had to prove that neither of his grandfathers was a bottle maker or related to one.

In the end the cycle was completed and the wine growers again acquired the prominence due them, while the bottle makers' association became too top-heavy to continue to exist. Individual bottle makers found their proper modest function furnishing simple reliable bottles as specified by the wine makers. From the temporary flare-up, when the bottle makers came near ruining the wine industry by their over-zealousness and naive conceit, some of the puzzling old sayings originated, such as, "tell your troubles to the bottle makers", or "try a different shape bottle".

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Nuclear Structure and Excited Radioactivity

FOLLOWING Heisenberg and Landé's suggestion, completed by Walke[1], every atomic nuclear can be considered as constituted by α-particles (α), deutons (π_2) and neutrons (n), according to the formula :

$$x\alpha + y\pi_2 + zn.$$

x, y, z must satisfy the equations

$$4x + 2y + z = A$$
$$2x + y = N$$

where A is atomic mass, N atomic number. For x one must choose the greatest possible value, when $y = 0$ or 1.

An examination of the table of all isotopes shows that the following formulæ

$$(1) \begin{cases} x\alpha + \pi \\ x\alpha + \pi_2 \text{ (for } x > 3) \\ x\alpha + \pi_2 + \pi \end{cases} \quad (2) \begin{cases} x\alpha + \pi_2 + zn \text{ (} z \text{ even)} \\ x\alpha + zn \text{ (} z \text{ even, } x < 4) \end{cases}$$

do not correspond to any known stable isotope. It should be noted here that $x\alpha + \pi$, $x\alpha + \pi_2 + \pi$ do not agree with the general form $x\alpha + y\pi_2 + zn$; they correspond to exceptions. It may therefore be concluded that they represent nuclei of unstable isotopes. It is easy to see that formulæ (1) lead to a positive electron emission ; the formulæ (2) to a negative electron emission.

The formula for nuclear structure also makes it possible to predict the reactions involved in artificial radioactivation.

The various possible cases are :

(1) $y = 1$, z odd, nuclear formula $x\alpha + \pi_2 + zn$;
(2) $y = 1$, $z = 0$, nuclear formula $x\alpha + \pi_2$;
(3) $y = 0$ nuclear formula $x\alpha + zn$.

In each case, it is easy to investigate the action of the various particles : α-particles, protons, deutons or neutrons ; and always we arrive at a formula of an unstable isotope.

For example, in case (1) the neutrons give :

$$(x\alpha + \pi_2 + zn) + n = x\alpha + \pi_2 + (z + 1)\, n$$
$$\text{or } [(x - 1)\alpha + \pi_2 + (z + 1)n] + \alpha\uparrow$$

two possible reactions which lead to two various periods ($_9F^{19}$, $_{11}Na^{23}$, $_{13}Al^{27}$ . . .).

In case (2), the α-particles give

$$(x\alpha + \pi_2) + \alpha = [(x + 1)\alpha + \pi] + n\uparrow \quad (_3Li^6,\ _5B^{10},\ _7N^{14}).$$

In case (3), the neutrons give

$$(x\alpha + zn) + n = [(x - 1)\alpha + \pi_2 + (z + 2)n] + \pi\uparrow,$$

the resulting nucleus being unstable if z is even or zero ($_{12}Mg^{24}$, $_{14}Si^{28}$, $_{16}S^{32}$, $_{26}Fe^{56}$ . . .).

A full account of the results will appear shortly in the *Annales de la Société scientifique de Bruxelles.*

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Sept. 15.

[1] Walke, *Phil. Mag.*, **17**, 793 ; 1934. **18**, 129 ; 1934.

Ionisation of Gases by Atom Beams

ON the ionisation of gases by particles of atomic mass (ions and atoms) very few results have been obtained hitherto. As regards neutral atoms with moderate energy (less than 1,000 electron-volts), the only available data are those referring to the effective cross-sections for ionisation of argon by argon atoms with 500 and 650 e.v. energy, as determined lately by O. Beeck and H. Wayland[1] ; earlier work by Beeck and by C. J. Brasefield[2] being of a rather qualitative character, and their results uncertain.

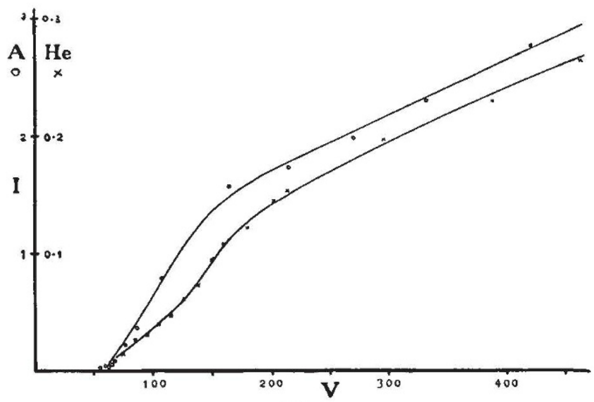

FIG. 1.

I have been able lately to determine the effective cross-sections for ionisation of argon and helium by their own atoms with an energy varying between 50 and 700 e.v. The values are given in the accompanying diagram (Fig. 1). Both curves fall abruptly at small values of the energy, and they both reach the abscissa at a value of nearly 60 e.v. The value of the cross-section for helium is about a tenth of the corresponding values for argon. A full account of the investigation will be published *in extenso* in *Nuovo Cimento*[3].

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[1] O Beeck and H Wayland, *Ann. Phys.*, **19**, 129 ; 1934.
[2] O. Beeck, *Proc. Nat. Acad. Sci.*, **18**, 311 ; 1932. *Z. Phys.*, **76**, 799 ; 1932. C. J. Brasefield, *Phys. Rev.*, **42**, 11 ; 1932. **43**, 785 ; 1933.
[3] See also *La ricerca scientifica*, July–August, 1934.