and reduced pressures, and also in several other gases. A full account of these investigations will be published elsewhere.

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[1] Allibone, *Nature*, **161**, 970 (1948).
[2] Saxe and Meek, Brit. Elect. and Allied Ind. Res. Assoc. Report Ref. L/T.183 (1947); Report Ref. L/T.188 (1947) (completed and revised accounts are in process of issue).
[3] Allibone and Meek, *Proc. Roy. Soc.*, **166**, 97 (1938); **169**, 246 (1938).
[4] Meek and Craggs, *Nature*, **152**, 538 (1943).
[5] Prime and Saxe, *J. Inst. Elect. Eng.* (in the press).

THE object of my recent experiments[1] was to bring out photographically what we have known for many years. With an adequate background of visual observation of spark formation, there is no difficulty in determining in general terms the sequence of occurrence of the different kinds of discharge. As the voltage applied to a point/plane gap is increased, the corona extending therefrom increases (I would not have described the volume of discharge as hemispherical in shape; Fig. 5 in ref. 2 is a very typical shape for such a discharge), and near breakdown the concentrated bright streamers or leader strokes first become obvious extending over part of the gap as described in my communication in *Nature*[1]. The technique of chopping the spark with another spark gap in parallel enables the development of the leader stroke to be followed.

Prof. Meek and Mr. Saxe's technique will be invaluable in providing quantitative data on the corona and leader stroke currents and the light emitted by these discharges; but the facts they describe are well known though not well supported by photographs. The simple Lichtenberg figure technique which I have described gives the best photographic record of the leader stroke developing out of the corona discharge; it might even be more sensitive than the photomultiplier, because Fig. 2 of ref. 2 shows unmistakable evidence of corona one metre ahead of the leader stroke, whereas the multiplier has recorded light emission only 10 cm. ahead of the central core or leader stroke.

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[1] *Nature*, **161**, 970 (1948).
[2] *J. Inst. Elect. Eng.*, **82**, 513 (1928).

Internal Pair Conversion

WHEN a γ-quantum, emitted from the nucleus of a radioactive atom, is absorbed by the same atomic system, an ordinary electron and a positron may be liberated if the energy of the γ-quantum is greater than $2mc^2$. This effect has been calculated by Jaeger and Hulme[1] on the assumption that the γ-ray is electric dipole or quadrupole radiation. I have performed the corresponding calculation for the magnetic dipole radiation and the element $Z = 84$. In calculating the coefficient, Dirac's exact wave equation of the electron is used and the process is interpreted as the transition of an ordinary electron from a negative energy to a positive energy state. The results are given in the accompanying table, where the energies are expressed in units of mc^2 and N is the number of positrons (which is, of course, equal to the number of the pairs created) per unit energy range.

Energy distribution of the electron pairs

$h\nu = 2{\cdot}62$ MeV.	$\frac{E_+ - 1}{h\nu - 2}$	0·159	0·383	0·612	0·840
	$N(h\nu - 2)10^4$	7·10	9·70	14·9	26·2
$h\nu = 8{\cdot}00$ MeV.	$\frac{E_+ - 1}{h\nu - 2}$	0·073	0·366	0·635	0·926
	$N(h\nu - 2)10^4$	31·3	48·8	77·6	58·7

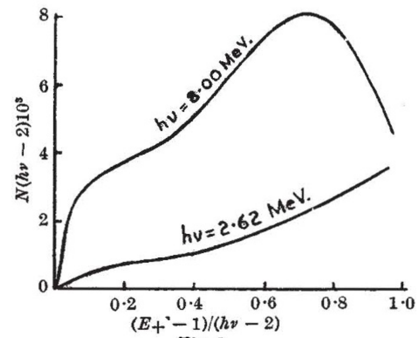

Fig. 1

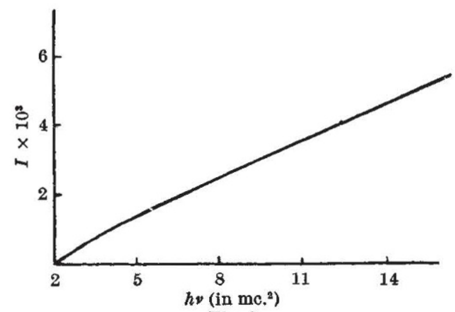

Fig. 2

In Fig. 1, $N(h\nu - 2)$ is plotted against $(E_+ - 1)/(h\nu - 2)$. The marked difference in the average energy of the electrons and positrons is due to the Coulomb forces acting on the two particles. Moreover, the curve, for $h\nu = 8{\cdot}00$ MeV., shows a maximum near the highest positron energy, as would be expected. By integrating over these curves, the coefficients of the internal pair conversion of the γ-rays are deduced. The results are:

$$I = 1{\cdot}5 \times 10^{-3} \text{ for } h\nu = 2{\cdot}62 \text{ MeV.},$$
$$\text{and } I = 5{\cdot}6 \times 10^{-3} \text{ for } h\nu = 8{\cdot}00 \text{ MeV.}$$

If we plot I against $h\nu$ (Fig. 2), it is found that a straight line connecting these two points nearly passes through the point ($I = 0$, $h\nu = 2mc^2$).

In conclusion, I want to express my gratitude to Mrs. B. Jeffreys and Dr. N. Kemmer for their valuable discussions.

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June 22.

[1] *Proc. Roy. Soc.*, A, **148**, 708 (1935).