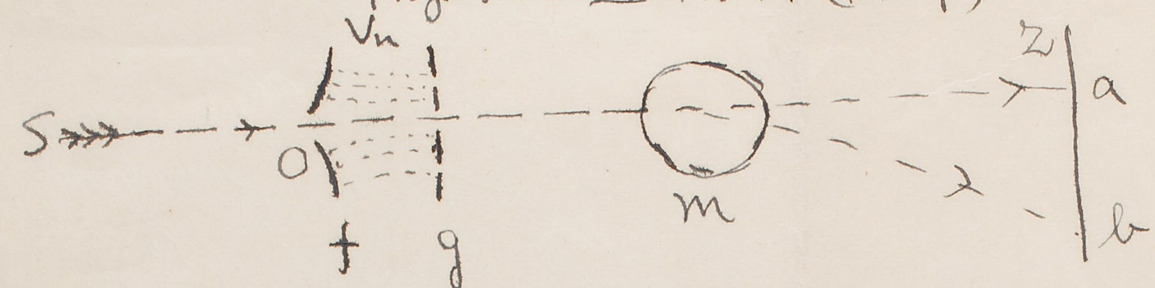
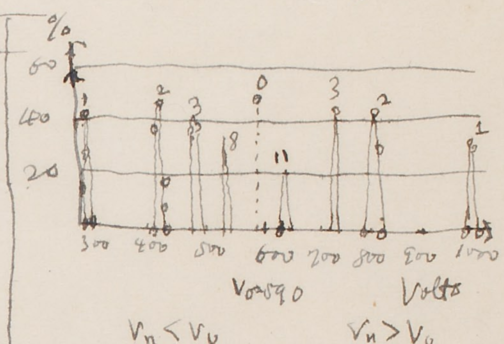


If an α-particle captures an electron between f and g it will not be deflected to b.

n	$V_n < V_0$	E_n	$V_n > V_0$	E_n	$E_n = 4(13.54)/n^2$ volts	Mean of E_n
1	295	50.6	1005	54.9	54.16	52.
2	410	16.7	800	15.6	13.54	16.2
3	483	5.33	720	6.45	6.01	5.67
4	505	3.29	700	4.71	3.38	4.00
5	519	2.28	681	3.27	2.16	2.77
6	531	1.56	667	2.41	1.50	1.98
7	535	1.34	653	1.59	1.10	1.46
8	538	1.19	645	1.23	.84	1.21
9	—	—	638	.96	.668	—
10	—	—	635	.88	.54	—



$$E_n = |V_0^{\frac{1}{2}} - V_n^{\frac{1}{2}}|^2$$

$$= \sqrt{\frac{m}{e}} \frac{1m}{2e}(v_0 - v_n)^2.$$

(emitted from Polonium)

The α-particles are deflected by a magnetic field at M and strike the zinc sulphide screen at b. The scintillation are counted in the usual manner. If an α-particle captures an electron between f and g it will not be deflected to b. The number of scintillations per minute will decrease. The experimental procedure was to count the scintillations without the electron stream, then to turn on the electron stream and progressively increase the electric field V_n by small steps. The decrease in scintillations gives at once the percent of captures.

The results of our experiment are given in Fig 2. and in the table. The ordinates are percent captures, and the abscissae are applied voltages, V_n. The voltage $V_0 = 590$ is the potential difference that gave the electrons a velocity equal to that of the α-particle. This velocity was 1.45×10^9 cm/sec. The velocity of the α-particles was diminished from their original one of 1.59×10^9 cm/sec by passing through a thin glass window that admitted them into the highly exhausted chamber. It was so arranged that the normal number of scintillations should be about 60 per minute. All observations were made with an electron current of 60 milliamperes excepting in the case of No 1 on the low voltage side, namely, at $V_n = 295$ Volts. This curve was take at 30 milliamperes.