to lie on a straight line having a slope $7/3 \pm 1/1000$. The expression $E = 1.153\ Z^{7/3}$ fits the observed data quite well and it may certainly be expected to hold for higher values of Z than those considered in this note. The column E_{calc} in the above table was computed by this formula. Milne arrived (theoretically) at a value $a = 1.23$ which is about 7% higher than the one given here. It is felt that the difference may lie in the difficult numerical calculations on which Milne's result is based.

Thomas, Fermi, and Milne have supposed their theory to hold only for heavy atoms. We have shown here that it holds *exactly* for $z > 1$. Thus, when there are two or more electrons in an atom they seem to behave as a completely degenerate Fermi gas. Small deviations may arise when the outer electrons do not form spherically symmetrical closed groups.

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October 7, 1929.

Double Vibrational Isotope Effect in the Silver Chloride Band Spectrum

The emission band spectrum of AgCl already reported showed the presence of the two Cl isotopes. Photographs of the same spectrum in absorption, under higher dispersion, reveal also the two silver isotopes. The heads of the band systems due to the molecules $Ag^{107}\ Cl^{35}$, $Ag^{109}\ Cl^{35}$, $Ag^{107}\ Cl^{37}$, $Ag^{109}\ Cl^{37}$ have been measured. The measured separations of the Cl isotopes, are of the order 3 to 30 cm^{-1}; of the Ag isotopes, 1 to 4 cm^{-1}. Agreement with theoretical displacements is close.

A complete assignment of vibrational quantum numbers has been made. The (0,0) band lies at 31574.4 cm^{-1}. The heat of dissociation of AgCl in the normal state is 3.00 volts; in the excited state 0.35 volt. Complete results will be published soon.

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Electron Scattering in Hydrogen

In a study of electron scattering in hydrogen, Jones and Whiddington, and more recently Harnwell, have observed an energy loss that does not fit in with the current views as to the structure of the hydrogen molecule. Jones and Whiddington observed an energy loss of about 7 or 8 volts and Harnwell observed a loss of 6 or 7 volts. Harnwell also noticed that this low energy loss became less intense as the amount of atomic hydrogen in the scattering tube increased, and therefore concluded that the loss must be directly attributable to the molecule.

An attempt was made last year by the writer of this note to explain the results of Jones and Whiddington by saying that the low energy loss corresponded to a transition between the 1^3S and the 2^3S levels of the molecule. It may be recalled that the 1^3S level was theoretically predicted by Heitler and London and used by Winans and Stueckelberg to explain the continuous spectrum of the molecule. The above explanation of the low energy loss is modified now to say that it corresponds to the excitation by electron impact of molecules that are in states represented by the horizontal portions of the Franck-Condon potential energy curves associated with the 1^1S and the 1^3S levels. Molecules in these levels possess energies equal to or greater than the heat of dissociation and consequently the energy necessary to excite the low lying singlet or triplet levels is about 7 to 8 volts. This is in good agreement with the observations.

There are several ways in which a hydrogen molecule can get into the states represented by the flat parts of the potential energy curves associated with the 1^1S or the 1^3S levels. The recombination of two hydrogen atoms may result in an unstable molecule in one of these two levels. This process should of course be most probable in atomic hydrogen. The emission of the continuous spectrum should result in molecules in the 1^3S levels and these should therefore be most numerous in molecular hydrogen. Since the low energy loss is less frequent in atomic than in molecular hydrogen, it seems that on the basis of the ideas in this note, it corresponds to excitation of molecules in the 1^3S level. It may be however that the formation of quasi-molecules by recombination is very improbable.

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October 7, 1929.