involved, we found new bands originating from the combination of Curtis's terms with the vibrational quantum number one and two, and could thus extend the results of Weizel and Füchtbauer. For the transition $2s - 3p$, *e.g.*, the following bands are now known $0 \longrightarrow 0$ ($\lambda 465\ m\mu$); $0 \longrightarrow 1$ (505); $1 \longrightarrow 1$ (467); $1 \longrightarrow 0$ (432); $1 \longrightarrow 2$ (505); $2 \longrightarrow 2$ (468). Of these, 465 is the main band analysed by Curtis, 505 and half of 467 were found by Weizel and Füchtbauer. Evidence was found that the discrepancy between the zero lines of the $p - R$ and the Q-branches found by Curtis is due to the slightly different vibrational frequencies of the p_a and p_b terms (especially well marked in the $2p - 3d$, $1 \longrightarrow 1$ band for the $3d_a$ and $3d_b$ terms). If it can be postulated—as theoretical considerations and the results obtained from other band spectra make probable—that the a- and b-states are exactly coincident for the vibration- and rotationless molecule, this discrepancy can be regarded as another experimental proof for the half-integer values of the vibrational quantum number.

In another note we hope to discuss the theoretical significance of the new levels. Details about the work can be found in a series of forthcoming articles in the *Zeit. f. Physik* and the Scientific Papers of the Institute of Physical and Chemical Research, Tokyo.

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New Type of Discharge in Neon Tubes.

IT was found some years ago by one of us (J. W. R.) that if a condenser of the order of a microfarad capacity was discharged through a tube containing neon at a pressure of about 10 mm. with an adjustable resistance in series, then when the resistance was reduced below a certain value there was a marked change in the character of the discharge, distinguishing clearly the new type of discharge from others obtainable in such tubes.

Further study now makes possible a brief statement of the general properties of discharges of this type.

The appearance of the tube during the passage of the heavy current discharge is quite different from that for the normal neon glow discharge, which in the tubes used amounted to a few milliamperes only. The heavy current was marked by a small bright spot or scintillation of bluish light at a single point on the surface of the cathode. In this neighbourhood the nickel spectrum could be seen. The spot was almost always either on the weld between the cathode disc and its supporting wire or on the square-cut edge of the disc. When the discharge passed a sharp click could usually be heard. Occasionally, instead of the bright spot, there was a violet flash between the electrodes, and the current recorded was about one-half the expected value. Conspicuous fluorescence of the glass usually occurred.

That some special conditions at the electrodes are necessary is shown by the fact that in some tubes when one of the two apparently similar electrodes is made cathode heavy currents are obtained, whereas with the other as cathode they are not.

It was found that the value of the current depends chiefly on the circuit conditions external to the tube, particularly the resistance and the condenser voltage. Currents of various magnitudes between 100 amp. and 1·6 amp. were measured and were found to repeat fairly well for successive discharges under any given set of conditions.

A point of clear distinction between this and the glow discharge is that a change in the area of the electrodes (over a range of at least 10 to 1) did not affect the value of the current.

The voltage across the tube at the moment of maximum current falls to a low value, about 20 volts for the smallest currents, rising to a constant value of 60 volts for all currents above 20 amperes.

After the discharge is over, the condenser is usually found to have some charge still remaining, the voltages varying from zero up to about 90 v.; with a normal neon glow discharge this voltage would be about 130 v. Where there is no resistance in circuit the final voltage is sometimes of the opposite sign to that of the original charging, indicating that the discharge was oscillatory. For this to occur in the circuit used, the effective resistance of the discharge could not have exceeded one or two ohms.

A further characteristic property of the discharge should be mentioned. If the capacity of the condenser or alternatively the charging voltage is sufficiently low, a heavy current is not obtained every time the condenser is discharged; indeed, there is a regular relation between the value of the capacity and the probability of a heavy current discharge.

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Disappearance and Reversal of the Kerr Effect.

A BEAUTIFUL confirmation of recent theories of the electric birefringence in liquids (C. V. Raman and K. S. Krishnan, *Phil. Mag.*, April 1927) is furnished by observations of the phenomenon in electric fields oscillating with radio-frequency such as may readily be obtained with thermionic valves. The Kerr effect arises from the orienting action of the field on the molecules, and the time taken by the latter to adjust themselves to a state of statistical equilibrium has naturally to be taken into account. It may be pointed out here that the orienting couple acting on the *permanent* electric moment of the molecule (assumed to be chemically polar) stands on a different footing from the couple acting on the oscillating *induced* moment in it. The couple acting on the permanent moment is purely periodic, and its effect must tend to disappear at sufficiently high frequencies. The couple on the induced moment, on the other hand, has a quasi-static part and tends to persist even at optical frequencies.

The Kerr effect expressly due to the polarity of the molecule must thus disappear at high frequencies, while the non-polar part will continue. In certain polar liquids, for example, chloroform or the higher alcohols, the Kerr effect is negative and may be considered as the resultant of a *negative polar*, and a *positive non-polar* Kerr effect. In all such cases we should expect the Kerr effect to *diminish and vanish as the frequency is increased*, and then to *reappear* at still higher frequencies.

Observations with octyl alcohol made by us confirm this remarkable prediction, the Kerr effect disappearing at 32 metres frequency and reappearing at still shorter wave-lengths. Cooling the liquid with a freezing mixture shifts the frequency of disappearance and reversal to longer wave-lengths, as might be expected.

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