The Disintegration of Mesotrons

Ryerson Physical Laboratory,
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In order to test the hypothesis of the spontaneous decay of mesotrons we have compared the absorption of the mesotron component of cosmic radiation in air and in carbon.

The mesotrons were detected by the coincidences of three Geiger-Müller tubes arranged in a vertical plane. The counters were shielded with 10 cm of lead on each side to prevent coincidences from the air showers. Also, 12.7 cm of lead was placed between the counters in order to cut off the soft component.

The absorption in air was measured by counting coincidences at different heights from Chicago up to the top of Mt. Evans, Colorado, (4300 m). The absorption in carbon was measured by putting layers of graphite above the counters.

It was consistently found that the mass absorption in air was considerably larger than that in carbon. One set of measurements, for instance, gave the following results: Mt. Evans (4300 m, atmospheric pressure 618 g/cm^2) without graphite: 11.9 ± 0.07 coinc./min. *Ibid.,* under 84 g/cm^2 graphite: 11.0 ± 0.057 coinc./min. Echo Lake (3240 m, atmospheric pressure 700 g/cm^2) without graphite; 9.7 ± 0.046 coinc./min.

Thus the additional air layer of 82 g/cm^2 between Mt. Evans and Echo Lake reduced the intensity of the mesotrons by more than twice as much as did the graphite screen of 84 g/cm^2. It is obvious that this large difference cannot be ascribed to the difference in stopping power of air and carbon. We see, therefore, definite evidence for the disintegration of the mesotrons.

The above results show that 1.3 mesotrons out of 11 disintegrate while traveling a distance of $4.30 \times 10^5 - 3.24 \times 10^5 = 1.06 \times 10^5$ cm. Their mean-free-path for the disintegration is, therefore, $L = 1.06 \times 10^5 / \log(11/9.7) = 8.5 \times 10^5$cm.

L is connected with the lifetime τ_0 by the formula: $c\tau_0 = \mu c L/p$ where μ is the mass and p the momentum of the mesotrons. At sea level the average value of $\mu c/p$ was estimated to be about 0.07[1]. Assuming tentatively the same value in our case, one finds $\tau_0 = 2 \times 10^{-6}$ sec.

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Bruno Rossi
H. Van Norman Hilberry
J. Barton Hoag

[1]B. Rosel, Cosmic Ray Symposium, Chicago, June, 1939; Rev. Mod. Phys. July-October (1939).