from a small glass nozzle by a rotating siren disk and then allowing these puffs to enter a glass tube, one end of which was corked and in which pith dust was distributed along the bottom. These striae were formed when the air jet was interrupted too slowly to produce an audible tone.

The author is continuing his investigation of these striae photographically and is making an effort to determine the effects produced by forming them in various gases and in tubes of various diameters and lengths, and when produced by sources of various frequencies.

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August 12, 1930.

Intensity Changes of Cameron Bands in the Electrodeless Discharge

The band spectra of carbon monoxide obtained in the electrodeless ring discharge have been photographed by the writers under various conditions in order to determine to what extent this source permits controlled excitation, or modification of relative intensities of different band systems. Pronounced intensity changes have been observed, and of these the variations of the Cameron bands are most striking.

The Cameron bands (Phil. Mag. **1**, 405, 1926) were discovered in a discharge tube containing neon and a little CO. They involve transitions from the $^3\Pi$ state which is somewhat metastable, to the $^1\Sigma$ or normal electronic state of the molecule, and are not easy to obtain in emission, although Hopfield and Birge (Phys. Rev. **29**, 922, 1927) without giving details, report finding them in both emission and absorption. Since the initial state has a long life, the bands would be expected to appear only at relatively low pressures, because of the longer interval between impacts. This led Herzberg (Zeits. f. Physik **52**, 815, 1928) to look for them in his careful study of the CO spectra obtained in the electrodeless ring discharge maintained by a damped wave oscillator. Although he kept the gas at quite low pressures, the Cameron bands were not present on his plates.

The oscillator used in the present work is tube driven, with a frequency of about five millions cycles, and a power input variable from about five to one hundred watts. With low power input, the Cameron bands were entirely missing; with increased power they began to appear, and with the highest input they were well developed, with about the same intensity on a microphotometer record as the bands of the fourth positive group lying near them. The exposure in the last case was for 20 minutes, and the pressure was 0.09 mm. Herzberg's excitation apparently is comparable to that of our oscillator with low power input.

Another effect of the high power input was to produce a rise in pressure, in contrast to the decrease or "clean up" obtained with low power. The increase was as much as five fold, far more than could be explained by the rise in temperature. Since there is considerable carbon deposited in the vessel, a release of adsorbed gas from this finely divided carbon, caused by the rise in temperature, must probably be held responsible for the pressure increase.

A quartz spectrograph of low dispersion has been used in searching for intensity changes; since it was proved that the relative intensities of bands can be varied in the electrodeless discharge, it is planned to continue this work with higher dispersion.

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August 29, 1930.

On the Direction of Emission of Photoelectrons from Potassium Vapor by Ultraviolet Light

The wave mechanics (A. Sommerfeld, Atombau und Spektrallinien, Wellenmechanisches Ergänzungsband, p. 213) predicts that the most probable direction of ejection of photoelectrons by polarized light is in the plane of the light beam and the electric vector, the lateral distribution varying as the square of the cosine of the azimuth angle. This has been most satisfactorily shown to be true for light of x-ray frequencies by the well-known experimental work of several investigators.

We have been concerned with examining the same phenomenon in the optical region. Ultraviolet light of wave-length in the region of 2400A from a monochromator was polarized by a pile of quartz plates and passed through a jet of potassium vapor. A cylindrical grid provided a field-free space in the region of the illuminated vapor so that electrons passed out of the grid in the original directions of ejection by the light. A slit and faraday cylinder arrangement served for the measurement of the number of photoelectrons ejected in various directions relative to the electric vector of the exciting light. Though the energies of ejection were less than one volt-electron, the experiments have clearly shown that the optimum direction is that of the electric vector. Approximately twice as many electrons were observed to be ejected in the direction of the electric vector as at right angles thereto. It seems probable that the electrons observed as ejected at right angles to the electric vector were scattered by the vapor. Correcting for this scattering the observed variation with angle of ejection follows the cosine squared law deduced by Sommerfeld on the basis of the wave mechanics.

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September 8, 1930.

Electrostatic Surface Fields near Thoriated Tungsten Filaments by a Photoelectric Method

The electrostatic fields acting on electrons emitted from a thoriated tungsten filament[1] were studied by the photo-electric method described in a paper by E. O. Lawrence and the writer.[2] The cell was essentially the same as that used in the previous work. In the absence of potassium, a calcium deposit in a side tube immersed in liquid air was used as a getter.

The applied accelerating fields varied from 360 volts/cm, with a corresponding threshold at 4900A (6.1×10^{14} sec^{-1}), to 48,200 volts/cm, with a corresponding threshold at 5500A (5.5×10^{14} sec^{-1}). The apparent reduction in the work function by the increased field was 0.25 volt. This reduction is much larger than was produced by corresponding fields on potassium films, or the reduction which would occur if the Schottky (image force) law held. In the latter case the reduction would be 0.08 volts.

When the fields are calculated, as in the previous work, they are found to approximate the Schottky fields at distances less than 1.5×10^{-6} cm. At 10^{-5} cm from the surface there is a field of about 6000 volts/cm, and at 8×10^{-5} cm from the surface, a field of about 1000 volts/cm. The image fields at these distances are 350 volts/cm and 6 volts/cm respectively. The observed fields are very nearly the same as those Becker and Mueller[3] calculated for 70% thoriated tungsten from thermionic data. The agreement between the two independant methods of determining the fields is striking, and shows that sufficiently large fields are present near thoriated filaments to cause the noted deviations from Schottky's thermionic emission equation.

The hypothesis that the thorium ions exist on the surface in patches[4] which are electropositive with respect to the tungsten, appears best to explain the fields. Electrons emitted through these patches would not only be retarded by the image field, but also by the field between the patches and the ions. A uniform charge distribution on the surface could not cause the observed fields.

The writer intends to continue the studies under different methods of activation before making a detailed report of the work.

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September 9, 1930.

[1] A 4.4 mil thoriated tungsten filament (T122×10) kindly furnished by the Bell Telephone Laboratories, New York.

[2] Lawrence and Linford, Phys. Rev. **36**, 482 (1930).

[3] Becker and Mueller, Phys. Rev. **31**, 431 (1928).

[4] Reference 12 of the paper by Lawrence and Linford lists several articles on the theory of patches.