Letters to the Editor

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Electric Deflection of Cosmic Ultra-Radiation

FOR the purpose of an analysis of the cosmic ultra-radiation I have succeeded in deflecting the radiation by strong electric fields. This method is considerably more convenient for the investigation of cosmic ultra-radiation than the use of magnetic fields. The following gives the results obtained with fields of 700 volts and 70,000 volts per centimetre.

Four Geiger-Müller tube-counters of 35 cm. length and 2·7 cm. diameter are placed vertically one above the other, the axes in the east-west direction. The distances apart of their axes are: 6·0 cm. from the first to the second, 140·0 cm. from the second to the third, and 36·0 cm. from the third to the fourth. A plate condenser of 2·8 cm. plate distance, 40 cm. broad and 121 cm. long stands symmetrically between the second and the third tube. The counters are arranged to work in the usual coincidence method adopted for cosmic rays. The absorption in the whole apparatus is equivalent to 1·0 cm. of lead; over the apparatus there are also two covers of reinforced concrete and the roof of the building. The fourth and lowest tube-counter can be displaced to each side.

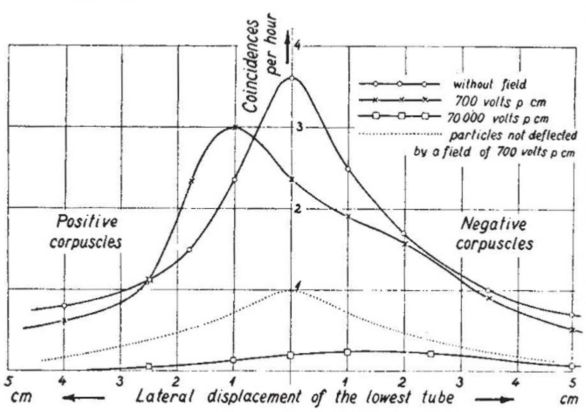

FIG. 1.

The uppermost curve in Fig. 1, giving the coincidences per hour, is then found without a field. At a field of 700 volts per centimetre in the condenser, 1 cm. deflection corresponds to particles of 1×10^7 electron volts. In this case we obtain more positive than negative corpuscles, if we take the difference between this curve and the curve indicating the non- or less-deflected particles. The latter form a similar curve to that without a field, with about 1·0 coincidence an hour in the centre. (Deflection $\leqslant 0{\cdot}5$ mm. corresponds to particles $\geqslant 5 \times 10^8$ e. volts, dotted curve in the figure.) At 70,000 volts per centimetre, there are more negative than positive corpuscles of 1–2 cm. deflection (1 cm. corresponds to $1{\cdot}0 \times 10^9$ e. volts). Without a field the mean statistical error of the measured points is 5 per cent, at 700 volts per centimetre it is 10 per cent and at 70,000 volts per centimetre it is 30 per cent; accidental coincidences have no effect.

I presume that the deflected particles observed with a field of 700 volts per centimetre correspond to the 'shower' particles, whilst the particles observed with a field of 70,000 volts per centimetre are chiefly primary corpuscles. The measurements are being continued with different fields in order to make an exact analysis of the radiation.

I wish to express my thanks to Prof. E. Regener for his kind help, and to the W. G. Kerckhoff Stiftung, Bad Nauheim, for providing funds for obtaining the condenser and the tube-counter in 1933, after preliminary work had been done since 1932.

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Use of the Centrifuge in Determining the Density of Small Crystals

THE accurate measurement of crystal density has recently acquired increased importance, since it is necessary to know this quantity in order to use X-ray methods for determining the molecular weights of unknown chemical substances. But the usual crystallographic methods of density measurement, using the specific gravity bottle or flotation of the crystals under gravity in liquids of known density, cannot easily be made to give accurate results where only small quantities of very finely crystalline material are available. We have therefore recently applied the centrifuge in the second of these two methods to hasten the settling of floating crystals, just as the centrifuge is used by biologists in the measurement of the densities of living cells.

The density determination even of minute crystals can then be made a very rapid process. In our experiments a small quantity of the substance under examination (about 0·05 mgm. or less) was introduced into a suitable liquid in a small test tube and all air bubbles removed from the liquid and crystals by evacuation in a vacuum desiccator. The test tube was then placed in a centrifuge and spun for 1–2 min. at a speed of 2,000–4,000 rev. per min. According to whether the crystals sank or rose under the centrifugal force, heavier or lighter liquids were then added to the tube and the process repeated until finally a liquid was obtained in which no movement of the crystal could be observed. At this point the density of the liquid is that of the crystals. The limits of experimental accuracy could very easily be followed by slightly changing the density of the liquid on either side of the mean until the crystals began definitely to rise or sink.

So far we have used this method to determine the density of the following five crystals: vitamin B_1 hydrochloride, supplied by Prof. Peters, and the hydrocarbons '$C_{21}H_{16}$', '$C_{25}H_{24}$', '$C_{26}H_{26}$', '$C_{27}H_{28}$', obtained by selenium dehydrogenation of cholic acid, cholesterol, ergosterol and phytosterols respectively and given us by Prof. Ruzicka. The density of vitamin B_1 HCl, which is water soluble, was measured in a mixture of bromonaphthalene and xylene. The hydrocarbons were soluble in organic solvents and here aqueous sugar solutions proved most satisfactory. To overcome difficulties due to the high surface tension of water, the hydrocarbons were first introduced into a drop of sodium taurocholeate solution which was