yield varies rapidly with the energy of the α-particle in a manner dependent on the shape of the potential barrier, which of course is different in these three elements. This variation has been measured in the case of aluminium, and we find that the yield of positrons increases by a factor of 15 as the energy of the α-particle is changed from 5·5 to 7×10^6 volts.

Using thorium C′ α-particles, the measurements have been extended to $8{\cdot}3 \times 10^6$ volts, and the probability of excitation appears to be reaching a maximum here. This is in agreement with the far more detailed results obtained by investigating the protons liberated from aluminium by α-particles. Our results are compatible with the view that an α-particle colliding with an aluminium nucleus has a certain chance of being captured, and that from this arises a phenomenon analogous to radioactive branching, the two alternatives being presumably the immediate emission of either a proton or a neutron. It is the latter emission which produces the radioactive isotope of phosphorus, which emits positrons. The branching ratio appears to be of the order of 50 to 1 in favour of the proton emission.

While we have been able to detect the positrons from aluminium by magnetic focusing, the numbers were not sufficient to give definite measurements of the distribution with velocity, but we detected positrons over the range 1 million to at least 2½ million volts. Measurements of the absorption in copper and aluminium showed as the most significant feature an initial flat portion of the curve. Comparing these curves with those obtained with the same apparatus but using β-particles of thorium (C + C″) leads us to think that there are very few, if any, positrons of low energy. Practically all of the positrons are stopped by 1·2 gm./cm.² of aluminium, which in the case of β-particles would correspond to an energy of about 2½ million volts.

An interesting feature of these absorption curves is that radiation is detectable through several millimetres of lead. Part of this γ-radiation is presumably the radiation arising from the annihilation of the positrons.

A full report of these experiments will be published shortly.

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[1] NATURE, **133**, 201, Feb. 10, 1934.

Inner Conversion in X-Ray Spectra

IN a recent communication[1], Saha and Mukerjie have pointed out that although the transition $L_{\text{II,III}} \rightarrow L_{\text{I}}$ is not forbidden by quantum mechanics, the X-ray spectral line corresponding to it has never been observed, and they have suggested that the failure to obtain such a line can be ascribed to its complete internal conversion in the *M*-shell. Such an explanation would appear, however, to be inconsistent with the conclusions reached by Taylor and Mott[2] in their recent discussion of the nature of the internal conversion process for γ-rays. (Clearly the same considerations will apply to the internal conversion of X-rays.) Briefly, stated in terms of the present problem, the conclusion reached is as follows: the presence of the *M*-electrons increases the number of $L_{\text{III}} \rightarrow L_{\text{I}}$ transitions above that to be expected from a direct calculation of the electric moment corresponding to such a transition, the rate of production of such 'induced transitions' being only slightly less than the rate of ejection of the *M*-electrons, and thus the intensity of the observed X-ray line should be only slightly decreased by the internal conversion.

It is evident, then, that the phenomenon of the internal conversion of X-rays (Auger effect) can have little bearing on the departure of measured X-ray line intensities from those calculated theoretically, and the statement that any radiation is "completely converted" in an inner shell is meaningless.

That the above considerations are in fact important in these problems has become evident from a theoretical investigation one of us (E. H. S. B.) is making of the Auger effect, full details of which will be published in due course. While not yet complete, this investigation is sufficiently advanced to show that, allowing for the presence of induced transitions, the *K*-series internal conversion coefficient (defined as the ratio of the number of Auger electrons to the total number of transitions to the *K*-shell occurring per unit time), is given closely by the expression $(1 + bZ^4)^{-1}$, Z being the atomic number of the element considered, and b a constant characteristic of the particular transition. A relation of this type satisfactorily fits the experimental data (as collected by Martin[3]) on the variation of the internal conversion coefficient with atomic number. If, however, there were no induced transitions, the internal conversion coefficient would be proportional to Z^{-4}, and there would then arise, for elements of low atomic number, the paradox that the number of Auger electrons emitted per unit time exceeds the total number of transitions.

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[1] NATURE, **133**, 377, March 10, 1934.
[2] Taylor and Mott, *Proc. Roy. Soc.*, A, **142**, 215; 1933.
[3] Martin, *Proc. Roy. Soc.*, A, **115**, 420; 1927.

Nuclear Moments of the Antimony Isotopes

Badami[1] first reported the existence of complex fine structures in the visible lines of the Sb II spectrum. As a source he used a relatively high current arc (3–5 amp.), and to explain the structures he suggested that the nuclear spin of the isotope 121 is 5/2 and that of the 123 isotope is 7/2. (These are the only isotopes in antimony.)

I have succeeded in producing a very brilliant Sb II spectrum in a hollow cathode using only one-seventh of an ampere, and as a result the lines are so very much sharper than those in the arc, that the extremely complex patterns encountered are more completely resolved, many lines showing more components than those reported by Badami. The analysis of the line patterns shows without any doubt that the nuclear mechanical spins of both 121 and 123 are 5/2 but that the two isotopes have different nuclear magnetic moments in the ratio 1·36 : 1, the 121 isotope having the larger value. This may be compared with the ratio 1·27 : 1 in gallium, the only other known case which has two isotopes with identical spins (½) and different nuclear magnetic moments.