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Radiation Laboratory

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RESEARCH PROGRESS MEETING

May 20, 1948

Margaret Foss Folden

Special Review of Declassified Reports
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Anthracene Counters. L. Wouters

Efforts have been made to design an anthracene counter without amplification. With a 1P21 tube, for photomultiplier stage voltages up to 120 volts, it was found that the signal-to-noise ratio remained nearly constant at about 5 to 1. The noises were caused by thermionic emission, field emission and positive ions. To keep the noise down it was determined that the first two stages should be run at low voltages. Voltages of 180 to 200 volts applied to the last seven stages will raise the total gain sufficiently to dispense with conventional vacuum tube pulsed amplifiers. The standard commercially available nine stage photomultiplier mounted directly at the deflecting plate terminals of an oscilloscope tube shows individual pulses of up to 20 volts in height. Since the charge transferred through the last few photomultiplier stages is large, the last few stages must be bypassed at the socket with small mica capacitors. The total voltage across pins 10 and 11 is around 1800 volts, so breakdown must be prevented. A slot was cut halfway through the base and socket between these pins, and a narrow sheet of polystyrene inserted into the slot. The tube base was filled with ceresin wax and the socket and circuit elements liberally coated with ceresin wax.

This arrangement permits direct determination of the counting by varying the decrement of the output circuit. Rough measurements confirm previous oscilloscope observations of duration of about 1/10 microseconds. This was a factor of 100 longer than the response time of a photomultiplier, so that this appears to be the ultimate limit of resolution of the anthracene as a detecting substance.

Bismuth α Emitters. H. Newman

Bombardments of lead with deuterons in the 184-inch cyclotron have produced α emitters shown to be bismuth isotopes. Half-lives of 1-2 min, of 9 min with

5.5 ± .2 Mev energy, and 60-75 minutes with 5.4 ± .2 Mev energy have been observed.

α pulse analyses to determine energies were also done. The amount of Geiger activity (10^6 GM counts/α decay) was so excessive that accurate measurements were not obtained.

Efforts were made to obtain mass assignments by recoil experiments on the thallium daughters. K capture was a complicating factor. Half-lives of 10 minutes, 1.5 hours, 6.5 hours and 29 hours were noted as compared with 1.8 hour, 7 hour and 27 hour activities of thallium isotopes. Certain inconsistencies may lead to the conclusion that the former are not thallium isotopes.

<u>Bent Crystal X-Ray Spectrograph. G. Barton</u>

Studies on the bent crystal x-ray spectrograph were begun, to differentiate between internal conversion relations and K capture in order to establish mass assignments and modes of decay.

Internal Conversion — K Capture

The x-ray is characteristic of the daughter nucleus and may be spectrographically established.

Balanced absorption is used for lower elements. For the higher elements, absorbers are not available and in addition the distance between the K_α and the K_β lines overlap. In consequence, a spectrograph must be used.

After studying the work[1] of DuMond and Kirkpatrick, 1930 and of Cauchois, 1932, a number of bent crystal arrangements were tried. The spectrograph shown in Figure 1 has now been constructed.

[1] Compton and Allison, X-Rays in Theory and Experiment, Van Nostrand and Company.

