Ranges of Particles emitted by Samarium

In view of some divergences in the determinations of the range of the α-particles of samarium, Prof. Wertenstein suggested that I should make some new experiments on this subject.

The ionization chamber used for determinations of ranges consisted of a spherical glass bulb, of 6·9 cm. radius, with silvered inner walls, and a concentric steel sphere of 1 cm. radius, on which a thin layer of the substance under examination could be deposited. This sphere was connected to a Hoffmann electrometer, while the bulb was put into communication with a vacuum pump. The ionization due to samarium was measured at different pressures. The sensitivity of the electrometer varied within small limits, but was on the average 30,000 ions for a division.

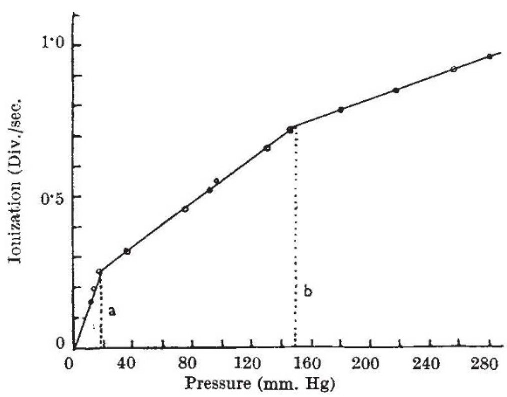

FIG. 1. Ranges of α-particles from samarium. *a* is the new range observed; *b* is the known range of samarium particles.

The curve in Fig. 1 shows the ionization current as a function of the pressure for a film of samarium oxide (Sm_2O_3) of 0·416 mgm./cm.^{2}. (A specimen of pure samarium oxide was kindly lent by Prof. G. v. Hevesy to Prof. Wertenstein.) The position of the kink corresponding to the range of α-particles of samarium can be determined with great precision. From this position I find that this range is equal at 760 mm. and 15° to 1·150 cm., in good agreement with the value recently found by R. Hosemann[1].

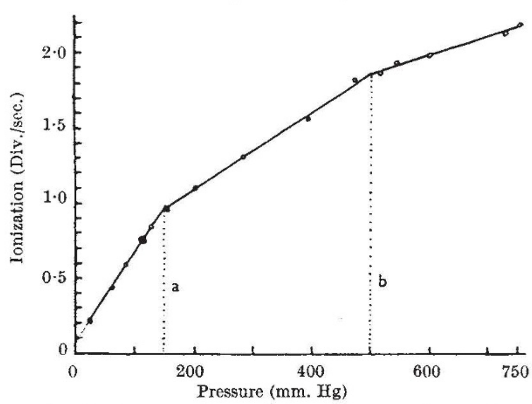

FIG. 2. Ranges of α-particles from samarium and polonium. *a* is the range of particles from samarium; *b* is the known range for particles from polonium.

The curve in Fig. 2 was obtained with a film of 1·05 mgm./cm.^{2} of samarium oxide to which a very small amount of polonium was added for calibration. The position of the kink due to α-particles of samarium is exactly the same as in Fig. 1, while the range of α-particles of polonium I find to be 3·907 cm., in excellent agreement with recent data.

The interesting fact is that the curve in Fig. 1 shows also another kink, clearly indicating the existence of ionizing particles of much shorter range, namely, 0·13 cm. The existence of these particles is also confirmed by the fact that the straight line continuation of the curve in Fig. 2 does not pass through the origin of co-ordinates but above it.

The total ionization due to these particles is equal to about 35 per cent of the total ionization due to α-particles, which makes it highly improbable that the particles of short range should be recoil atoms of any element formed during the disintegration of samarium. No adequate explanation of the nature and origin of these particles has so far been found, and further experiments are in progress.

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[1] R. Hosemann, *Z. Phys.*, **99**, 405 (1936).

Absorption of Thermal Neutrons in Silver at Low Temperatures

We have measured the absorption curves for neutrons of Fermi's[1] group 'C' using a silver target (2·3 min. activity) as detector, in the centre of a large Dewar vessel containing either liquid hydrogen or water at room temperature. Source, absorber and target were kept at room temperature. The intensity of the *C* group was determined in the usual way by taking the difference between the whole activity and that obtained by screening the target with 0·3 mm. cadmium. If a Maxwellian distribution for the energies of neutrons of this group be assumed, and if the $1/v$ absorption law predicted by theory is valid for silver, the ratio of the absorber thickness necessary for equal absorption at different temperatures would be expected to be independent of the absorption itself and to be equal to the square root of the inverse ratio of the temperatures. Experimentally we found that this ratio for 290° K. and 20·4° K. is in fact constant over the whole of the absorption curves; its value, however, was found to be 2·2 ± 0·2, instead of 3·8 to be expected from the $\sqrt{T_2}/\sqrt{T_1}$ hypothesis. One of the silver absorbers was measured also at 77° K. in paraffin and the ratio of thickness was also in this case considerably smaller than that given by the theory, the point being nearer to 290° K. than to the 20·4° K. curve. The results of the measurements are given in the table below.

Temperature (Kelvin)	Thickness of absorber mm.	gm./cm.^{2}	Transmission for *C*-neutrons per cent
20·4°	0·26	0·0273	58·5 ± 3·8
	0·50	0·0525	48·1 ± 2·5
	0·64	0·0672	40·0 ± 2·0
	2·0	0·210	15·3 ± 2·2
	3·0	0·315	9·4 ± 3·6
77°	0·64	0·0672	57·5 ± 2·8
290°	0·64	0·0672	63·8 ± 2·0
	2·0	0·210	31·4 ± 4·4
	3·0	0·315	22·2 ± 1·2