

The notations used in the formulas are chosen as in reference 2.

We remark that, generally speaking, we are taking into account the exchange of a "swollen" photon, for which the propagation function is  $d(q^2)/q^2$ , the function  $d(q^2)$  being included in the vertex functions  $f_1(q^2)$  and  $f_2(q^2)$ . On the basis of experiments on scattering it is in general impossible to distinguish a change of the vertex operator from a change of the propagation function of the photon.

It must also be noted that if new forces of a vector character (transferred by vector mesons) come into play at small distances, the formulas given here remain valid if we replace the photon propagation function  $-1/q^2$  by the propagation function of the meson.

The well known Möller formula is obtained from Eq. (2) if we set  $f_2 = 0$ ,  $f_1 = 1$ . All the radiative and mesonic corrections are included in the functions  $f_1(q^2)$  and  $f_2(q^2)$  (when we consider the

exchange of one photon, and just in this case it makes sense to speak of the form-factors  $f_1$  and  $f_2$ ) and can be calculated. A deviation from the Möller formula (with account taken of the corrections mentioned above and of the exchange of a larger number of photons) would indicate the inapplicability of quantum electrodynamics at small distances, and the experimental determination of the functions  $f_1(q^2)$  and  $f_2(q^2)$  will give information about the distributions of charge and current in the electron.

<sup>1</sup>W. K. H. Panofsky, Report at the Ninth International Conference on High-Energy Physics, Kiev, 1959.

<sup>2</sup>J. M. Jauch and F. Rohrlich, *The Theory of Photons and Electrons*, Cambridge, Mass., 1955.

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### MUTUAL SOLUBILITY OF HYDROGEN AND DEUTERIUM AT 4.2° K

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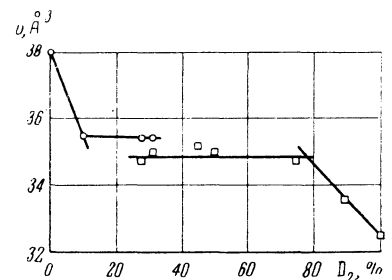
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WE published previously<sup>1</sup> the general outlines of the  $H_2 - D_2$  phase diagram. The two-phase region for the  $H_2 + D_2$  mixture was roughly mapped out at helium temperatures for that concentration range over which the x-ray lines of both hydrogen and deuterium appeared simultaneously. From the x-ray diagrams and data on the structure of the pure isotopes,<sup>2</sup> one can determine the limits of solubility of hydrogen in deuterium and of deuterium in hydrogen at 4.2° K.

From this data on the pure isotopes it follows that a molecule occupies a volume of  $38 \text{ \AA}^3$  in the  $H_2$  lattice, and the volume in the  $D_2$  lattice is  $32.5 \text{ \AA}^3$ . The figure shows the values of the volume  $v$  per molecule in the lattices of different solid mixtures. These results show that the limit

The volume corresponding to one molecule;  $\circ$  - in the hydrogen lattice and  $\square$  - in the deuterium lattice, as a function of composition.



of solubility of hydrogen in deuterium is 10% and of deuterium in hydrogen is 21%. It is interesting to note that the volumes corresponding to one molecule in both limiting mixtures are roughly the same ( $\sim 35 \text{ \AA}^3$ ), and are close to the arithmetic mean of the volumes per molecule in the lattices of the pure isotopes.

<sup>1</sup>Kogan, Lazarev, and Bulatova, JETP **34**, 238 (1958), Soviet Phys. JETP **7**, 165 (1958).

<sup>2</sup>Kogan, Lazarev, and Bulatova, JETP **37**, 678 (1959), Soviet Phys. JETP **10**, 485 (1960).

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