are different regarded as continuous curves though they represent the same point set. Secondly, the continuous surface:

$$\begin{aligned} x &= \sigma \mid \cos u . \sin 2 v \mid, \\ y &= \sin 2u . \cos^2 v, \\ z &= 1 - 2 \cos^2 u . \cos^2 v; \end{aligned} \quad \begin{cases} -\pi/2 \leqq u \leqq +3\pi/2, \ -\pi/2 \leqq v \leqq +\pi/2; \\ \sigma = -1, \text{ if } -\pi/2 \leqq u \leqq +\pi/2, \\ \sigma = +1, \text{ if } +\pi/2 \leqq u \leqq +3\pi/2; \end{cases}$$

is as point set coincident with the sphere

$$x^2 + y^2 + z^2 = 1$$

but as continuous surface it is of the type of the surface

$$x = \cos u . \cos v, \ y = {}^1/_2 \sin 2u . \cos^2 v, \ z = {}^1/_2 \cos u . \sin 2v$$

mentioned above (3).

[1] Fréchet, *Rend. Circ. Mat. Palermo,* **22** (1906), p. 67 et seq.

[2] The idea of such a problem cccurred to Prof. Fréchet by writing a paper (on the "distance" of two surfaces) soon to appear in the "*Ann. Soc. Math Polonaise*". This question was mentioned to me by Prof. Fréchet in a letter of Feb. 20, 1924, to whom I wrote the solution, as given in the text, in a letter of March 5, 1924.

[3] Kerékjártó, *Vorlesungen über Topologie,* **1,** (Berlin, 1923), p. 49.

[4] Kerékjártó, *l. c.,* p. 48, 123.

[5] See, for instance, Kerékjártó, *l. c.,* p. 31.

[6] The possibility of such a representation of G_1 upon a region G_1' follows from the results of Kerékjártó, *l. c.,* p. 48, 123; comp. also p. 165 et seq.

[7] Kerékjártó, *l. c.,* p. 38.

THE WAVE-LENGTH OF MOLYBDENUM Kα RAYS WHEN SCATTERED BY LIGHT ELEMENTS

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A paper by Clark, Stifler and Duane in the April number of these PROCEEDINGS describes measurements of the wave-length of the X-rays from a molybdenum target after they have been scattered by certain substances of low atomic number. The conclusion drawn from these experiments is that no secondary radiation occurs whose wave-length is increased by the amount 0.024 $(1-\cos\theta)$ A. U. predicted by the quantum theory of scattering. They find, on the other hand, evidence for modified secondary radiation whose minimum wave-length is $\lambda\lambda_k/(\lambda_k-\lambda)$, where λ is the wave-length of the incident rays and λ_k is the critical K absorption wave-length of the radiating element. The experiments described in the present paper were undertaken to examine this question in greater detail.

