$d\tau$ is an element of proper time associated with the track of the particle, dx^m is a component of displacement and φ_m is a component of electromagnetic potential. An interesting result is obtained if this be applied to an electron in an electrostatic field of potential Ne/r. This is the case with an electron in an atomic orbit where N is the number of the atom. The above condition then implies $(m_0c^2\sqrt{1-\beta^2} - Ne^2/r)\,dt \not< h$ where $\beta = v/c$, v being the velocity of the particle, and where account is taken of the fact that the nuclear and electronic charges are of opposite sign. If we consider the case of the K-level of an atom and make use of Sommerfeld's value for Ne^2/r, which may be regarded as a sufficient approximation, we obtain $m_0c^2\,(\sqrt{1-\beta^2} - \beta^2/\sqrt{1-\beta^2})\,dt \not< h$. In this case $\beta = N\alpha$, where α is the fine-structure constant $2\pi e^2/hc$. We note that as β approaches the value $1/\sqrt{2}$ the factor of dt approaches zero very rapidly, and the limitation states that the least possible value of dt is very large. We interpret this as an indication of the breakdown of the description of the charge as a particle in motion. This gives a clue to the nature of the limitation. It provides us at each point of space and time with a criterion for the dynamical description of an electric charge.

In this particular example the limitation is interpreted to mean that the K-level does not exist when $\beta = N\alpha \gg 1/\sqrt{2}$.

The condition appears to be similar to a condition of stability, the K-ring at a certain point becoming completely unstable.

The value of N which results from this equation is very close to 97, and we conclude that atoms with numbers up to 96 may possess a complete set of energy levels beginning with the K-level. Beyond this, K-levels do not exist and nuclei of a larger number would possess energy layers beginning at a higher level[2].

The condition $\beta \not> 1/\sqrt{2}$ can be expressed by stating that electrons in atomic orbits have de Broglie wave-lengths greater than h/m_0c. It is interesting to note in conclusion that in the example considered we find another relation involving the fine-structure constant to add to the considerable number already known.

H. T. FLINT.

Wheatstone Laboratory,
King's College,
London, W.C.2.
July 30.

[1] Flint, *Proc. Roy. Soc.*, A, **159**, 45 (1937).
[2] Flint and Richardson, *Proc. Roy. Soc.*, A, **117**, 637 (1928).

Ultra-Violet Band System of Silicon Monotelluride

FOLLOWING up the recent observations of ultra-violet band systems of SiS[1] and SiSe[2] in heavy-current discharges through silica tubes containing aluminium sulphide and aluminium selenide respectively, I have now applied an analogous method for the development of the corresponding system of SiTe. In this case, a 2·5-amp. A.C. discharge has been passed through a powdered mixture of aluminium and tellurium in a silica tube. The system lies between λ 3307 and λ 3831, having its $0 \rightarrow 0$ band at λ 3496·4.

As guides to the identification of the SiTe system there are not only the progressive changes in the system-origins and vibrational coefficients of SiO, SiS and SiSe, but also the data for the corresponding system, $B \leftarrow X$, of SnS, which has the same number of electrons (66) as SiTe. There is, indeed, a remarkable similarity between the expressions for these two systems, just as there is between those for the corresponding systems of the lighter isoelectronic pair, GeS and SiSe (48 electrons), thus:

$$\left.\begin{aligned} \nu_{GeS} &= 32889{\cdot}5 + (375{\cdot}0\,u' - 1{\cdot}51\,u'^2) - (575{\cdot}8\,u'' - 1{\cdot}80\,u''^2), \\ \nu_{SiSe} &= 32448{\cdot}7 + (404{\cdot}3\,u' - 3{\cdot}24\,u'^2) - (580{\cdot}0\,u'' - 1{\cdot}78\,u''^2), \end{aligned}\right\}$$

$$\left.\begin{aligned} \nu_{SnS} &= 28337{\cdot}9 + (331{\cdot}9\,u' - 1{\cdot}25\,u'^2) - (487{\cdot}7\,u'' - 1{\cdot}34\,u''^2) \\ \nu_{SiTe} &= 28665{\cdot}9 + (333{\cdot}4\,u' - 0{\cdot}54\,u'^2 - 0{\cdot}05\,u'^3) - (480{\cdot}7\,u'' - 1{\cdot}30\,u''^2) \end{aligned}\right\}$$

where, as usual, u stands for $v + \frac{1}{2}$.

The values of $I_M I_X/E_e$ and ω_e'/ω_e'' for SiTe are 20·6 and 0·694 respectively, which are of the same orders of magnitude as those previously found for SiS and SiSe. The ratio (ω$_e$ of SiTe)/(ω$_e$ of SiSe) takes the values 0·824 and 0·829 for the excited and ground states respectively. As expected, these are greater than those for (ω$_e$ of SiSe)/(ω$_e$ of SiS), namely, 0·790 and 0·774, respectively, which, again, are greater than those for (ω$_e$ of SiS)/(ω$_e$ of SiO), namely, 0·602 and 0·604 respectively. A similar change is found[3] in the corresponding ratios of coefficients in the case of PbTe, PbSe, PbS and PbO.

R. F. BARROW.

Imperial College,
London, S.W.7.
Aug. 8.

[1] Barrow, R. F., and Jevons, W., NATURE, **141**, 833 (1938).
[2] Barrow, R. F., NATURE, **142** [434] (1938).
[3] Barrow, R. F., and Jevons, W., forthcoming paper.

Band Spectrum of Helium

WHEN helium at a pressure of about 25 mm. of mercury is excited in such a way as to produce the line spectrum and the band spectrum in comparable intensity, McCallum and Wills[1] find that the band spectrum persists much longer than the line spectrum after the excitation is removed. They show a spectrogram of the discharge, taken 1/600 sec. after the discharge had been interrupted, in which the line spectrum has disappeared while the band spectrum is still of approximately the same intensity as that from the discharge before interruption.

From this persistence of the band spectrum McCallum and Wills infer that either the helium molecules formed in the discharge have a life of the order of 1/600 sec. or, more probably, they are formed after interruption of the discharge by the collision of a metastable atom with a neutral atom.

That the latter inference is correct is shown by the recent work of Arnot and M'Ewen[2], who have investigated the formation of helium molecules by the balanced space-charge method, and have shown that the helium molecule is formed in the ionized state by the attachment of a metastable atom in the $1s2s$, ^3S state of 19·77 volts energy to a normal atom. This paper was published after McCallum and Wills's letter was communicated.

F. L. ARNOT.

University,
St. Andrews.
Aug. 18.

[1] McCallum, S. P., and Wills, M. S., NATURE, **142**, 252 (1938).
[2] Arnot, F. L., and M'Ewen, M. B., *Proc. Roy. Soc.*, A, **166**, 543 (1938).