LETTERS TO THE EDITORS

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 637.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Connexion between the Life-time of the Meson and the Beta-Decay of Light Elements

As is well known, the assumption of the instability of the meson, which is included in the fundamental hypotheses of Yukawa's theory of beta-disintegration, has received a striking qualitative confirmation from investigations of the absorption of the penetrating component of the cosmic radiation¹. As stressed by Nordheim², there is, however, in the forms of the theory successively considered by Yukawa³ a serious quantitative discrepancy regarding the value of the ratio between the life-times of the free meson and of light beta-radioactive elements: the value of this ratio, calculated by using the values of the constants determined from the magnitude of the nuclear forces, turns out to be much smaller than that derived from observation. Since this discrepancy affects equally any other form of the theory involving only one of the four types of meson fields which, according to Kemmer⁴, are possible *a priori*, it may be concluded that no such form of the theory will be able to account quantitatively for the connexion between the life-time of the mesons and the beta-decay of light elements.

On the other hand, it is immediately apparent that the discrepancy in question can be removed as soon as a mixture of independent meson fields is introduced. Consider, for example, such a mixture of two fields *A* and *B*. The additive contribution of the field *B* to the beta-decay constant may then for some elements be much larger than that of the field *A*, while the life-time of the free mesons associated with field *B* will be so short compared with that of the mesons associated with field *A* that only the latter would have been observed at present in cosmic radiation.

Now a discussion of the problem of nuclear forces⁵ seems to bring out the necessity of introducing just such a mixture of two types of meson fields, namely, a vector meson field and a pseudoscalar meson field. A closer investigation, which is being continued, shows that such meson fields give rise to an interaction between heavy and light particles which, besides a term of the same type as that assumed in the original Fermi theory of beta-decay, may involve several possible combinations of other terms of a more complicated form.

The resulting theory of beta-decay thus contains a certain amount of arbitrariness, which a comparison with the available experiments is not yet able to remove. Anyhow, it may be expected that it will enable us not only to avoid the discrepancy pointed out by Nordheim, but also to account for such considerable variations of the form of the beta-spectrum and the value of the beta-decay constant

from element to element, as are already indicated by the present empirical data.

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¹ See, for example, Euler, H., and Heisenberg, W., *Ergebn. d. exakten Naturwiss.*, 17, 1 (1938).

² Nordheim, L., *Phys. Rev.*, 55, 506 (1939).

³ Yukawa, H., *Proc. phys.-math. Soc. Japan*, 17, 46 (1935); Bhabha, H., *NATURE*, 141, 117 (1938); Yukawa, H., Sakata, S., Kobayashi, M., and Taketani, M., *Proc. phys.-math. Soc. Japan*, 20, 720 (1938).

⁴ Kemmer, N., *Proc. Roy. Soc., A*, 168, 127 (1938).

⁵ Moller, C., and Rosenfeld, L., *NATURE*, 143, 241 (1939); 144, 476 (1939).

A New Technique for the Spreading of Proteins and the 'Spreading Number'

THE ordinary volatile solvents employed for fatty substances cannot be used for the spreading of protein monolayers on the surface of water, since the majority of proteins are soluble only in water. Hughes and Rideal¹ have spread proteins directly from the dry crystal, the amount spread being determined with a microbalance. Gorter and Grendel² deliberately inject an aqueous solution of the protein on the surface without worrying about the possible disappearance of a part of it in the substrate. Fatty substances and the exceptional protein, gliadin, have been successfully spread from alcoholic solution, in spite of the fact that ethyl alcohol is soluble in water. It appears that in this case, owing to its large spreading pressure, the alcohol spreads very rapidly before it has time to diffuse into the substrate.

Starting from these facts, a general method has been evolved for the spreading of proteins from aqueous solutions. The protein is dissolved in water, the surface tension of which is artificially lowered by adding traces of a capillary active substance, so that, when a drop is placed on the surface of the substrate, it quickly spreads. Once scattered, only the protein remains on the surface and the solvent dissolves in the substrate. As capillary active substance, amyl alcohol at a dilution of 1-2 per thousand has given very satisfactory results. The action is simply one of mechanical dispersion, and the same result may be obtained by using esters (for example, butyl acetate or propionate) as capillary active substances.

Various types of proteins have been thus spread on the surface of either distilled water or dilute hydrochloric acid or caustic soda. Particularly some globulins (for example, myosin, amandin, edestin) have been spread which were reputed not to form films,