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Emission of New Radiations by Metallic Uranium

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A few months ago, I showed that uranium salts emit radiations whose existence had not ben recognized and that these radiations enjoyed some remarkable properties, some of which are comparable with the properties of the radiation studied by Röntgen.The radiations of the uranium salts are emitted not only when the substances are exposed to light, but even when they are kept in darkness, and for more than two months the same fragments of various salts, shielded from all the exciting radiation known, have continued to emit the new rays, almost without perceptible wakening. From the third of March to the third of May these substances were shut up in a box of opaque cardboard. Since May third they have been placed in a double lead box which never leaves the darkroom. A very simple arrangement allows a photographic plate to slip underneath a black paper stretched parallel with the bottom of the box on which the substances under experiment rest, without these substances being exposed to any radiation which does not penetrate the lead.

Under these conditions the substances studied continue to emit active radiations.

If a fragment of one of the salts kept in darkness is exposed to the sun, or better, to the electric arc or to the spark from the discharge of a Leyden jar, it receives a slight excitation from the emission of the radiations we are studying, but this excitation falls in a few hour, and the substance resumes its state of very slow decrease.

I have also shown that these radiations are reflected and refracted as light is; they decompose the silver salts of a photographic plate and the silver iodide deposited on a daguerrotype plate.

They discharge electrified bodies and penetrate substances opaque to light, such as cardboard, aluminium, copper, and platinum. The weakening of these radiations by screens of the substances we have just mentioned is less than the weakening of the radiation emanating from the anticathode wall of a Crookes tube by the same screens.

All the salts of uranium I have studied, whether phosphorescent or not with respect to light, crystallized, fused, or in solution, have given comparable results.Thus I have been led to think that the effect was due to the presence in these salts of the element uranium, and that the metal would give more intense effects than its compounds would.

A few weeks ago an experiment with a commercial power of uranium which had long been in my laboratory confirmed this prediction; the photographic effect is notably stronger than the impression produced by one of the salts of uranium, and, in particular, by uranium–potassium sulfate.

Before publishing this results, I wanted to wait until our colleague, M. Moissan, whose beautiful investigations on uranium are being published today[1] could put some of the products he had prepared at my disposal. The results were even more clear–cut, and the impressions obtained on a photographic plate through black paper with crystallized uranium, with cast uranium, and with the carbide, were much more intense than with the double sulfate put for comparison on the same plate.

The same difference is found again in the phenomenon of the discharge of electrified bodies. Metallic uranium promotes the dissipation of charge with a greater speed than the salts do. The following numbers, relating to the action of a disc of cast uranium which M. Moissan has obligingly lent me, give an idea of the order of magnitude of this increase.

In a first series of measurements, the disc of cast uranium was placed below and very near the gold leaves of one of Hurmuzescu's electroscopes. For an initial charge corresponding to a 20° separation of the gold leaves, their speed of approach expressed in seconds of angle in a second of time was on the average 486. Next, a disk of cardboard whose surface was very nearly equal to that of the uranium disc was covered with flat pieces of the double uranium–potassium sulfate, and this disc was substituted for the uranium disc. Under these conditions, the discharge did not occur regularly; the curve of the separation of the leaves as a function of time is no longer a straight line, and the mean speed of dissipation of charges equal to the former ones varied from 106.2 to 137.1, following the arrangement and the shape of the lamellas. The ratio of the speeds corresponding to uranium and double sulfate then varied between 4. 56 and 3.54.

A better arrangement consisted in placing the substances outside the

[1][See reference 12. Moissan's paper in printed immediately after Becquerel's. – A.R.]

electroscope, above the copper ball of its stem, substituting for the bonnet of the apparatus a metallic cylinder closed a flat plate in which there was a suitable opening. In this way discharged were obtained which were very perceptibly proportional to the time, and the speeds of loss for charges separating the gold leaves by 10° were 78.75 for the uranium and 21.53 for the uranium–potassium double sulfate. The ratio of these two numbers is 3.65.

Although I am continuing the study of these new phenomena, I thought it was not without interest to point out the emission produced by the uranium, which, I believe, is the first example of a metal exhibiting a phenomenon of the type of an invisible phosphorescence.