On the Mean Life of $\mu^-$-Mesons
in Elements of Medium and High Atomic Number.

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Summary. — The mean life of $\mu^-$-mesons stopped in iron has been investigated by means of a new apparatus. The experimental arrangement for the determination of the mean life of $\mu^-$ in elements of mean and high atomic number is described. The deflection of the trajectory of a cosmic ray $\mu^-$-meson passing through two magnetized iron blocks ($B=1.5\ \text{Wb m}^{-2}$) indicates the sign of the incoming meson. The deflection is measured by an hodoscope of 90 Geiger counters. A fast syncroscope determines the interval of time between the arrival of the meson and its disappearance in the absorbers due either to capture by nuclei or to the normal process of decay. The error in the reading of the time interval is $\sim 10^{-8}\ \text{s}$. The mean life of the meson in the element constituting the absorber is directly calculated from the distribution of the delays. The value for the mean life of the $\mu^-$-meson in iron was found to be $\tau = (16 \pm 1) \cdot 10^{-8}\ \text{s}$.

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Introduction.

In the last decade the experimental study of the behaviour of $\mu$-mesons coming to rest in the proximity of atomic nuclei has been carried out by several laboratories. It has thus been possible to shed some light on several aspects of the nature of this particle, among which the weak interaction $\mu$-meson-nucleon and its reaction with the proton according to the scheme

$$\mu^- + P \rightarrow N + \nu.$$  

It has moreover been possible to obtain interesting information concerning the processes induced in nuclei of different atomic number by the capture of negative $\mu$-mesons. In this connection it is noteworthy to observe that although it does not seem likely that this type of research could provide further information on the nature of the $\mu$-meson (with the obvious exception of capture by hydrogen), it can be assumed that a more accurate investigation of the interactions between negative $\mu$-mesons and nuclei of different atomic numbers $Z$ could give useful information about the structure of the nuclei themselves.

First of all it is important to remember that several experimental approaches to this problem have been adopted; they can be briefly summarized as follows:

1) Direct determination of the mean life $\tau$, of the negative meson in elements of different atomic number ($^{1-10}$).

2) Determination of the ratio $R$ between the number of negative $\mu$-mesons disintegrated after stopping in a given element and the total number of negative $\mu$-mesons stopped by the same element ($^{11-12}$).

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