Letters to the Editor

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ON A HOLE THEORY OF LIQUIDS.

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We will consider here the interlattice holes of a crystal as the regular sites of a second lattice and also like Lennard-Jones and Devonshire (1939), assume that each atom of a monatomic crystal is associated with a hole. Upto the fusion point and even at the beginning of the liquid state this is the position The two lattices coincide at absolute zero and with rise of temperature gradually the two are separated till at the fusion point the two are completely dissociated. After this when the temperature rises, gradually the atoms leave the lattice sites to wander as free particles and the corresponding holes dissolve in the interstetial space. When all the holes will dissolve, we shall get a perfect gas.

All the atoms are at their respective position on the lattice (may be on the minute crystals into which the large crystal has been divided) at the melting point These atoms cannot produce any impact on the wall of the container and hence can exert no pressure At any temperature T, let there be N_1 free atoms and N_2 atoms fixed to the lattice sites. So N_1 holes must have been lost in the interstetial space and only N_2 holes must have remained at the regular lattice sites.

At melting point (T_m) $N_2 = L$, the Avogador's number for one gram. mol. of substance. With increase of temperature N_2 will go on decreasing till at a high temperature it reduces to zero. N_1 will change in a reverse order and will behave as a perfect gas at all temperatures. So the situation is as if a saturated vapour is in contact with its condensed phase. Here N_1 particles belong to one phase space and N_2 to another phase space and with change of temperature, particles pass from one phase space to the other. The N_1 phase space corresponds to the ideal gas and the N_2 phase space corresponds to the ideal solid.

A similar situation we meet when particles come out of a radioactive substance. One type of phase space controls the behaviour of the nuclei and another controls the behaviour of the particles radiated. It is to be noted that the number of particles passing from one space to the other is found out by a non- mechanical statistics, determined by trial. We will also follow a similar procedure.

Let dN be the number by which N_2 decreases when temperature increases by dT.

Let $dN = -\theta N T^{-\frac{1}{2}} dT$ whre $N = N_2$

From this we get $N = Le^{-2\theta(T^{\frac{1}{2}} - T_m^{\frac{1}{2}})} = N_2$ ... (1)

by introducing the condition that at T_m, $N = L$

Now $N_1 = L - N = L[1 - e^{-2\theta(T^{\frac{1}{2}} - T_m^{\frac{1}{2}})}]$ ... (2)

The picture that we have taken for liquids (and real gases), make it very clear that the only effect of the heat added to the system is to remove the atoms from the lattice sites and to increase the kinetic energy of the particles in the interstetial space. It has, so to say, no other effect on the atoms at the regular lattice sites. So in order to determine the energy-content of a liquid (or of a real gas) we need only consider the effect of the N_1 particles. Since these particles behave like particles of a perfect gas, we are only to write $L[1 - e^{-2\theta(T^{\frac{1}{2}} - T_m^{\frac{1}{2}})}]$ in place of L in perfect gas equations The variation of specific heat with temperature in case of four liquids have been explained successfully by the author (Misra, 1966) on this basis. It has also been shown in another paper (to be published) that the idea can be extended to the case of nonuniform properties like viscosity. Assuming regular distribution of the holes, we can explain X-ray haloes in case of liquids. Attempts are being made to explain other properties of liquids and gases with this idea.

REFERENCES

Lennard-Jones and Devonshire, 1939, *Proc Roy. Soc* **169A**, 317.

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