spinning electrons of neighbouring atoms (*Zeit. f. Phys.*, **49**, 619; 1928); on this theory one would expect less hysteresis as the magnetic atoms become more isolated. The theory also explains the effect of annealing in reducing the hysteresis by uniformly distributing cobalt atoms which were closely clustered in groups in the hard drawn state, and thus likewise reducing resonance phenomena.

F. W. CONSTANT
(National Research Fellow).
California Institute of Technology,
Pasadena, California, May 23.

### The Atomic Weight of Arsenic.

As the International Committee on Atomic Weights has not provided a table since 1921, the British Sub-Committee published in the *Journal of the Chemical Society* of January last a revised table of atomic weights for 1929. In the report attached to this table we read that "for the nine 'simple' elements H, He, C, N, F, Na, P, As, and I the values obtained by F. W. Aston with his new mass-spectrograph are adopted in preference to those deduced from the physical or chemical data, because we are of opinion that, in these cases, Aston's method is less liable to error than any other". . . .

Dr. Aston is to be congratulated that his spectrograph allows the reading corresponding, as regards the accuracy, to that of modern atomic weights determination, namely, 1 in 10,000.

Since from the year 1927 I have been engaged on the revision of atomic weight of arsenic, based on chemical analysis, I am highly interested in the new Aston figure, As = 74·934, derived for this element from the mass spectrum alone. The atomic weight of arsenic, As = 74·96, hitherto adopted internationally, is based on the Baxter and Coffin method of converting silver arsenate into silver chloride or silver bromide by the action of hydrogen chloride or hydrogen bromide. From the chemical point of view this international value for arsenic is a little higher than the actual one. From this reason I have undertaken a new determination of this figure deduced from the analysis of the purest arsenic chloride and bromide. From the eight determinations of the ratio $AsCl_3$ : 3Ag hitherto made, I have obtained the average As = 74·937 (using Ag = 107·88 and Cl = 35·458), which is in excellent agreement with the value obtained by Aston. This agreement corroborates the probability of the lower value, which was to be expected, and shows at the same time the trustworthiness of Aston's method used for the derivation of atomic weights of simple elements.

My preliminary paper concerning this matter was read before the Congress of Czechoslovak Scientists held in Prague, May 1928. After completion of the analyses of arsenic chloride and those of arsenic bromide, the definite value obtained will be published.

H. KŘEPELKA.
Institute of Inorganic Chemistry,
Charles University,
Prague, May 7.

### A New Ultra-violet Band Spectrum of Hydrogen Chloride.

HITHERTO no band spectra have been found which involve electronic excitation in neutral or ionised hydrogen chloride. We have recently photographed an extended band system in the region λ2830-λ3966 from a low pressure discharge in pure hydrogen chloride gas with platinum electrodes. The bands are degraded toward long wave-lengths, and have the characteristic widely spaced structure always observed in hydride spectra. A discharge in hydrogen gives the same band system if a small amount of silver chloride or cuprous chloride is fused on the electrodes, but not if silver bromide is used. Thus there is strong evidence that this spectrum is due to the hydrogen chloride molecule. Moreover, there are reasons, both experimental and theoretical, for believing that the emitter is singly charged, probably the $HCl^+$ ion. For example, the bands are obtained only from the negative glow, whereas in general the spectra of ionised molecules, such as $N^+_2$, are relatively stronger.

Owing to the unusual intensity distribution in this band spectrum, it has not been possible to reach an assignment of vibrational quantum numbers, and thus to determine the electronic frequency. The isotope effect, which we hope to obtain by the detailed analysis of the fine structure now in progress, should prove helpful in this regard. The bands occur in pairs of constant separation, 658 cm.$^{-1}$, indicating that a doublet electronic level is involved. The two components of a pair have about equal intensities. The wave-numbers of the band heads may be represented by

$$\nu = \left.\begin{matrix} 28446 \\ 27788 \end{matrix}\right\} + 1561p - 30{\cdot}3p^2 - 2573n,$$

observed values of $(p, n)$ being (−1, 0)?, (0, 1), (3, 1)?, (0, 0), (1, 0), (2, 0), (3, 0), (4, 0), (5, 0). The pair (0, 0) at λλ3514, 3598 is the strongest, and the five succeeding pairs have regularly decreasing intensity. They apparently form a progression with a common vibrational quantum number in the lower state. As was pointed out to us by Dr. F. Hund, it can be shown by a correlation with the energy terms of the equivalent atom, Cl, and the separate atoms H and $Cl^+$, that a transition $^2\Sigma \dashrightarrow {}^2\Pi$ might be expected in $HCl^+$. A preliminary examination of the rotational structure shows that it is probably compatible with such an interpretation.

BROOKS A. BRICE.
F. A. JENKINS.
New York University,
University Heights, N.Y., April 26.

### Dirac Equations and Einstein Theory.

HERMANN WEYL (*Proc. Nat. Acad. of the U.S.A.*, **15**, 323; April 1929) has recently developed a relativistic theory of the Dirac equation which, like that of Wigner (*Zeit. f. Phys.*, **53**, 592; 1929), and that of Vallarta and myself (NATURE, Mar. 2, 1929, p. 317), employs the Einstein notion of an '*n*-leg'. Unlike the two other theories, Weyl rejects Einstein's distant parallelism, and obtains a theory invariant under a local rotation varying continuously from point to point. That is, Weyl's theory depends solely on the $g_{\lambda\mu}$'s of Einstein's 1916 gravitational theory, and not on the ${}^sh_\lambda$ of his 1929 theory. It is perhaps interesting to remark that the same degree of invariance may be obtained by choosing as the 4-legs of the Einstein theory the Ricci principal directions. If we write $R_{\lambda\mu}$ for the 1916 contracted curvature tensor, this additional condition is expressed by the formula

$$_th^\mu{}_sh^\lambda R_{\lambda\mu} = 0 \quad (s \neq t). \qquad . \quad . \quad (1)$$

This condition is trivial and nugatory in case the original Einstein equations $R_{\lambda\mu}$ = const. $g_{\lambda\mu}$ are fulfilled. Since the new gravitational-electric-matter equations, whatever their final form may be, are close approximations to these, it is perhaps not too much to hope that the supplementary condition (1) not only is compatible with them, but even not too restrictive so far as terms of observable magnitude are concerned.

Thus gravitational phenomena appear to be such