800 and 1000 Mev. The 1000-Mev distribution is so distinctive and this character appears so suddenly as the energy is increased, that we are tempted to ascribe it to a $T=1/2$, $J=5/2$ resonance first suggested in pion scattering data[6] near an energy corresponding to photoproduction at 1100 Mev. This temptation is supported by two or three arguments. First, a $D_{5/2}$ state from magnetic quadrupole absorption or an $F_{5/2}$ state from electric quadrupole would have an angular distribution of the form $1+6\cos^2\theta - 5\cos^4\theta$ and this appears to be a major component in the 1000-Mev distribution, together with a strong $\cos\theta$ interference term. This interpretation is also useful for π^0 photoproduction, since the above angular distribution fits qualitatively the 940-Mev π^0 data of Vette[2] where the angular distribution was found to be different from that at all lower energies. A second, somewhat weak, point is that the total π^+ cross section shown in Table I does not continue to decrease appreciably between 900 and 1000 Mev, and this is consistent with a resonance at a somewhat higher energy, 1050 or 1100 Mev, which is just the energy expected from the pion scattering data.[6]

A possible difficulty is that the 1000-Mev data seem to require higher powers of $\cos\theta$ than the fourth, in order to achieve a reasonable fit. Perhaps the small-angle behavior can be explained by interference effects with the term in the photoproduction amplitude corresponding to interaction of the photon with the meson current. As Moravcsik has emphasized,[4] this term should not be ignored, and an analysis including it is being attempted. No contribution of this term alone as distinct from interference effects is obvious in the data.

A complete report of this experiment, including the final corrections to the data discussed above, will be published later. We wish to thank Mr. Gerry Neugebauer for helping to take some of the final data.

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POLARIZATION OF RaE ELECTRONS

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For β-decay with $\Delta J=1$, yes, the longitudinal polarization P is $-v/c$, if the ξ-approximation is valid. The ξ-approximation gives an allowed spectrum. There is only one exception, RaE. Therefore one expects $P(\text{RaE}) \neq -v/c$. Theoretical investigations by Curtis and Lewis[1] and by Kotani and Ross[2] point out that P(RaE) should give information about time reversal at small energies and about matrix elements at larger energies. First measurements from Geiger et al.[3] with Møller scattering and from Heintze et al.[4] with Mott scattering after deflection by multiple scattering indicate that $|P(\text{RaE})|<v/c$, indeed. Unfortunately the energy discrimination in both measurements is too poor for a detailed conclusion.

We have measured P(RaE) for $E_{\text{kin}}=120$, 155, 209, and 290 kev by Mott scattering after deflection through an electric field. Figure 1 shows our experimental arrangements.[5] The source Q is imaged to the receiving diaphragm of the spherical electric field by a thin magnetic lens. The end of the field (120° deflection) can be imaged to the scattering foil to avoid frame scattering. The depolarization by this lens has been measured earlier. Electrons which are once scattered in the scattering foil and then back-scattered by the walls are suppressed by

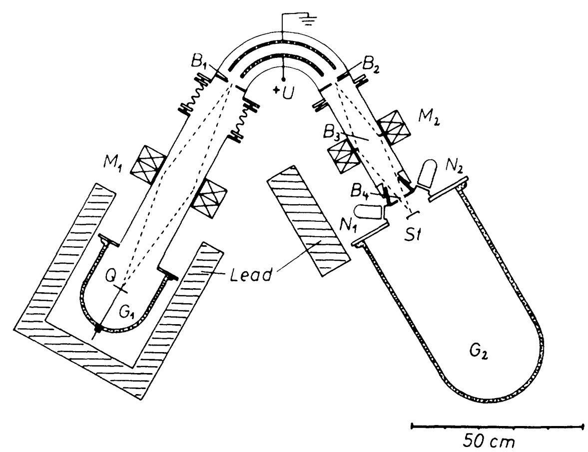

FIG. 1. Experimental arrangement. Q = source, M_1, M_2 = thin magnetic lenses, B_1 - B_4 = diaphragms, N_1, N_2 = counters, St - scattering foil, G_1, G_2 = glass cylinders; the other parts are of metal. The scattering part can be rotated. Lead = lead shielding.

the large glass tube G_2. We use two GM counters N_1 and N_2 and measure with Au and Al foils (scattering angle 120°). The scattering part can be rotated (together with the counters). The RaE source was obtained from a RaD+E solution by precipitating the RaE with Fe carrier. The RaE +Fe was then electroplated to 0.2 mg/cm^2 Al which was evaporated onto 1 mg/cm^2 Melinex. We corrected for the following influences: depolarization in the source, plural scattering in the scattering foil,[6] apparatus asymmetry, solid angle corrections, spin deflection, and back scattering from the walls.

The influence of screening to the asymmetry function S (without screening tabulated by Sherman[7]) was measured, assuming full polarization for Co^{60} electrons (allowed GT transition). We find $S_{exp}/S_{theor} = 0.86 \pm 0.02$, 0.96 ± 0.02, and 1.00 ± 0.02 for $v/c = 0.58$ (120 kev), 0.64 (155 kev), and 0.70 (209 kev), respectively.

The results for the degree of longitudinal polarization of RaE electrons are $P/(-v/c) = 0.69 \pm 0.04$, 0.75 ± 0.04, 0.75 ± 0.04, and 0.66 ± 0.06 for E_{kin} = 120, 155, 209, and 290 kev, respectively. These values are nearly energy independent and are somewhat higher than the upper limit of the possible values as calculated by Bincer et al.[8] according to the "best fit" of the RaE spectrum. But it is possible to fit the spectrum with parameters which involve a higher degree of polarization. In Fig. 2, $P/(-v/c)$ is shown as a function of E_{kin}. The thoretical limits are taken from reference 8. All experimental data known to us are included.

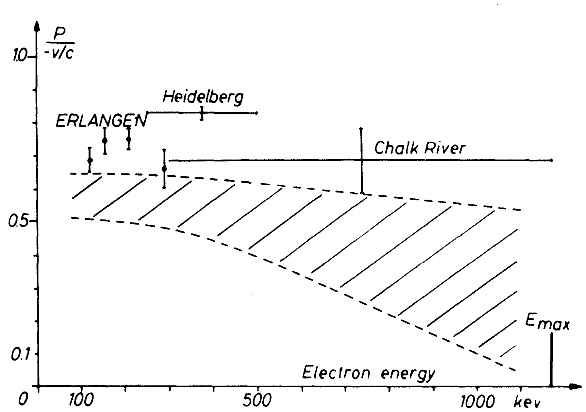

FIG. 2. Electron polarization of RaE versus energy. The range of theoretical values after the "best fit" of the spectrum is shown. The experimental values of Erlangen (present work) have been obtained with Mott scattering after electrostatic deflection, Heidelberg (Heintze et al.) with Mott scattering after deflection by multiple scattering, Chalk River (Geiger et al.) with Møller scattering.

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STRENGTH FUNCTIONS FOR DEFORMED NUCLEI*

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Optical models have recently been successful in accounting for the interaction of various particles with nuclei over wide ranges of energy. One fundamental property of the models is the low-energy neutron "strength function," or $\bar{\Gamma}_n^0/D$ ratio, with $\bar{\Gamma}_n^0$ the mean reduced neutron width of s resonances, and D their spacing. This ratio is proportional to the cross section for compound nucleus formation and is thus closely related to the penetrability of the potential barrier at the surface of the nucleus. The compound nucleus formation can be well measured at low energy, where, averaged over resonances, it is inversely proportional to neutron velocity. The experimental strength function has been useful as a test of the applicability of optical models and as a means for establishing their parameters.