in a natural way. The first part corresponds to organized oscilla-tions of the medium as a whole. These are the so-called plasma oscillations, which resemble sound waves and represent the long-range correlations brought about by the Coulomb force. At low temperatures, these oscillations are so weakly excited that they make a negligible contribution to the specific heat. The remainder of the Hamiltonian then reduces to a screened Coulomb inter-action, since the long-range part of the interaction has been ef-fectively included in the oscillations of the medium as a whole. The screening radius is found to be $\lambda \cong v_0/\omega_p = (\hbar k_0/m)(m/4\pi n_0 e^2)^{\frac{1}{2}}$ where v_0 is the velocity of an electron at the top of the Fermi dis-tribution, $\omega_p = (4\pi n_0 e^2/m)^{\frac{1}{2}}$ is the "plasma frequency," and n_0 is the electron density. For sodium, $k_0 \cong 0.9 \times 10^8$ cm, and $\lambda \cong 10^{-8}$ cm, in agreement with the screening radius adopted empirically by Landsberg and Wohlfarth.

A more detailed report of this work is being prepared for publication.

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Neutron Yield from Be⁹(γ,n)Be⁸ Reaction*

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ALTHOUGH the $Be^9(\gamma,n)Be^8$ reaction is one of the most commonly employed neutron sources, only a small amount of information is available concerning the obtainable neutron flux under various conditions. In the experiments reported here, the thickness of the beryllium target necessary to yield the maxi-mum slow neutron flux was determined.

With a 200-gram powdered beryllium target and a Van de Graaff generator as an x-ray source, Wiedenbeck[1] compared the neutron yield directly with that of a Ra-Be source. He obtained a yield equivalent to 10^3 curies of radium with an electron ac-celerator potential of 3.2 Mev and a beam current of 100 μamp.

The present measurements have also been made with a Van de Graaff accelerator, but at a potential of 2.5 Mev and a 100 μamp. electron current. The beryllium target consisted of solid square pieces of beryllium (9×9 cm) of various thicknesses. These were placed about 3 mm from the x-ray exit window. Directly beneath the last beryllium block a stack of large thin paraffin plates (35 cm in diameter) were mounted. Copper and indium foils were placed (with and without cadmium covers) at different depths between the paraffin plates, and on the axis of the x-ray beam. Their induced activity was taken as a measure of the slow neutron flux. The highest activity was observed with about 2 cm of paraffin between the beryllium target and the detector foil. When the beryllium target was also surrounded by paraffin, the slow neu-tron flux at points below the target increased only slightly.

Under the above conditions and with a 4 cm thick beryllium target, the slow neutron flux was observed to reach a maximum density of about 10^7 neutrons/cm²/sec., while at thicknesses of 2 and 7 cm, the flux is only 85 percent of the maximum value. The neutron production increases in proportion to the amount of beryllium penetrated by the x-rays. Therefore, the activity of the foils decreased as the thickness of the beryllium target was re-duced below 4 cm. However, with a beryllium target more than 4 cm thick, the activity of the foils also decreased because of the effect of the inverse square law. With increasing target thickness fewer neutrons reach the detector foils beneath it, regardless of the fact that the total neutron production increases. A reduction of the target dimensions from 9×9 to 5×5 cm reduces the flux by a factor of three. As a result of the predominantly forward

direction of the x-ray beam, an increase in target diameter beyond 9 cm had little effect on the neutron flux.

Measurements with a BF_3 counter placed five feet from the beryllium target in a plane perpendicular to the x-ray beam showed an increase of the neutron flux with target thickness up to 15 cm. At greater thicknesses, a steady value of the neutron flux was obtained. Although neutrons from any point of the target have about equal probability of reaching the counter, the attenuation and divergence of the x-ray beam limits the increase of the total neutron emission with increasing amount of target material.

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Half-Life of Cu⁶⁶

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IN 1949 Silver[1] reported precision measurements of the decay periods of a number of isotopes using a differential ionization chamber with a vibrating reed condenser electrometer and feed-back amplifier. The half-life of Cu^{66} was found to be 4.34 ± 0.03 minutes. We were unable to reconcile this value with an activity obtained in copper which had been exposed to photo-neutrons, and we have therefore made a careful measurement of this half-life.

Lead bricks were piled in front of the "22"-Mev betatron to absorb the gamma-ray beam and to provide a source of photo-neutrons. An electrolytically pure copper disk was placed at the center of a block of paraffin beside the lead bricks. After the lead had been irradiated for 11 minutes, the copper disk was counted with an end-window β-counter connected through scalers to a time-stamping machine. The decay curve shown in Fig. 1 is that
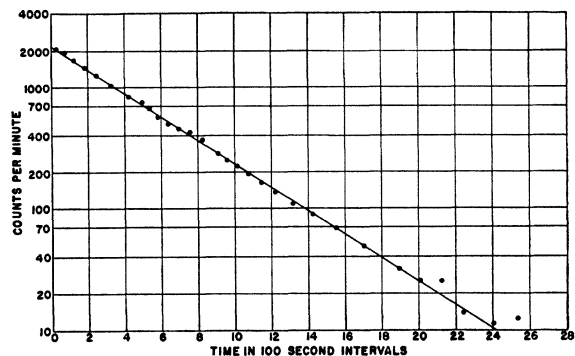

FIG. 1. Decay of Cu^{66}. The background of 34 counts/min. and a long-lived activity of 7 counts/min. have been subtracted.

obtained after subtraction of background of 34 counts/min. and a long-lived activity of 7 counts/min. (presumably 12.9 hour Cu^{64}).

A similar irradiation was made with a copper disk surrounded by cadmium. The initial activity of this disk was only 50 percent above background. This established that the activity of Fig. 1 resulted from the capture of slow neutrons by copper, and hence must arise from the reaction $Cu^{65}(n, \gamma)Cu^{66}$.

We therefore find the half-life of Cu^{66} to be 5.18 ± 0.10 minutes. This is in good agreement with the old value of 5 minutes measured by Amaldi et al.[2]

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