These relationships are being used in connection with approximate calculations of potential energies in the interpretation of the observed lengths and electric moments of organic molecules.

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January 29, 1932.

Another New X-ray Non-Diagram Line

In a recent letter to the Editor (Phys. Rev. Feb. 1, 1932) the writer gave values for the wave-lengths of a non-diagram line found in the K spectrum of molybdenum, rhodium, palladium, and silver. The line was provisionally christened β_4 and its possible origin indicated.

The search for faint lines has been continued. Close to β_1 on the short wave-length side another and somewhat fainter line has been found and will be referred to as β_5. The wave-length was determined on a double-crystal spectrometer working in the second order. The International Critical Table values of λ for $\gamma(\beta_2)$ and β_1 were accepted and the wave-length of β_5 found by interpolation. For convenience in determining the probable origin of the new line, its frequency was computed as on page 35, Vol. VI, International Critical Tables. The frequency of the new line was then compared with differences of limiting frequencies of x-ray levels as given in the tables.

The line may be explained as the result of either of two equivalent double transitions, i.e., $(M_{21}\rightarrow K)+(M_{22}\rightarrow M_{11})$ or $(M_{22}\rightarrow K)+(M_{21}\rightarrow M_{11})$. Both demand a double ionization resulting from the simultaneous removal of a K and an M_{11} electron and both demand an improbable transition from one M level to another, but a line less than one one thousandth as intense as β_1 must have something very improbable in its origin.

	$\lambda\beta_5$(X.U.)	$\nu\beta_5$	$(\nu K \lim - \nu M_{21}) + (\nu M_{11} - \nu M_{22})$
Mo	629.46	1448.4	1448.5
Rh	542.87	1679.4	1679.6
Pd	517.84	1760.6	1760.1
Ag	494.27	1844.7	1844.3

Two groups of even fainter lines have been detected. One group lies at the foot of γ on the long wave-length side. The other group lies at the foot of β_2 on the long wave-length side. Each group seems to consist of about five overlapping lines. The present rather uncertain determinations of their wave-lengths indicate that they cannot be explained by any combination of transitions between known x-ray energy levels.

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Note on the New Effect Produced by Action of X-rays on Matter

G. I. Pokrowski[1] reported in this journal the results of a series of experiments to determine what effect x-ray irradiation of metals may have. These experiments seem to show that when elements of high atomic number are irradiated with x-rays, they acquire feeble radioactive properties. Two methods were used to demonstrate this feeble radioactivity; first, the ionization produced by the irradiated samples, and second, the scintillations produced on a screen of zinc blende placed near the irradiated samples. For the first method, the irradiated element was placed in an ionization chamber, and the current was measured with an electroscope. Measurements showed that the ionization produced decreased with the time after the end of x-ray irradiation, but in the case of lead, was measurable 90 minutes after irradiation. A table showing this variation was also given.

An attempt was made by the writer to measure the ionization current produced by metals irradiated with x-rays. The samples were irradiated with 45 kv and with 160 kv x-rays at a distance of about 20 cm from the x-ray tube targets, and for various times. They were then placed in a copper ionization chamber, and the ionization current was measured with a Lindemann electrometer, with a voltage sensitivity of 400 divisions per volt.

[1] G. I. Pokrowski, Phys. Rev. **38**, 925 (1931).

The capacity of the electrometer and chamber was about 12 cm, and the residual ionization in the chamber amounted to about 8.5 ions per cc per second. When a plate of unirradiated lead 12 cm square was placed in the chamber, the electrometer readings were quite irregular, and the total ionization now produced, varied between a maximum of 21.2 ions per cc per second, and a minimum of 17 ions per cc per second. When this same lead was irradiated with 160 kv x-rays for as much as 30 minutes, or with 45 kv x-rays for as much as 45 minutes, the earlier experiments gave a curve of ionization vs. time after irradiation similar to that obtained by Pokrowski, except that the initial ionization was about one half and the slope was steeper. This initial ionization was found to vary considerably, and to be independent of the metal used. However, when improved shielding of the apparatus was provided, no difference whatever could be detected between the ionization produced by unirradiated metals (Pb, Mo, Cu, Al) and that produced by the same metals after irradiation. A particularly troublesome source of heavy ions was traced to the corona produced by other high voltage apparatus in the same room.

If the table that Pokrowski gives records the ionization current in ions per second per square cm of irradiated metal, and not total ionization (which seems probable, but is not definitely stated), then his effect, if it exists, should have been detected easily. In fact, the maximum for lead given by him would have been of the order of 100 times the smallest detectable amount in these experiments. The current measuring device used by Pokrowski is pictured as an electroscope, and, although no mention is made of its current sensitivity, it probably was at least ten times smaller than that of the arrangement used by the writer. Without proper precautions, furthermore, it is possible for very heavy ions to enter the chamber or other sensitive parts of the system, and, according to Hess,[2] may require times of the order of ten minutes to be swept out. It is difficult to explain, however, why Pokrowski should have obtained a relation between the ionization produced, and the atomic number of the metal.

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February 1, 1932.

[2] Hess, Electrical Conductivity of the Atmosphere and Its Causes, D. Van Nostrand Company.