The apparatus used was identical in general design with that employed

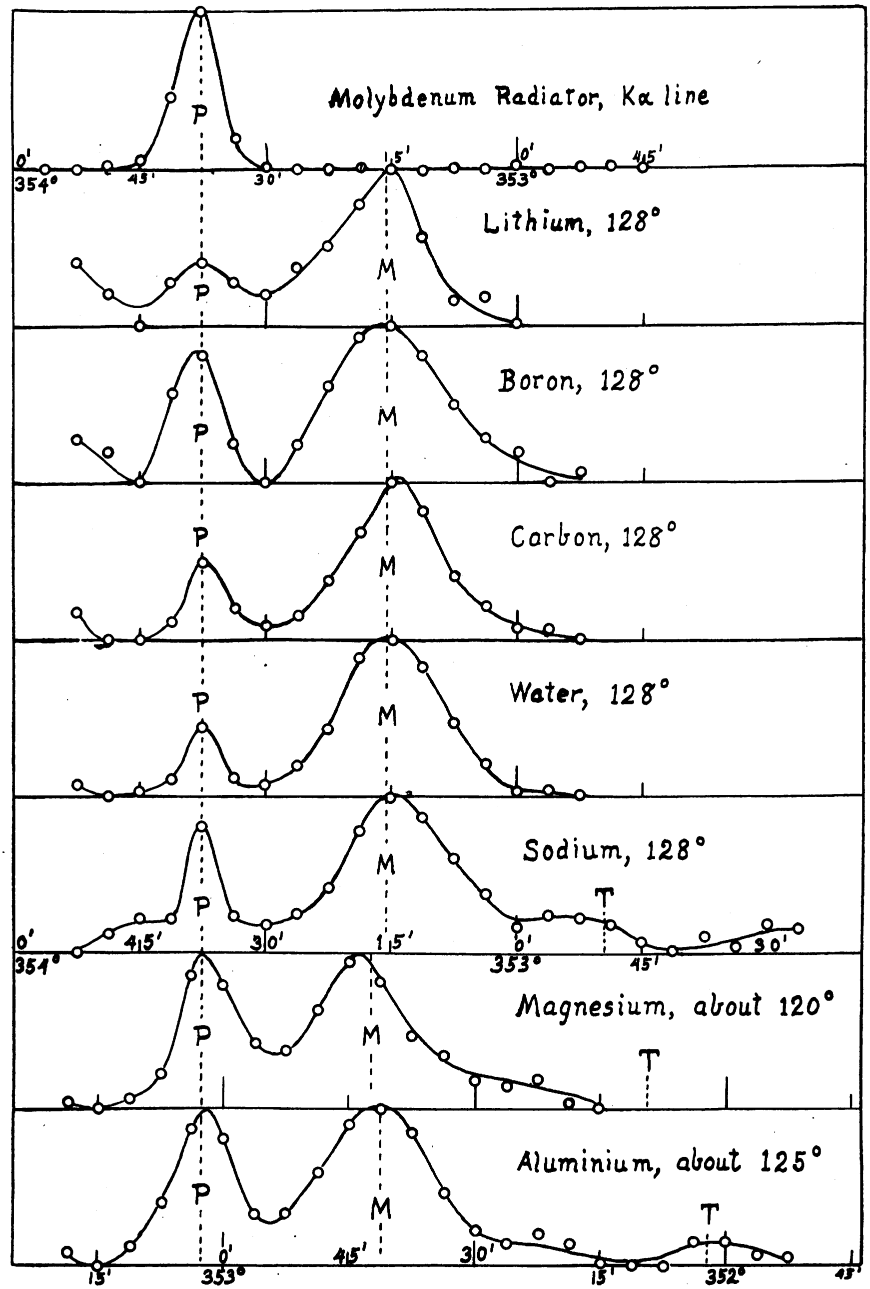

FIGURE 1

Spectra from calcite of the secondary radiation from various elements, traversed by X-rays from a molybdenum target. P marks the position of the primary K_{α} peak, M the theoretical position of the modified peak, and T the peak of the "tertiary radiation" according to Clark, Stifler and Duane's experiments.

by one of the writers for measuring the change of wave-length of X-rays scattered by carbon.[1] In the present work, however, instead of a pair of slits to direct the beam falling on the crystal, a collimator was employed composed of a pile of sheets of lead foil separated by strips of lead foil.[2] This device, due to W. Soller, enabled us to secure greater intensity than in the earlier measurements. The water cooled X-ray tube was operated at about 65 kilovolts peak and 40 milliamperes.

The samples of lithium, carbon and sodium were in the form of cylinders of 8 mm. diameter, and the boron and water were held in a very thin walled, waxed paper cylinder of the same diametei. In order to secure greater intensity, the samples of magnesium and aluminium were in the form of flat plates. These radiators were clamped in turn approximately 2.5 cm. from the focal spot of the X-ray tube, in such a position that they would scatter the rays into the collimating slits at about 125°. A slight surface oxidation of the lithium and sodium occurred during the course of the experiments. The boron used was in the amorphous form, which contains 4 or 5 per cent of oxygen. Our sample also had traces of silica, and the paper container introduced small amounts of carbon and hydrogen. The rays scattered from the water may be considered characteristic of oxygen, with hydrogen and some carbon from the paper container as impurities. The carbon (graphite), magnesium and aluminium presumably had impurities only in relatively small amounts.

The results of our measurements with radiators of molybdenum, lithium, boron, carbon, oxygen (water), sodium, magnesium and aluminium are shown in figure 1. The spectra from the first six radiators were taken without changing the adjustments. For the last two elements, the width of the slits of the diaphragm was increased from 0.1 to 0.2 mm. in order to secure greater intensity. The readjustment resulted in an altered zero point, as is indicated in the figure.

The important point in this figure is that the spectra obtained from the various elements are almost identical in character. In every case an unmodified line P occurs at the same position as the fluorescent Mo Kα line, and there is a modified line whose peak is within experimental error at the position M, calculated from the quantum change of wave-length formula given above. There is also perhaps some evidence in the cases of sodium and aluminium for a hump at the position T, where according to the experiments of Clark, Stifler and Duane the peak of the line due to "tertiary radiation" should appear.

In view of the consistency of the results for the different elements, we feel that these experiments show beyond question the reality of the spectrum shift predicted by the quantum theory of scattering.

[1] A. H. Compton, *Physic. Rev.*, **22**, 409 (1923).

[2] *Cf.* W. Soller, *Ibid.*, **23**, 292 (1924).