that fusion shifts a 3μ crystalline band to the new position.

An examination of the curves of Dreisch or of Drummond justifies this conclusion. But the variation in the depth of the 2·7μ band in the investigations cited, and its absence in all of our specimens, makes this interpretation doubtful. To account for the variation displayed one would have to postulate an ageing effect; yet it is probable that some of the specimens used by Drummond were older than ours.

It is more probable that the 2·7μ band arises from an impurity which occurs in some samples but not in others. Correspondence with representatives of two companies that manufacture fused quartz ware indicates that this is not an impossible interpretation. A clue to the source of the impurity is contained in a paper by Lord Rayleigh[4], who points out the existence of water and carbon dioxide in at least SiO_2 in the form of pure sand. If the band is caused by either or both of these materials, they must exist as in solution in the fused quartz, since not enough molecules could exist as gas in pockets at a reasonable pressure to produce the depths of band observed. Carbon dioxide has a well-known band at 2·7μ, and recent work of Plyler and Williams[5] on the spectrum of solutions of water in acetone, and as yet unpublished work of Ellis and Kinsey on the absorption of a very dilute solution of water in carbon disulphide seem to indicate that the 3μ band of water in dilute solutions assumes a position more nearly equal to that of water vapour near 2·7μ.

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Radioactive β-Decay and Nuclear Exchange Force as a Consequence of a Unitary Field Theory

THE hypothesis is put forward that positive electron, neutrino, positive proton and neutron are four different quantum states of one elementary particle. Such an assumption would be trivial unless transitions between the different states occur. It is required that Dirac's equation follows from the theory, and that the conservation law of electric charge holds, so only a small number of transitions are allowed. If in addition we satisfy a certain symmetry condition (corresponding to the conservation law of Jordan's neutrino charge[1]) the number of possible processes is further reduced. The permitted transitions are:

(I) positive electron ⇄ neutrino
(II) positive electron ⇄ neutron
(III) positive proton ⇄ neutrino
(IV) positive proton ⇄ neutron.

Any one of these transmutations can occur only if another one of them takes place in the reverse direction.

Process (IV) (from right to left) and (I) (from left to right) give rise to a transmutation of a neutron into a proton, while simultaneously a positive electron (being in one of the negative energy states of Dirac's theory) becomes a neutrino. Thus a 'Dirac hole' (to be identified with a negative electron) and a neutrino are produced. An explicit calculation according to this theory gives the Fermi[2] formula for radioactive β-decay.

If the transformation (IV) of one particle is coupled with the same transformation (of a second particle) in the reverse direction, the corresponding interaction energy is the one postulated by Majorana[3] in order to explain nuclear constitution (exchange force neutron–proton).

Combining I, II, III and IV, there is a number of further reactions possible which will be discussed elsewhere together with the complete theory[4]. As soon as the neutrino theory of light[5] can be formulated in a satisfactory way, we have a unitary field theory, its field variable being a spinor of 16 components.

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[2] E. Fermi, *Z. Phys.*, **88**, 161 (1934); Konopinsky and Uhlenbeck, *Phys. Rev.*, **48**, 7 and 107 (1936).
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[4] To be published in the *Helv. Phys. Acta. Note added in proof:* It seems worth while to point out that combinations between (I) and (III) or between (II) and (IV) which lead to destruction of heavy particles, cannot occur if the negative electron and the positive proton are both considered as *true particles* (being the opposite of the 'holes' or antiparticles in Dirac's theory).
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Influence of Œstrogens on the Prostate Gland

RECENT investigation[1] suggests that the benign enlargement of the prostate which occurs spontaneously both in elderly men and aged dogs is a consequence of œstrogenic stimulation. No evidence has, however, been found hitherto which demonstrates the identity of the histological changes throughout the naturally and experimentally enlarged prostates, and only such evidence can provide the conclusive step in the substantiation of the hypothesis. It is therefore important to record the fact that a specimen of a spontaneously enlarged prostate in a dog, which has recently become available for study, presents a histological picture identical with that provided by the prostates of dogs experimentally treated with relatively large doses of œstrone[2]. The characteristic epithelial changes of the experimental prostate, which are not seen in the usual spontaneous enlargement, are reproduced in detail in this specimen, and it may be assumed that their usual absence is due to a lesser degree of œstrogenic stimulation than was the case in the animal under consideration.

The specimen will shortly be reported on in detail in collaboration with Mr. J. R. Groome, of the Department of Zoology, University of Oxford.

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