Barometric Co-efficient of Extensive Cosmic Ray Showers

Counter experiments, intended to measure the rate of shower-producing radiation associated with extensive showers at sea-level, have given us an opportunity of measuring the barometric effect of showers up to 20 metres in mean diameter.

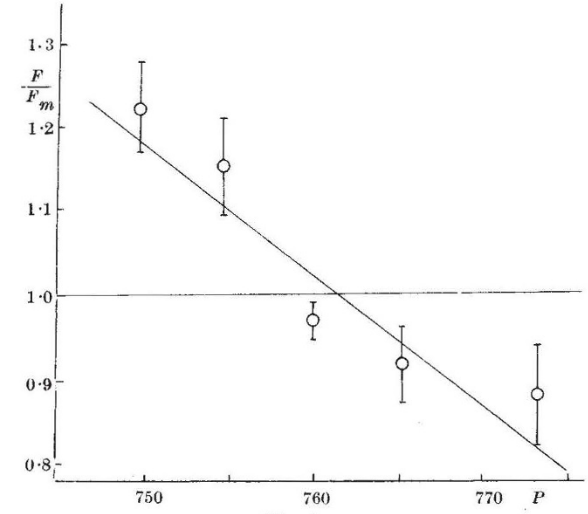

Fig. 1

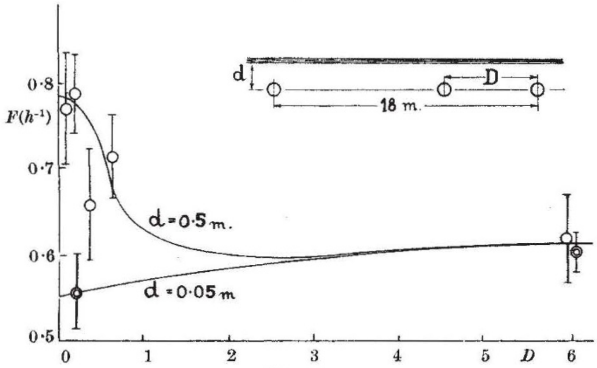

Fig. 2

We found that the barometric coefficient increases quickly with the diameter of the showers: for a barometric variation of 1 cm. of mercury, we found a corresponding variation of the frequency of showers of 4–5 per cent for 0·3 metre diameter showers: 8 ± 3 per cent for showers 12 metres in diameter, and 16 ± 3 per cent for showers 18 metres in diameter.

The measurements were made by means of a set of three counters, each of 120 cm.^{2} effective cross-section, under or above a thin tile roof.

Fig. 1 refers to a continuous run of four months, with daily recording. ($D = 18$ m.)

Comparison between measurements above and at different distances under the tile roof shows that, at sea-level, an important part of the soft rays associated with 20 m. showers are produced in the roof as ordinary secondary showers.

This is clearly shown in Fig. 2, which demonstrates the secondary coherence of most of the rays. No such increase was observed above the roof.

Thus, the distribution of rays in space follows closely the Poisson law above the roof and at several metres beneath; but the proximity of the roof introduces a secondary coherence between the rays. This explains the apparent discrepancy between the results of Auger[1] and those of Janossy and Lovell[2], for even a thin roof produces a large secondary coherence.

More experiments, now in progress in our laboratory, are needed before trying to reach quantitative conclusions.

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[1] Auger, P., and Maze, R., *C.R. Acad. Sci.*, **207**, 671 (1938).

[2] Janossy, L., and Lovell, A. C. B., Nature, **142**, 716 (1938).

Volume Integration of Dosage for X- and γ-Radiation

In radiation therapy as practised in this institution at the present time, the underlying principle adopted in the planning of treatment is to give a uniform tumour dose between 4000 r. and 6000 r. To achieve this, in deep-seated lesions, a multiple field technique has to be employed, and much radiation is absorbed which contributes not to the destruction of the tumour itself but to that of the normal tissues of the body. In the following note, methods are given for integration of dosage in a volume through which a beam passes.

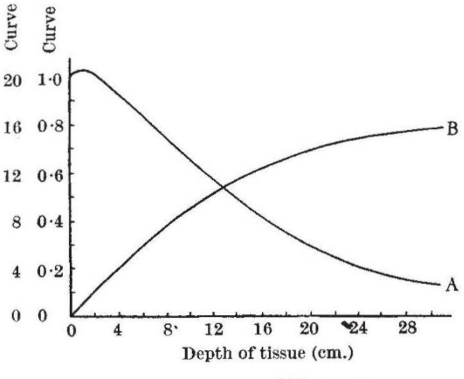
If at any point in a volume V, r is the dose of radiation in roentgens, then in that volume the integrated radiation dosage R is given by

$$R = \int_0^V r.dv, \qquad . \quad . \quad . \quad . \quad . \quad (1)$$

where R is measured in E.S.U. of charge.

To evaluate R. (*a*) In a series of complete isodose curves[1], the integrated radiation dosage can be evaluated graphically; the results of this method of calculation will be published in detail elsewhere. The few results already obtained are in agreement with the theory of section (*b*).

(*b*) In the case of radiation from a point source



$$\text{Curve } A: \frac{r_x}{r_0} \cdot \frac{(40 + x)^2}{40^2}$$

$$\text{Curve } B: \int_0^x \frac{r_x}{r_0} \cdot \frac{(40 + x)^2}{40^2} . \, dx$$