A CASE WHERE CURRENT AND VOLTAGE IN RAREFIED GAS ARE OF OPPOSITE DIRECTIONS

By **T. Suetin** and **E. Polenova**

All-Union Electrotechnical Institute

(Received November 20, 1946)

In investigating the proper electrical oscillations in a low-pressure arc discharge a new phenomenon has been discovered. The experiments were carried out with discharge tubes with a small-sized tungsten anode 3 mm in diameter and 5—7 mm long. Two types of cathodes were used: one being oxide-coated, the other a mercury pool. In all the tests the discharge tubes were filled with mercury vapour.

If such a discharge tube is connected to an aperiodic circuit, there can arise in it intensive electrical oscillations with a frequency of the order of $5 \cdot 10^4$ cycles. The amplitude of the voltage oscillations may be as high as several tens of volts. However, with an external circuit of this kind the phase of the oscillations is not sufficiently stable.

Insertion of reactive resistances into the discharge circuit enables to increase further the amplitude of current and voltage oscillations, to vary the frequency and to enhance greatly their stability.

In a circuit comprising a current source, resistor and discharge tube shunted by a capacitor, under certain conditions, the following phenomena are observable. The voltage and current oscillations increase in amplitude with rising mean value of current I. As current I rises the voltage minimum ($U_{\min}$) approaches zero, and the maximum value ($U_{\max}$) approaches the full voltage supplied by the battery. At a certain value of I, $U_{\min}$ reaches zero without the current being interrupted. And at last, with further rise of I, $U_{\min}$ becomes negative although the current continues to flow in the former direction and attains a magnitude of several amperes. Thus at these instants of time the current direction is opposite to the voltage direction. This phenomenon lasts for several microseconds. At times the appearance of negative voltage is attended by oscillations of a higher frequency of the order of 10^6 cycles.

Under such conditions the dynamic volt-ampere characteristic disposes in the first and fourth quadrants of the coordinate plane and can be of a highly uncommon shape.

That a negative voltage appears on the tube anode has been established, besides the cathode-ray oscillograph, by several other methods, for instance, by means of a galvanometer and of a kenotron rectifier tube; the latter was connected in parallel to the discharge tube but in opposite direction. Thus the passage of current through the rectifier tube was the evidence of the fact that a negative voltage has appeared across the discharge tube.

A more detailed description of the experiments will be published in this journal later on.

INTERNAL CONVERSION OF MAGNETIC MULTIPOLE RADIATION

By **V. Berestetzky**

(ERRATUM)

(Received December 1, 1946)

In my paper, recently published in this journal[1] I have calculated the coefficient of magnetic conversion of magnetic multipole radiation by the K an L shells electrons. In the calculation of conversion for the L_{II} and L_{III} shells I have made an error. As a result formulae (23), (25), (26) and accompanying remarks are incorrect.

Both kinds of transitions into the states $j=l+{}^1/_2$ and $j=l-{}^1/_2$ are possible from the L_{II} and L_{III} shells, and formulae (23) and (26) should be

$$\left({}^1/_2,\ 1,\ {}^1/_2\,|\,\mathbf{A}\nabla\,|\,l+{}^1/_2,\ l,\ {}^1/_2\right) = -\sqrt{\frac{2l}{3(2l+1)}}\,(1,\ 1\,|\,\mathbf{A}\nabla\,|\,l,\ 1),$$

$$\left({}^1/_2,\ 1,\ {}^1/_2\,|\,\mathbf{A}\nabla\,|\,l-{}^1/_2,\ l,\ {}^1/_2\right) = \sqrt{\frac{2(l+1)}{3(2l+1)}}\,(1,\ 1\,|\,\mathbf{A}\nabla\,|\,l,\ 1),$$

$$\left({}^3/_2,\ 1,\ {}^1/_2\,|\,\mathbf{A}\nabla\,|\,l+{}^1/_2,\ l,\ {}^1/_2\right) = \sqrt{\frac{l}{3(2l+1)}}\,(1,\ 1\,|\,\mathbf{A}\nabla\,|\,l,\ 1),$$

$$\left({}^3/_2,\ 1,\ {}^1/_2\,|\,\mathbf{A}\nabla\,|\,l-{}^1/_2,\ l,\ {}^1/_2\right) = -\sqrt{\frac{l+1}{3(2l+1)}}\,(1,\ 1\,|\,\mathbf{A}\nabla\,|\,l,\ 1),$$

$$\left({}^3/_2,\ 1,\ {}^3/_2\,|\,\mathbf{A}\nabla\,|\,l+{}^1/_2,\ l,\ {}^3/_2\right) = \sqrt{\frac{l+2}{2l+1}}\,(1,\ 1\,|\,\mathbf{A}\nabla\,|\,l,\ 1),$$

$$\left({}^3/_2,\ 1,\ {}^3/_2\,|\,\mathbf{A}\nabla\,|\,l-{}^1/_2,\ l,\ {}^3/_2\right) = \sqrt{\frac{l-1}{2l+1}}\,(1,\ 1\,|\,\mathbf{A}\nabla\,|\,l,\ 1).$$

Then the interference terms (spin and orbital interactions) in (30) are cancelled when summation over all states of the L shell is performed and the correct formula for the conversion coefficient for L shell is

$$\left(\frac{N_L}{N_\gamma}\right)^{(l)}_{\text{magn}} = \pi^2 \frac{e^2}{\hbar c}\left(\frac{\hbar\omega}{2mc^2}\right)^2 \hbar\omega \left\{ \frac{l}{2l+1}\,|J_0(l+1,\ l+1)|^2 + \frac{l+1}{2l+1}\,|J_0(l-1,\ l-1)|^2 + \right.$$
$$+\left[\frac{3l(l+1)}{(2l+1)(2l+3)} + \frac{12}{(2l+1)^2}\right]|J_1(l,\ l+1)|^2 + \frac{3l(l+1)}{(2l+1)(2l-1)}\,|J_1(l,\ l-1)|^2 +$$
$$\left. + \frac{3(l+2)l}{(2l+1)(2l+3)}\,|J_1(l+2,\ l+1)|^2 + \frac{3(l+1)(l-1)}{(2l+1)(2l-1)}\,|J_1(l-2),\ l-1)|^2 \right\}.$$

1 V. Berestetzky, Journ. of Phys., 10, 137 (1946).