The polarization of the general radiation from an x-ray tube has been studied by several experimenters. In general it has been found that the shorter wave-lengths of the general radiation are more strongly polarized than the longer wave-lengths. As the cathode ray velocity is increased the polarization is however decreased. Experiments by Barkla and others on fluorescent radiation have indicated that the characteristic radiation is unpolarized. Bishop, using a unique scheme of filtering the radiation from a molybdenum target x-ray tube, has made a series of measurements of the polarization of the molybdenum Kα radiation. In all his measurements he has found a partial polarization of this radiation. If this is a true effect it constitutes the most fundamental difference between the characteristic radiation from an element used as anticathode and the fluorescent rays from the same element. Since a large part of the characteristic radiation from a tube is fluorescent it would indicate that the characteristic radiation directly excited must be very strongly polarized.

The importance of knowing the exact magnitude of the polarization of the characteristic x-rays seems to warrant a repetition of Bishop's experiment with filtered x-rays, but under more favorable conditions. It has also been found possible to make accurate polarization measurements using a monochromatic (Kα line reflected from a calcite crystal) beam of x-rays, thereby eliminating the uncertainty of the effect due to the general radiation.

The apparatus used in the first part of this experiment is shown in figure 1. X-rays from a water-cooled molybdenum tube, placed directly above the Bragg spectrometer and in a nearly horizontal position, were collimated by slits S1 and S2 about 0.5 mm. in diameter. Between the slits was placed a double filter system F1F2 on a slide F. The filter F1 was made of strontium oxide and F2 of zirconium oxide. The filters were matched by Barrett very precisely according to the method suggested by Ross. The intensity of the Kα line is about 85 to 90% of the total intensity transmitted by the system. The beam fell vertically on a graphite block G 1/8" thick and 2" in diameter placed at the center of the Bragg Spectrometer. The block was placed at an angle of 45° to the x-ray beam, and facing the window of the ionization chamber. The chamber was filled with methyl bromide, and the ionization current measured by a sensitive Compton electrometer. A is a screen for protecting the ionization cham-
ber from stray radiation. The tube was operated at about 50 kv. and 1 to 40 ma.

In taking the readings the ionization chamber was first placed in position $I_1$ (parallel to the cathode rays). The intensity of the rays scattered by the graphite block was measured for each filter $F_1$ and $F_2$. The chamber and scatterer were then moved to position $I_\perp$ (perpendicular to the cathode rays, not shown in the figures) and similar measurements taken. Likewise for position $I_3$ (parallel to cathode rays). The difference of the intensity $F_2 - F_1$ for each setting of the ionization chamber gave the scattering due to the $K\alpha$ radiation of molybdenum plus about 10 or 15% general radia-

![Diagram of apparatus.](image)

In order to test the geometric symmetry of the apparatus the following method was used. A fluorescent radiator of strontium oxide was put in place of the graphite scattering block $G$. The excitation of fluorescent radiation not being influenced by the polarization of the primary rays one would get the same intensity for the three positions of the ionization chamber as used above. Measurements taken with and without the filters gave very precisely

$$\frac{I_\perp}{I_\parallel} = 1.000,$$
showing that there was no lack of symmetry in the apparatus. The results thus indicate a polarization of the rays which is greater than the experimental error. At least a part of the polarization can however be ascribed to the general radiation which was present with the molybdenum \( K\alpha \) radiation.

A further test was made by arranging the apparatus as shown in figure 2. A calcite crystal was put in place of the filters \( F_1F_2 \) and the target of the x-ray tube adjusted so that the crystal reflected the molybdenum \( K\alpha \) line vertically down to the center of the spectrometer. Slit \( S_1 \) was 2 mm. wide and \( S_2 \) was 0.5 mm. by 10 mm. The radiation fell on the graphite block \( G \) as before. The block was rotated with the ionization chamber so that the same amount of the graphite was scattering in each position and the distance traversed by the rays was the same in the three positions. The opening in the ionization chamber was about 20 mm. in diameter and about 15.75 cm. from the center of the scattering block. The average of 48 sets of measurements gave

\[
\frac{I_\perp}{I_\parallel} = 0.984 \pm 0.003.
\]

Another series of measurements using a strontium oxide fluorescent radiator as above gave

\[
\frac{I_\perp}{I_\parallel} = 1.021 \pm 0.002.
\]

Combining this correction with the measured ratio one gets the true ratio

\[
\frac{I_\perp}{I_\parallel} = 0.965.
\]

The intensity in this case is greater in the direction of the cathode rays. If the x-rays were unpolarized the ratio should be \( \frac{I_\perp}{I_\parallel} = 0.972 \) due to polarization introduced by the crystal. Correcting the observed ratio for the polarization introduced by the crystal one gets

\[
\frac{I_\perp}{I_\parallel} = 0.993 \pm 0.004.
\]

The difference between this value and 1, which it should be for unpolarized x-rays, is within the experimental error.

In the case of the filtered radiation there appears to be a slight polarization of the characteristic radiation but much smaller than the value found by Bishop. In the more direct method using a crystal for separating out the \( K\alpha \) radiation there is no indication of any polarization of the characteristic radiation.
PHYSICS: C. BARUS

Kirkpatrick's method of using crystal reflection to measure the polarization is not as satisfactory as the present method because the intensity reflected by a crystal depends so greatly on the geometric symmetry of the apparatus. By using two reflecting crystals, as is used in absolute intensity measurements, a more accurate determination might be made than with a single crystal. It seems however that the results obtained by the more direct method used by the writer should be more reliable than those obtained by either of these methods.

My results thus indicate that the characteristic radiation from an x-ray tube is probably unpolarized. This result is in good accord with the ordinary ideas of x-ray production, and also with the recent results on the polarization of fluorescent radiation by Compton. The criticism of Kirkpatrick that the polarization factor in the formula for the intensity of x-ray reflection has not been used correctly by many writers accordingly applies only to discussions in which the general radiation from an x-ray tube was used.

4. A. H. Compton, elsewhere in these PROCEEDINGS.

THE REPULSION BETWEEN ELECTRIC CURRENTS AND THEIR INDUCED EDDY CURRENTS IN PARALLEL

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1. Apparatus.—The interferometer U-gage, with its two flat cylindrical pools of mercury seemed to lend itself well for measurements in relation to Elihu Thomson's phenomena and I, therefore, tested an apparatus (Fig. 1) for this purpose. Here \( U \) is the mercury in one shank of the gage, about 10 cm. diam. and 1 cm. deep, with a thin cover glass \( g \) in the block of iron \( B \). \( C \) is an annular coil, 8 cm. external, 4 cm. in internal diameter, and 3.5 cm. high, containing about 350 turns of wire. Adjustable on 3 tripod screws, \( s, s' \), the base could be put at a distance \( D \) from the surface of \( U \) at pleasure. The coil was supplied with an alternating current of 60 cycles from the electric lighting circuit, transformed down to 10 to 30 volts. When the current circulates in \( C \), there is a pressure on \( U \), due to the eddy currents induced in the mercury. The coil was additionally provided with