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.

Nuclear Isomerism in Rhodium

Pontecorvo[1] has recently pointed out that Rh^{104} emits numerous electrons of energy 35–60 kev. He ascribes these electrons to the internal conversion of the gamma-radiation emitted when the Rh^{104} nucleus goes from an excited state (4.2-minute period) to the ground state. From the ground state there is beta-emission which gives Pd^{104} and is ascribed to the 44-second period. The emission of the gamma-ray from the excited state is an alternative process to the direct emission of a beta-ray from the excited state. In this latter connection the beta-ray spectra associated with the two periods are of interest.

A study of these beta-ray spectra had already been undertaken in this laboratory with a cloud chamber in a magnetic field. It has been found that the beta-ray spectra associated with these two periods are identical in shape and end point within the limits of error of the measurements. Samples of Rh in the form of thin sheets (184 mg per square cm) were bombarded by neutrons (from Li bombarded by 1.2 Mev deuterons) after passing through paraffin. The 4.2 minute and 44 second isomers were separated by varying the time of activation and time of observation. The contamination of the undesired isomer was reduced to 3.7 percent for the spectrum of the 44-second period and to 0.8 percent for the spectrum of the 4.2-minute period. The visually extrapolated upper limit obtained was 2.25 Mev for both spectra and the shape of the two curves was very nearly identical. Konopinski-Uhlenbeck diagrams were plotted to obtain a better value for the difference of the upper limits. The end points obtained were 2.74 Mev for the 44-second period and 2.76 Mev for the 4.2-minute period. The estimated error in each of the end points is 0.06 Mev. The 44-second Konopinski-Uhlenbeck upper limit has been reported by Gaerttner, Turin, and Crane[2] as 2.8 Mev.

The similarity of the two beta-ray spectra in both shape and end point is in agreement with Pontecorvo's results. In addition, since the direct emission of beta-particles from the excited state would probably give the spectrum associated with the 4.2-minute period a shape unlike that from the 44-second period, these results indicate that the presence of the direct beta-transitions to any considerable extent is unlikely.

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October 27, 1938.

[1] B. Pontecorvo, Phys. Rev. **54**, 542 (1938).
[2] Gaerttner, Turin, and Crane, Phys. Rev. **49**, 793 (1936).

On the Formation of Deuterons by Proton Combination

The probability of the reaction $H+H=D+e^+$ at stellar temperatures was studied in a paper which appeared recently in the *Physical Review*.[1] In that discussion the Gamow-Teller modification[2] of the Fermi beta-theory was adopted in order that the change in spin between a ^1S state of two protons (most favorable to their close approach) and the resulting ^3S state of the deuteron could take place. It has been suggested to the authors that the symmetry considerations which allow this transition be amplified.

The initial proton state is antisymmetric to an interchange of space and spin coordinates and the final deuteron state is symmetric in this respect. If this were a complete description of the exchange symmetry properties the transition desired would be forbidden. The point which was not made explicit in the original discussion is that to use configuration space in considering beta-processes one must include another coordinate, namely the isotopic spin, which represents the neutron and the proton as two states of one particle. The ^1S function of two protons is symmetric to interchange of this coordinate, whereas the deuteron function is antisymmetric. In the complete coordinate system, therefore, the positron emission assumed accompanies a transition from one antisymmetrical state to another and may be permitted.

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[1] Bethe and Critchfield, Phys. Rev. **54**, 248 (1938).
[2] Gamow and Teller, Phys. Rev. **49**, 895 (1936).

Sign Preference in Cloud Condensation on Gaseous Ions

In a recent paper Loeb, Kip and Einarsson[1] gave data and formulated a theory as to the nature of the sign preference in the condensation of various vapors on ions in a C. T. R. Wilson cloud chamber. There it was indicated that condensation about ions in vapors of nonpolar liquids should show *no sign preference*. Publication of that paper was withheld for a year because after the initial experiments on supposedly C. P. vapors of C_6H_6 later measurements on C_6H_6 and CCl_4 had shown definite sign preference. Careful purification of C_6H_6 by Edmund Chambers and Einarsson had eventually shown that pure dry C_6H_6 showed no sign preference but that with 10 percent of