

CHARACTERISTIC SOFT X-RAYS FROM ARCS IN GASES AND VAPORS.⁵By **F. L. Mohler and Paul D. Foote.**

[ABSTRACT.]

IF an electron current is maintained by a potential V between a hot cathode and anode in a vapor at low pressure, then as V is increased successive changes occur in the spectrum excited by electron impact. The highest frequency ν of each additional group of lines is related to the least potential required to excite the group by the quantum equation $Ve = h\nu$ or V (in volts) = $\frac{12345}{\lambda \text{ (in } \text{Å})}$.

The authors have studied the stages in the discharge by measuring the photo-electric effect of the radiation on two other electrodes entirely shielded from ions produced in the arc. This photo-electric current plotted as a function of the exciting voltage shows nearly a linear relation with changes of slope at critical potentials. In this manner potentials have been found which are determined by the limiting frequency of the softest X-ray series of a number of elements.

The table gives the observed potentials, and the corresponding wave-lengths for these X-rays. Carbon was studied in the compounds CO , CO_2 , C_2H_4 , and CCl_4 . The latter compound also gave the chlorine points. The nitrogen point was obtained from air and the other points from the various elements at temperatures giving suitable vapor pressures.

The limits L_a of the L series for light elements, computed from X-ray spectral data by the relation $L_a = K_a - K_a$, are included in Table I. A plot of $\sqrt{1/\lambda}$ against atomic number shows that both the observed (column a) and computed points from magnesium to chlorine fall on the same straight line within the probable observational error. The points "b" for these elements lie on a nearly parallel line. They indicate a new X-ray series of feeble intensity. The value of L_a for sodium falls above the extrapolated straight line but is consistent with Millikan's recent observation of the L_a lines as $\lambda = 372$, and 376 \AA . The K limits found for carbon, nitrogen and oxygen fall close to the extrapolated

⁵ Scientific Papers, No. 425.

Ka line. Theories of atomic structure indicate that the potassium points must be ascribed to M series excitation.

Experiments with radiation from solids indicate the existence of soft characteristic X-radiation with no measurable general radiation under the best vacuum conditions. Nickel shows radiation starting at 80 volts. Experimental difficulties make the results obtained from solids less convincing than those from gases.

TABLE I.
Soft X-rays from Low Voltage Arcs.

Element	Observed Potentials in volts		λ in A		Computed λ L α	Remarks
	a	b	a	b		
Sodium.....	35.	17.	353.	726.	.....	.....
Magnesium....	46.	33.	268.	374.	263.	.....
Phosphorus....	126.	95.	98.0	130.	92.2	.....
Sulphur.....	152.	122.	81.2	101.	77.2	.....
Ohlorine.....	198.	157.	62.3	78.6	61.9	.....
Carbon.....	272.	.....	45.4	.....	.....	.....
Nitrogen.....	374.	.....	33.0	.....	.....	} K series limits
Oxygen.....	478.	.....	25.8	.....	.....
Potassium.....	23.	19.	536.	650.	.....	} M series limits

THE MATHEMATICAL THEORY OF THE INDUCED VOLTAGE IN THE HIGH TENSION MAGNETO.⁶

By F. B. Silsbee.

[ABSTRACT.]

THE high tension magneto is an exceedingly complex electrical system, and any attempt to treat the phenomena on a mathematical basis necessarily involves numerous assumptions. The present paper considers only the short but very important period in the cycle of operations in the magneto between the moment of interruption of the primary current and the moment when the spark gap breaks down. During this period the magnetic energy stored in the primary inductance is in part transferred to electrostatic form and charges the primary and secondary capacities. Three different types of simplified electrical models are described, each of which serves to take account of certain of the characteristics of the complete device.

⁶Scientific Papers, No. 424.