LETTERS TO THE EDITOR

Prompt publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the eighteenth of the preceding month, for the second issue, the third of the month. Because of the late closing dates for the section no proof can be shown to authors. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

Communications should not in general exceed 600 words in length.

Showers Produced by Penetrating Rays

For investigating showers we have used an apparatus involving the following: At the top there is a block of lead 20 cm square and 18 cm thick. Below this, and separated by spaces so as to cover a total length of 140 cm, there are four slabs of lead each 1 cm thick. Above the thick lead block, and at suitable distances above each of the other blocks, and beneath the lowest are trays, each containing 18 Geiger counters placed side by side. The counters are 1 cm in diameter and 20 cm long. Each is connected to an individual electroscope. The nature of the electrical arrangements is such that no electroscope is allowed to deflect unless at least one ray—and so a penetrating ray—has passed through all of the trays. Under these conditions, however, every counter which discharges is caused to record such discharge by means of a process in which spots of light reflected from the mirrors of all of the electroscopes are photographed.

We have used the above apparatus, among other studies, for the determination of the number of events which are accompanied by n additional rays for a range of n from 1 to 8. Results of two sets of experiments[1] are recorded in Table I together with the theoretical data given by H. J. Bhabha's[2] theory. In this table, E refers to the energy of a mesotron and m to its rest mass.

TABLE I. *Number of events which are accompanied by n additional rays E is the mesotron energy, m its rest mass.*

Theoretical

$E-mc^2$	$n=1$	2	3	4	5	6	7	8
10^8 ev	13.6	2.3	1.5	0.8	—	—	—	—
10^{10}	26.0	8.0	5.6	3.2	2.1	0.7	—	—
10^{12}	26.0	8.5	6.0	3.4	2.3	0.8	—	—

Experimental

Exp.	Thickness of Pb	$n=1$	2	3	4	5	6	7	8
1.	Below 18 cm Pb	11	5	1	2	1	1	1	1
	Below 19 cm Pb	13	4	3	0	3	0	0	0
2.	Below 18 cm Pb	7	3	0	0	0	1		
	Below 19 cm Pb	10	4	1	1	0	0		
	Below 20 cm Pb	12	2	1	0	0	0		
	Below 21 cm Pb	11	2	1	1	0	0		
	Below 22 cm Pb	9	1	0	1	0	0		
Averages for all data		10	3	1	0.7	0.6	0.3		
Final corrected averages		12.5	5	2	1.7	1.8	1.2		

The final averages given at the bottom of the table are corrected for counter inefficiency. It will be seen that these results agree very well with Bhabha's theory as regards the relative number of rays for mesotron energies between 10^{10} ev and 10^{12} ev. The actual number of rays found experimentally is about half that given by the theory and is more in accord with mesotron energies of 10^8 ev.

A complete description of these experiments and of other results from them will be published in a paper entitled "Showers Produced by Penetrating Rays and Allied Phenomena" by W. F. G. Swann, given as part of the "Symposium on Cosmic Rays" held at the University of Chicago, June 27–30, 1939.

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[1] These two experiments differ in the fact that in the first there was a single 1-cm block of lead in addition to the 18-cm block, while in the second experiment there were four 1-cm blocks in addition to the 18-cm block. Moreover, in the second experiment certain precautions were taken to eliminate the effect of electron showers coming in from the side and operating the apparatus.

[2] H. J. Bhabha, Proc. Roy. Soc. **164**, 257 (1938).

Heavy Water Rochelle Salt

It has been found that replacing the water of crystallization of Rochelle salt by deuterium oxide by growing the crystals in heavy water raises the upper critical temperature and lowers the lower critical temperature at which abrupt changes in the dielectric and piezoelectric properties occur. The amount of the change of temperature depends upon the D_2O-H_2O ratio in the solution. With 99.5 percent D_2O the upper critical temperature is raised from 23.5°C to 34.5°C and the lower critical temperature is reduced from −19°C to −24°C. The values of the dielectric constant and the piezoelectric constant which exhibit the critical temperatures are reduced in the 99.5 percent D_2O crystal at temperatures between the Curie points to about 75 percent of the H_2O crystal values. Otherwise the elastic, dielectric, and piezoelectric properties are substantially unchanged. The results are reported in greater detail in a forthcoming paper by W. P. Mason and A. N. Holden.

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