The Mechanism of Formation of the Latent Photographic Image.

It is with great interest that I see in NATURE of Sept. 24, p. 441, Dr. Toy's letter with regard to the part played by the photo-electric conduction effect in the formation of the latent image on silver halide.

At the Detroit meeting of the American Chemical Society on Sept. 10 last I read a paper in which I presented a tentative picture of a mechanism for the formation of the latent image based on the known facts of silver halide and silver sulphide. An earlier paper on the same subject will appear in the November number of the *Journal of the Franklin Institute*.

E. P. Wightman and R. F. Quirk, at the American Chemical Society meeting in Sept. 1926, stated in their second paper on "Intensification of the Latent Image on Photographic Plates and Films," that they believed that the sensitivity spots on silver halide grains contain some silver in addition to the silver sulphide. W. Clark independently, in his experiments on the action of oxidisers on the sensitivity and latent image, supports this view of Wightman and Quirk. He concludes: "It appears, then, that the results obtained could be explained on the view that silver sulfide is present in the sensitivity substance provided it is postulated that there is also present something—say, silver—which is attackable by oxidisers of potentials too low to attack silver sulfide."

Assuming that the explanations of Wightman, Quirk, and Clark are correct, we have in our high sensitivity photographic materials to deal with the system:

silver | silver halide | silver sulphide
in which silver and silver sulphide are in contact with each other. This system represents a photo-electric cell of the Becquerel type, in which silver is the cathode, silver sulphide is the anode, and silver halide is the solid electrolyte.

In light, the potential difference between the electrodes increases, the conductivity of the silver halide increases (*i.e.* photo-conductivity), and an electric current flows around in this closed system. The result will be an electrolysis of the silver halide, the cations moving towards the cathode (concentration speck theory; coagulation theory of the latent image), the anions losing their charge and staying in the crystal substance (Tubandt).

The photo-electric action according to the old theory (Fajans) was

The halogen ion loses an electron, which moves towards the silver ion, thus discharging the silver cation. According to the above proposed theory, the electron from the halogen anion liberated by the light absorption moves towards the silver sulphide anode, then goes to the cathode; at the same time, the

silver cation moves towards the cathode and is there discharged by the electron from the halogen anion. If the silver speck has grown to a certain size, developability is introduced.

This picture of the formation of the latent image also takes into account the failure of the reciprocity law and the intermittency effect.

One of the difficulties in the photo-electric conduction theory of the latent image has been the wave-length effect, which has now been removed by the valuable work of Dr. Toy. A. P. F. TRIVELLI.

Research Laboratory,
Eastman Kodak Company,
Rochester, N.Y., Oct. 13.

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Some Further Spectral Lines of Trebly-ionised Germanium.

CARROLL (*Phil. Trans. Roy. Soc.*, vol. 225, p. 357) has identified the first members of each of the first principal, sharp, diffuse, and fundamental series of trebly-ionised germanium (Ge IV), which in Hund's notation may be represented by $4S_1 - 4P_{1,2} - 4P_{1,2} - 5S_1$, $4P_{1,2} - 4D_{2,3}$ and $4D_{2,3} - 4F_{3,4}$ respectively. All these lines lie in the Schumann region. Using a condensed spark between metallic electrodes *in vacuo*, the near ultra-violet region has been examined for further spectral lines of Ge IV by means of a concave grating of radius 2 metres arranged on a Rowland mounting.

The first members of the second principal series $5S_1 - 5P_{1,2}$ were easily found at $\lambda\lambda 3554$ and 3676 . A triplet resulting from combinations between $4D_{2,3}$ and $5P_{1,2}$ has also been identified. Taking Carroll's value 178094 for the wave-number of $4D_2$, the $4D_{2,3} - 5P_{1,2}$ triplet yields for $5P_1$ and $5P_2$ the wave-numbers 142242 and 141305 respectively. These terms combining with $4S_1$ would give a doublet, namely, the second member of the first principal series, of wave-number 227396 and 226459. This doublet has been found by Dr. R. J. Lang, to whom I am indebted for the measures of these lines and permission to include them in the table below. The discrepancy between the estimated and measured wave-numbers of these lines is due to a lack of adequately accurate standards in the $\lambda 400$ region.

The measures are given in the following table:

Intensity.	λ Å. air.	ν .	ν .	Term Combination.
8	3676.61	27191.3	} 936.9 {	$5S_1 - 5P_1$
9	3554.14	28128.2		$5S_1 - 5P_2$
5	2788.41	25852.2	} 936.7 {	$4D_2 - 5P_1$
5	2736.09	36537.7		$4D_3 - 5P_2$
1	2717.41	36788.9		$4D_2 - 5P_2$
1	441.95	226270	} 946 {	$4S_1 - 5P_1$
1	440.11	227216		$4S_1 - 5P_2$

STANLEY SMITH.

University of Alberta,
Edmonton, Canada,
Sept. 30.

The 'Green Flash' at Sunrise.

WATCHING the sunrise this morning across the Nile valley, under conditions of very good visibility and no local wind, using Goerz $\times 8$ binoculars, I saw what is, to the best of my knowledge, a novel form of the 'green flash.'

From the top floor of Mena House Hotel the sunrise was behind Gebel Tura, with its skyline at about 300 metres elevation, and some 25 kilometres away. The dawn was clear, a light white mist lying low on the valley floor; the sky was cinnamon colour, changing to amber as the sun rose; the desert hills appeared deep blue to the naked eye, and brownish purple through the field-glasses.

The form of the actual flash was totally unexpected; it preceded the emergence of the limb of the sun itself by perhaps as much as two seconds, and I can only describe it as resembling a shallow and turbulent river of apple-green water hanging ready to break over the hill crest. But this river flowed with a surface which seemed to follow the minor prominences of the skyline, instead of first appearing between them; it appeared suddenly, not seeming to widen