To begin with, the intensity of magnetization was measured in a weak field of 1.2 oersted in the temperature range $+50^{\circ}$ C to -200°C and is shown in Fig. 1. From the results of this experiment, it was confirmed that a gradual increase of the intensity of magnetization with decreasing temperature is interrupted by a fall in the range $+20^{\circ}$ C to -150° C, below which temperature the magnetization remains constant. During heating, these changes take place almost reversibly. Moreover, with increasing field the magnitude of the drop in intensity of magnetization (from room temperature to liquid nitrogen temperature) at first increases, up to a field of 2.25 oersted, and afterwards diminishes; it disappears at about 6.1 oersted, at which field the intensity of magnetization shows a value of 216 gauss. When the field is increased further, the intensity of magnetization increases with decreasing temperature. These changes of magnetization due to temperature are shown in Fig. 2 as a function of applied field.

From these results, it can be concluded that the mangan ferrite undergoes a transition like other complete inverted ferrites in the temperature range of $+20^{\circ}$ C to -150° C.

The electrical resistivity was also observed in the same temperature range and was found to increase considerably with decreasing temperature.

Details of the present experiment will be published in Scientific Reports of the Research Institute of Tokohu University.

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The Existence of Wheeler-Compounds

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R ECENT experiments by Deutsch have revealed that significant information concerning the interaction of positrons with the constituents of ordinary matter can be obtained from a study of the annihilation of positrons in gases.¹ In particular, it has been demonstrated in a striking manner that the phenomena of positronium formation and conversion can have pronounced effects upon the observed values of the mean life of the positrons.

The progress in this field of physics has added interest to the question of whether a positron can attach itself to an atomic or to a molecular structure, to become a member of a short-lived system of the kind first envisaged by Wheeler.²

The first question with which one is confronted when inquiring into the properties of these "Wheeler-compounds" is, clearly, that of whether such structures can exist at all, i.e., whether they will be energetically stable. Theoretical evidence has already been published, which strongly suggests that some systems of this kind, e.g., Cl^-e^+ , actually possess this dynamical stability.^{3,4} However, it is hardly justified to say that, in any single case considered up to the present, the stability has been established in a mathematically entirely convincing way. It may be of interest, therefore, to report one case, viz., that of the simple Wheeler-compound H^-e^+ , where the variational method can be applied and furnishes an unambiguous proof.

One might perhaps argue that the stability of H^-e^+ is to be expected because the structure of this particular compound lies somewhere between that of the hydrogen molecule and that of the positronium molecule, both of which are known to be stable. However, this qualitative argument would carry but little weight, on account of the fact that the symmetry in positive particles characteristic of each of the latter two systems is not present in the hybrid.

In attempting to establish the dynamical stability of H^-e^+ we first considered the feasibility of deriving the desired result by means of trial wave functions which would describe the system

roughly in terms of a positron moving in the field of a polarized negative hydrogen ion. Utilizing mathematical techniques well known, particularly from early works by Hylleraas, functions can be handled which contain as independent variables the three distances from the proton to the light particles, in addition to the two angles which the direction from the proton to the positron forms with those to the two electrons. However, this approach led to approximate energy values which were too high to guarantee against a dissociation of H^-e^+ into a hydrogen atom and a positronium atom-which represents the critical mode of disintegration.

A better approximation will be one which describes the system more closely as a positronium atom coupled to a hydrogen atom. The following symmetrized, simple trial wave function will be of this kind:

$$\psi = \exp\left[-k(r_{1a} + \alpha r_{2a} + \beta r_{2b})\right] + \exp\left[-k(r_{2a} + \alpha r_{1a} + \beta r_{1b})\right]. \tag{1}$$

The subscript a refers to the proton, b to the positron, and 1 and 2 to the respective electrons. The parameter k permits a variation with respect to a change in scale. For $\alpha = 0$, $\beta = 0.5$, the function (1) describes the dissociated system correctly. In general, the parameter α introduces a coupling of the negative member of the positronium atom to the hydrogen atom.

The above function can be handled essentially by the method which has proved to be successful for treating the positronium molecule.⁵ While the high degree of symmetry of the latter system permitted an exclusive use of the volume element

$$\sim dr_{ab}r_{1a}dr_{1a}r_{1b}dr_{1b}r_{2a}dr_{2a}r_{2b}dr_{2b}, \qquad (2$$

some of the terms in the energy integral now have to be evaluated by introducing in addition the analogous volume element

dı

$$d\tau \sim dr_{12}r_{1a}dr_{1a}r_{1b}dr_{1b}r_{2a}dr_{2a}r_{2b}dr_{2b}.$$
 (3)

The determination of the optimum values of α and β is facilitated if one first considers the idealized system in which the proton mass is taken to be infinitely large. In the dissociated state this system has the energy $E_0 = -1.5 R_{\infty} h$. Using the same unit of energy one finds for the compound

$$E_{\min} = -1.50502; \quad \alpha = 0.25, \quad \beta = 0.5 \tag{4}$$

corresponding to a lower limit of the binding energy of

$$E_0 - E_{\min} = 0.0050 R_{\infty} h = 0.07 \text{ ev.}$$
 (5)

The correction due to the kinetic energy of the proton can easily be determined, but it will not affect the value (5), for the corrections to E_0 and to E_{\min} are, naturally enough, found to be practically equal. Hence, we conclude that H^-e^+ will be stable against dissociation by at least the value given by (5), and this value is already sufficient even to prevent the system from breaking up in an ordinary thermal collision process.

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On the Relative Intensities of First-Order Stark Components

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1. Error in Gordon's formula. The relative intensities of the first-order Stark components of a spectral line are given sep-