The fission pulses were sorted by a simple ten-channel pulse analyzer and recorded on a ten-pen Esterline Angus operation recorder. The distribution obtained in one of the runs is shown in Fig. 1. The energy scale was obtained by comparison with the α-pulses in terms of a pulse signal-generator.[6]

The results of three runs are given in Table I together with data on slow neutron fission.[7] Before any detailed comparison could be made, much longer runs with finer pulse analyzer resolution would be required. Moreover, a thinner source would also be desirable. However, the investigation aimed at seeing if there were any major difference between spontaneous and slow neutron induced fission. Apparently there is not.

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[1] P. R. Tunnicliffe, Chalk River report CRG-449, unpublished.

[2] B. Pontecorvo and D. West, Chalk River report MP-210 (1945), unpublished.

[3] B. Rossi and H. Staub, *Ionization Chambers and Counters* (McGraw-Hill Book Company, Inc., New York, 1949), p. 14.

[4] Hanna, Harvey, and Moss, Phys. Rev. **78**, 617 (1950).

[5] Bunemann, Cranshaw, and Harvey, Can. J. Research **A27**, 191 (1948).

[6] Because of the very high α-counting rate the α-pulses were compared with the signal generator on a triggered oscilloscope. In spite of the short distance between the source and the grid, enough α-particles left the source sufficiently obliquely to give a well-resolved trace corresponding to the total α-energy.

[7] D. C. Brunton and W. B. Thompson, Can. J. Research **A28**, 498 1950).

Low Temperature Resistance Minimum in Magnesium Measured by a Mutual Inductance Method*

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SOME experiments performed recently by the authors to investigate the low temperature resistance of magnesium have utilized a method which may prove to be useful for many types of low temperature resistance measurements. Owing to the strong influence of impurities and crystal structure on low temperature resistivities, a method was developed which makes it possible to use a bulk sample of material rather than a drawn wire. The principle utilized in this method is that the complex mutual inductance of two coaxial coils surrounding a sample depends on the conductivity of the sample. The mutual inductance is measured with a bridge. The calculations can be easily carried out for cylindrical symmetry[1] (two coaxial coils containing a cylindrical core of conductivity σ), yielding a relation between the mutual inductance and the core conductivity. Refinements to the calculation can be introduced to correct for the finite length of the coil and the core.

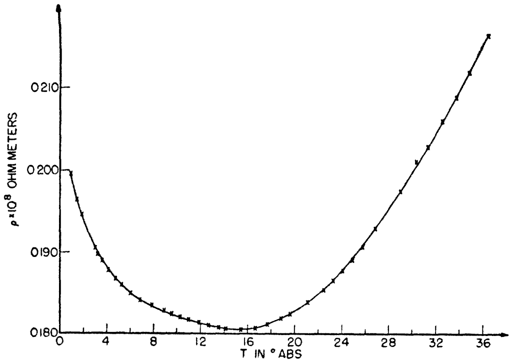

FIG. 1. A plot of resistivity *vs* temperature for a cylindrical sample of magnesium.

This method has several advantages over the customary measurements made with wires and resistance bridges. No connections to the sample are necessary, thus eliminating contact effects and the possibility of a heat leak down the connecting wires. Single crystal samples can be easily made in a shape suitable for use in conductivity measurements. Further, the bulk resistivity comes fully into play, making small imperfections, which might greatly influence wire measurements, of little importance.

The resistivity of magnesium has been measured by this method in order to study the resistance minimum reported by Garfunkel, Dunnington, and Serin.[2] An illustration of the results is shown in Fig. 1.

At the present time, measurements are under way at this Laboratory to investigate the effect of impurity content and crystal structure on the resistance minimum.

* This work was supported in part by the Signal Corps, the Air Materiel Command, and ONR.

[1] N. W. McLachlan, *Bessel Functions for Engineers* (Oxford University Press, London, 1941), Chapter IX.

[2] Garfunkel, Dunnington, and Serin, Phys. Rev. **79**, 1 (1950).

Detection of Gamma-Ray Polarization by Pair Production*

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IT has been pointed out by Yang,[1] that pair production may provide a method for detecting the polarization of γ-rays in the high energy range: $h\nu \gg mc^2$ (m being the electron mass) where the usual Compton recoil method becomes insensitive. The idea is to utilize the azimuthal dependence of the pair production cross section $d\sigma$, the azimuth ϕ being measured around the direction $\mathbf{k}$ of the incident quantum and from the plane containing $\mathbf{k}$ and the electric polarization vector $\boldsymbol{\varepsilon}$ of the quantum. Actually, of course, one must consider two azimuths ϕ_+ and ϕ_- for the positive and negative electron respectively. Berlin and Madansky,[2] from whose paper our notation is borrowed, have made a careful study of the dependence of $d\sigma$ on ϕ_- when $\phi_+ = \phi_- + \pi$. In this case the plane of the pair contains *exactly* the direction $\mathbf{k}$ of the incident quantum, and one can speak simply of the azimuth $\phi = \phi_-$ of the plane of the pair with respect to the plane of polarization. From the experimental standpoint it will be practically impossible to select the pairs which satisfy the Berlin-Madansky condition. Both electrons will be emitted within a narrow cone around $\mathbf{k}$, and the plane of the pair will always make a very small angle with $\mathbf{k}$. No matter whether pairs are observed in a photographic emulsion or produced in a thin target and detected with counters, scattering within the emulsion or target will unavoidably distort the initial directions to a considerable extent. It seems more reasonable, therefore, to set as our goal the measurement of the angle between the plane of the pair and the plane of polarization without any selection. The question then arises whether the case considered by Berlin and Madansky is sufficiently representative to permit a rough prediction of what is to be expected in the general case. The result of the following calculation may indicate that it is not.

The Bethe-Heitler formula for $d\sigma$ has a quite complicated dependence on the various parameters involved, so that the sign and magnitude of the effect to be expected can be seen only at the end of a laborious integration. In order to find a simpler picture we have used the Weizsäcker-Williams approximation.[3] In order to deal with pair production, Williams makes a Lorentz-transformation parallel to $\mathbf{k}$ with velocity $v = c(\xi - 1)/(\xi + 1)$, with $\xi = h\nu/mc^2$. In the new system the quantum has an energy $h\nu_1 = mc^2$. The method can be applied if $\xi \gg 1$ so that v is very close to c; the field of the nucleus can then be approximately substituted by a spectrum $\sim(C/\nu)d\nu$ of virtual quanta, C being a slowly variable function of ν, which we shall treat as a constant. These quanta move in the direction $-\mathbf{k}$, and if one of them, having an energy $h\nu_2 > mc^2$, collides with the real quantum, a pair may be produced. It is characteristic of the Weizsäcker-Williams