By means of a "megavolt meter,"[4] a direct reading of the electron energy and of the corresponding x-rays produced could be obtained in all cases. Thereby an instantaneous change from 11 Mev without d.c. bias to 20.5 Mev with d.c. bias could be produced and read by merely turning on the direct current and rephasing the electron injection pulse. In both cases, electron injection voltages as low as 8000 volts could be used indicating a high degree of uniformity of the magnetic guiding field with azimuth. With oil-cooled coils, the machine will produce 50-million volt x-rays.

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The Capture Cross Section of Boron for Neutrons of Energies from 0.01 ev to 1000 ev*

R. B. SUTTON,[1] B. D. MCDANIEL,[2] E. E. ANDERSON,[3] AND L. S. LAVATELLI[4]
University of California, Los Alamos Scientific Laboratory, Santa Fe, New Mexico
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THE slow neutron capture cross section of boron has been measured for neutron energies from 0.01 ev to 1000 ev. The cross section was obtained by determining the transmission of boron-containing samples. Neutron energies were determined by using the method of modulation of a cyclotron beam to obtain the time of flight of the neutrons over a 7.6-meter path between the neutron moderator and a BF_3 neutron detector. This method is similar to that described by Baker and Bacher[5] and by Bacher, Baker, and McDaniel.[6] The equipment used was constructed in the Physics Department at Cornell University by B. D. McDaniel and C. P. Baker; a description will appear in the literature shortly. Neutron pulses in twelve time-of-flight intervals could be recorded simultaneously.

In order to cover the range of neutron energies four samples, each of different boron content, were used. The one containing least boron was a BF_3 gas cell; the others were B_4C. Of the three B_4C samples the thickest and thinnest consisted of cells containing B_4C powder; the third was composed of a mixture of B_4C and lead borate which was hot-pressed to form a compact disk.

The curve of total cross section σ_T *vs.* time-of-flight τ for each absorber was found to vary in the following manner

$$\sigma_T=\alpha\tau+\beta,$$

where α and β are constants. It was assumed that the constant β corresponded to the scattering cross section of the various elements present, and the term $\alpha\tau$ corresponded to the absorption cross section of boron. The scattering cross section, β, was obtained by taking the extrapolated value of σ at $\tau=0$. The scattering cross section for boron was found by correcting β for the cross sections of the other elements present. Values used were for fluorine, 4.1×10^{-24} cm^2, for carbon, 4.85×10^{-24} cm^2, for oxygen, 4.2×10^{-24} cm^2, and for lead 9.6×10^{-24} cm^2. The value obtained for the boron scattering cross section was 4.2×10^{-24} cm^2. The total contribution of the other elements in the B_4C samples was 2.2×10^{-24} cm^2 per B atom. The capture cross section of boron was obtained from

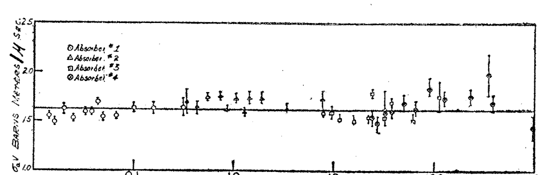

FIG. 1. The product ($\sigma_a v$) between boron absorption cross section and neutron velocity plotted against the logarithm of the neutron energy.

$$\sigma_a=\sigma_T-\beta=\alpha\tau$$

by assuming that all the capture cross section was represented by $\alpha\tau$ and none was included in β. In Fig. 1 the values of the product of the capture cross section by neutron velocity are plotted as a function of neutron energy. The instrumental resolution function is triangular. The resolution used depended on the energy region under investigation; in Fig. 1 the base of the triangle is equal in length to the separation of the points.

The value of $\sigma_a v$ determined from the weighted average of the points on the curve is $1.61\pm.02\times10^{-24}$ cm^2 meter/μ sec. It can be seen from the curve that systematic deviations occur between different absorbers. This is probably owing to errors in the determination of the boron content of the absorbers. The value of $\sigma_a v$ determined from the BF_3 gas alone is 1.58×10^{-24} cm^2 meter/μ sec. which may be a better value than the one given above, since the boron content of the BF_3 was probably better known. Both these values are lower than the figure of $118\times10^{-24}E^{-\frac{1}{2}}$ cm^2 (or 1.63×10^{-24} cm^2 meter/μ sec.) recently given by Rainwater and Havens,[7] but are higher than the value of 1.55×10^{-24} cm^2 meter/μ sec. obtained by Bacher, Baker and McDaniel.[6] All agree within the uncertainties given. The figure also indicates that $\sigma_a v$ is essentially constant (to ±10 percent) up to 1000 ev, if the assumption is correct that β contains only components of scattering cross section.

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[1] Now at Carnegie Institute of Technology, Pittsburgh, Pennsylvania.
[2] Now at Cornell University, Ithaca, New York.
[3] Now at Milwaukee-Downer College, Milwaukee, Wisconsin.
[4] Now at Harvard University, Cambridge, Massachusetts.
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Remarks on Dr. Bhabha's Note "On the Expansibility of Solutions in Powers of the Interaction Constants"

NIELS ARLEY
Institute of Theoretical Physics, Copenhagen, and Palmer Physical Laboratory, Princeton, New Jersey
January 13, 1947

IN a recent note Bhabha[1] has pointed out that the difference between the physical and the non-physical solutions in the classical electron theory proposed by Dirac[2] may be characterized by the fact that the former is