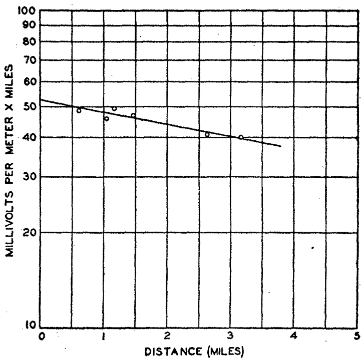

FIG. 3. Measured field intensities.

on Fig. 1. These values of field intensity were multiplied by the distance in miles to the measuring point to obtain the $F\cdot d$ curve shown in Fig. 3. This curve, when extrapolated to zero miles, yields the effective field intensity at one mile along this radial. Comparison of this value with Figs. 1 and 2 shows an excellent agreement with Fig. 1, which was based on a velocity of propagation of the radio waves equal to the velocity of light in free space.

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Transmission of Slow Neutrons Through Crystals*

We have found a marked dependence of the slow neutron cross section upon the crystalline state of the material which the neutrons traverse.[1] Measurements of the transmission of slow neutrons through single crystals of iron, nickel, quartz and permalloy show that as compared with the polycrystalline state the materials are much more transparent when in the form of single crystals.

The cross section of single crystals may depend upon their thickness and the orientation of the crystalline axis relative to the neutron beam.[2] In quartz no such easily measurable effect was noticed with our highly collimated neutron beam.[3] Since the increase in transparency for single crystals is large and no easily measurable thickness effect was observable we conclude that under these conditions only a narrow band of the neutron wave-length spectrum is scattered by a single crystal orientation.

TABLE I. *Cross sections per atom or molecule for slow neutrons.*

	Polycrystalline $\sigma\times 10^{24}$ cm^{-2}		Single Crystal $\sigma\times 10^{24}$ cm^{-2}	G/cm^2
Fe	12.0 ± 0.2		7.0 ± 1	1.6
			6.1 ± 1	8.8
Ni	19.8 ± 0.5		14.1 ± 1.2	4.4
SiO_2	8.0 ± 1	(fused)	4.5 ± 0.6	3.7
	8.8 ± 1	(sand)	4.1 ± 0.6	1.3
	10.5	(additive)		
Permalloy				
(73% Ni – 27% Fe)			10.2 ± 1.3	6.2
(68% Ni – 32% Fe)			10.2 ± 1.3	6.2

TABLE II. *Cross sections of permalloy for slow electrons.*

	Experimental $\sigma\times 10^{24}$ cm^{-2}	Computed from Ni – Fe Content $\sigma\times 10^{24}$ cm^{-2}
78	12.5 ± 0.7	18.2
45	16.0 ± 0.8	15.8

In Table I the results of our measurements of the total cross section per atom or molecule are given.

In Table II are shown the cross sections of permalloy 78 and 45. In this case the material was in a polycrystalline state.

Previously[4] we have reported that the cross sections of compounds are not equal to the sum of the cross sections of the constituent elements. There one compared the cross section of compounds in polycrystalline states with the cross section of the elements which compose them. The constituent elements sometimes might be polycrystalline or even liquid. In this case, the effect is complicated by the different change of phase of the scattered wave[2] from the constituent elements which form the compound.

These phenomena are apparently connected with interference within crystal lattices.[5,6] Some theoretical viewpoints for an understanding of the dependence of nuclear interaction upon crystal structure have been set forth.[1,2,7]

Because the slow neutron interaction is so dependent upon the crystalline state of the material the effective slow neutron cross section as usually measured must now be considered as characteristic of the state of the material and not immediately related to the true nuclear cross section per atom.

The permalloy and nickel crystals were obtained from the Bell Telephone Laboratory, through the courtesy of Dr. R. M. Bozorth. These crystals were grown by Mr. Boothby following a method described by Cioffi and Boothby.[8] Some of the quartz crystals were supplied by Professor Hubbard of Johns Hopkins University. We take pleasure in acknowledging the above cooperation.

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* Publication assisted by the Ernest Kempton Adams Fund for Physical Research of Columbia University.
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