

used was about 0.1 percent. The pressure in the absorption cell was approximately 70 microns and the total number of  $\text{COS}^{35}$  molecules was of the order of  $3 \times 10^{15}$ .

\* Work performed at Brookhaven National Laboratory under contract with the AEC.

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### Confirmation of $\text{Cl}^{39}$ Activity

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July 15, 1949

IN an attempt to discover the activity of the isotope  $\text{A}^{39}$ , pure argon was irradiated by the University of Saskatchewan betatron, at a pressure of 10 atmospheres and at a betatron energy of 23 Mev. The irradiated gas was then allowed to expand into a counting chamber surrounding a thin-walled beta-counter. An activity of half-life of about 110 minutes was present, due to  $\text{A}^{41}$ . It was noticed however, that the apparent half-life of this activity was always less than the expected 110 minutes<sup>1</sup> and varied considerably from run to run. It was surmised that this deviation was caused by the presence of an activity of somewhat similar half-life which might be due to  $\text{A}^{39}$  or  $\text{Cl}^{39}$ . A plug of glass wool saturated with antimony powder was introduced into the tube connecting the irradiation and counting chambers to absorb any chlorine present. The activity measured in the counting chamber, and thus due to the filtered argon, was then found to have a half-life of exactly 110 minutes, and the glass wool-antimony filter carried a  $\beta^-$ -activity of  $55.5 \pm 0.2$  minutes (curve A, Fig. 1). This is ascribed to the isotope  $\text{Cl}^{39}$  produced in the reaction  $\text{A}^{40}(\gamma, \beta)\text{Cl}^{39}$ . This isotope is listed in the table of Seaborg and Perlman<sup>2</sup> as having a half-life of one hour. This result is based on unpublished data.

A careful chemical separation confirmed the assignment of the activity to a chlorine isotope.

A greatly increased count is obtained by washing the glass wool filter and the inside of the brass irradiation chamber with dilute HCl, precipitating with  $\text{AgNO}_3$  and filtering out the active  $\text{AgCl}$  precipitate. When this is done, there is evidence of a long period activity which may be due to  $\text{A}^{39}$  formed by the disintegration of  $\text{Cl}^{39}$  (curve B). At present the evidence is not conclusive and further work is in progress to test this assumption, and, if it is valid, to measure the half-life of  $\text{A}^{39}$ . However, it appears certain that the 4-minute activity ascribed to  $\text{A}^{39}$  in the above-mentioned table<sup>2,3</sup> and given an  $F$  rating does not occur. Such an activity would easily have been detected in our experiments, for in general the cross section for a  $(\gamma, n)$  reaction is greater than that for the  $(\gamma, \beta)$  reaction in the same isotope.

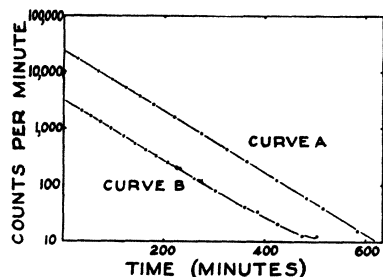


FIG. 1. Decay curve of  $\text{Cl}^{39}$ . Half-life—55.5 m.

Aluminum absorption curves show that if only one  $\beta^-$  is present in the  $\text{Cl}^{39}$  decay, it has an energy of 2.5 Mev. A more exact analysis is in progress to determine the disintegration scheme of this isotope.

The authors express their thanks to Dr. K. J. McCallum of the Chemistry Department of the University of Saskatchewan for performing the chemical separations and for much valuable advice. This work was carried out with the aid of a grant from the Canadian National Research Council whose assistance is gratefully acknowledged.

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<sup>3</sup> Pool, Cork, and Thornton, Phys. Rev. **52**, 239 (1937).

### Detection of X-Ray Quanta by a Cadmium Sulphide Crystal Counter

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July 18, 1949

WE have observed voltage pulses of the order of 50  $\mu$ volts from a CdS crystal irradiated with 0.5A x-rays.

A single crystal of CdS  $7 \times 10^{-3}$  cm thick with flat faces of 1 mm<sup>2</sup> area was prepared for use as a counter by applying Aquadag coatings to opposite faces and attaching a fine copper wire to each coating. The crystal was inserted in a metal tube so that it was located directly behind an end window of  $5 \times 10^{-4}$  cm silver foil. The other end of the tube was fastened to the can containing the first stage of amplification. One lead was attached to the input grid and the other to a 21 v battery which supplied the voltage across the crystal.

The circuit diagram of the first preamplifier is shown in Fig. 1. The voltage pulses were amplified further by a commercial preamplifier and linear amplifier<sup>1</sup> and the amplified pulses were fed to a discriminator and scaler.<sup>2</sup> The system was calibrated with step function input pulses over the region from 20 to 500 microvolts. The background level under operating conditions was such that approximately two counts/minute were observed of amplitude greater than 20 microvolts. The input capacity of the first stage plus crystal was found to be 8  $\mu$ mf.

The crystal was inserted in a beam of x-rays from a molybdenum target x-ray tube operated at 20 ma and 45 kv peak voltage, self-rectified. Pulses were obtained of amplitudes up to 68 microvolts. Absorption curves were taken by inserting aluminum absorbers in the beam, and yielded the familiar concave upward plot for heterochromatic radiation. (Fig. 2.)

At higher intensities, corresponding to counting rates in excess of  $10^6$  per minute, a direct current through the crystal was detected. This current was measured by placing a microammeter in the plate lead to the first amplifier tube. The plate current was known as a function of grid voltage from a previous calibration, so a reading of the plate current yielded the grid voltage and hence the current through the grid resistor. A plot of change in crystal current vs. absorber thickness yielded a logarithmic plot of approximately the same slope as the one obtained by counting.

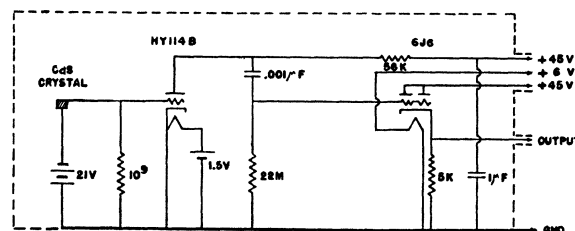


FIG. 1. First pre-amplifier schematic and counter.