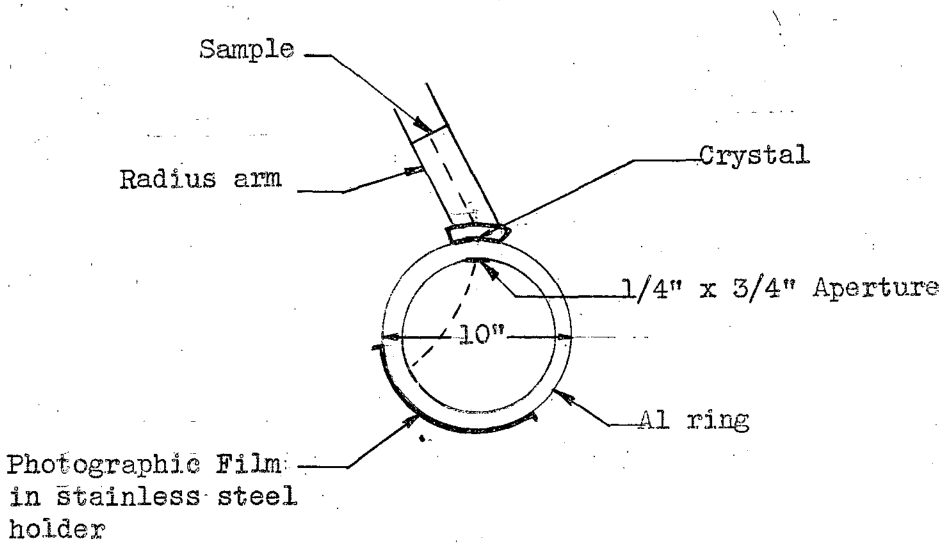

Figure 1

The grating space is 1.178Å and a 5 mil crystal is used. The film is held in position by a stainless steel holder.

This spectrograph gives good focussing for Cu and Mo x-rays.

A spectrograph as illustrated in Figure 2 with the crystal at the focus and the counter behind the crystal is now in the final stages of design. With this arrangement the slit and counter are aligned as the sample is moved. The collimator keeps the direct beam from entering the counter.

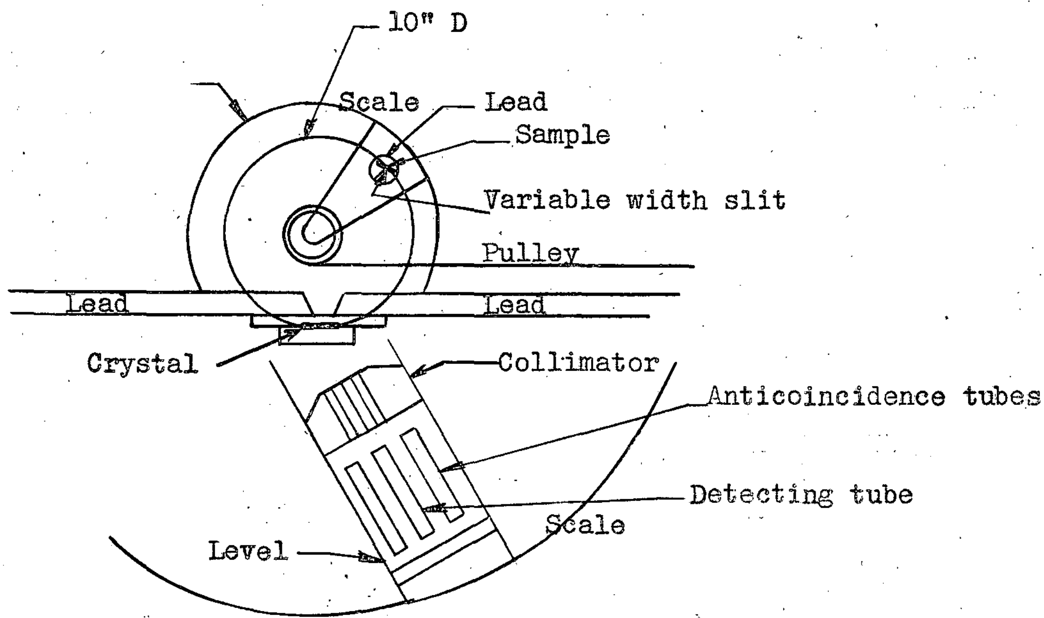

Figure 2

It is planned to test both spectrographs with 303 day Cd^{109}.

The Synchrotron. E.McMillan

At pressures of 3-4 microamperes, with the magnet on and without r.f., betatron action and x-radiation has occurred. This seems to prove that the magnetic field is satisfactory.

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