

UNIVERSIDADE DE SÃO PAULO
 FACULDADE DE FILOSOFIA, CIÊNCIAS E LETRAS
 Departamento de Física

São Paulo (Brasil) de de 19.....

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*Letter to the Editor
 of the Physical Review*

SHOWERS OF PENETRATING PARTICLES.

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In previous papers a report was given ^{of} measurements which put in evidence the existence of showers containing ^{of} at least ~~new~~ ^{two} particles penetrating ~~each~~ ^{of a range smaller} not less than 17 cm. of lead and the size of the penetrating core which is of the order of ~~2.2~~ ^{2.2} sq. m.

On this paper, further measurements are reported

A closer examination shows that in order to put in evidence the existence of associated penetrating particles the experimental arrangement must exclude the possibility of being the shower produced by only one mesotrons accompanied by some ~~soft~~ ^{secondary} radiation (photons, knock-on electrons and cascade-showers).

[For instance the average number of particles (~ 15) which arrive at the depth of the lowest counter in the arrangement III gives only the total number of penetrating and soft particles, at this depth.]

In this paper, further measurements are reported. In order to examine the possible association of the observed showers with the extensive showers, discovered by Auger and his collaborators, we have used a five-fold coincidence set, in an arrangement in which four counters were arranged in two telescopes at a distance of 30 cm. and surrounded ^{by} lead as in arrangement I, and the fifth was placed at a distance of 280 cm from the others. The observed frequency was of $8 \cdot 10^{-4} \text{ min}^{-1}$, showing that some soft radiation is associated with the penetrating core. This frequency shows that the effect observed by us ^{is} responsible for some of the extensive showers.

~~Other experiments and results are indicated in fig. #~~ The results of measurements IV and V show that a part of the rays responsible for the five-fold coincidences at a distance of 30 cm. between the two telescopes, is absorbed by 24 cm of lead. By a narrower arrangement of type VI-X, there is no noticeable absorption and the observed frequency is about 3 times greater than the frequency of 5-fold coincidences in IV ^{and} (more than ~~a~~ 10 times greater than in V) where 20 cm of Pb are placed between the telescopes. It could be objected



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In this paper are reported further measurements made with a 6-fold coincidence set⁽³⁾ with a coincidence time of $3 \cdot 10^{-8}$ mm using the multivibrator circuit developed by one of us (3). Some of the arrangements used (fig.I) were chosen in order to avoid knock-on showers and the secondary effects of the soft-radiation which usually accompanies the penetrating rays.

First we have tried to get evidence of a possible association of the observed showers with the extensive showers discovered by Auger and his co-workers. A five-fold coincidence set ~~with a coincidence time of $3 \cdot 10^{-8}$ mm~~ was used: four counters were arranged in two telescopes at a distance of 30 cm from each other and surrounded by lead (arrangement I); the fifth counters was placed at a distance of 280 cm from the others.

→ The observed frequency was of $8 \cdot 10^{-4}$ mm⁻¹ showing that some soft radiation is associated to the penetrating core; we can therefore conclude that the mesons showers are responsible of some of the extensive showers (4).

Other experiments on the nature of the penetrating showers are given in fig. I. #

~~and several field counters~~
~~with a coincidence time of $3 \cdot 10^{-8}$ min~~

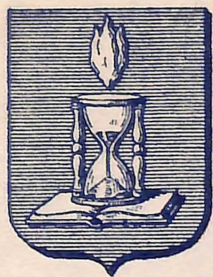
In this paper, further measurements [are reported] made with a coincidence set, using the multivibrator circuit developed by one of us (+). ^{Some of} the arrangements used (fig) were ~~chosen~~ chosen in order to avoid knock-on showers and the secondary effects of the soft-radiation which usually accompanies the penetrating rays.

First we have tried to get evidence of a possible association of the observed showers with Auger's and the extensive showers discovered by Auger and his co-workers. A five-fold coincidence set (%) with a coincidence time of $3 \cdot 10^{-8}$ min, was used: four counters were arranged in two telescopes at a distance of 30 cm and surrounded by lead (arrangement I); the fifth counter was placed at a distance of 250 cm from the others.

The observed frequency was of $8 \cdot 10^{-4}$ min⁻¹ showing that some soft radiation is associated to the penetrating core; ~~this~~ we can therefore conclude that the ~~extensive~~ extensive showers are responsible for some of the extensive showers (S).

Other experiments on the nature of the penetrating showers are indicated in fig I.

10^{-8} min⁻¹



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