ular, which will be designated $\tau_{\text{null}}$, there will be no tail. Since the system relaxes or returns to equilibrium exponentially with the time constant $T_1$, it is easily shown that $T_1$ may be calculated directly from the measured value of $\tau_{\text{null}}$ by using the relation $\tau_{\text{null}} = T_1 \ln 2$. A 180° pulse at $t=\tau+\tau_2$ will cause an echo to be formed at $t=\tau+2\tau_2$. If $2\tau_2 \ll T_2$ this echo may be used as an indicator of the growth of $M_z$ from $-M_0$ to $M_0$. The inhomogeneity of $H_z$ plays no role in the decay and growth of the longitudinal component of the polarization; diffusion and convection may here be ignored. One precaution must be noted, however. It has been assumed that each sequence of pulses is initiated only after the system has returned to thermal equilibrium. Thus if the above relation is used to compute $T_1$, the time interval between sequences must be large compared to $T_1$.

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# Beta-Ray Spectrum of $Ag^{110}$

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The soft beta-ray spectrum of $Ag^{110}$ has been measured by a double coil, magnetic lens beta-ray spectrometer, with a thin source and a thin counter window. From the analysis of the Fermi plot, three soft beta-ray groups of allowed type are found, with end points of 80 kev, 314 kev, and 530 kev. The ratio of their intensities is 10.7:3.2:15.3.

THE decay of $Ag^{110}$ by the emission of three beta rays with end points of 87 kev, 530 kev, and 2.86 Mev, and of many groups of gamma rays, has been reported.[1–8] The difficulties involved in the analysis of these soft beta rays have also been pointed out.

In the present experiments the soft beta-ray spectrum has been measured by using a double coil, magnetic lens beta-ray spectrometer of about 2.0 percent resolving power. The detector consisted of a Geiger counter with a thin Zapon window which will detect electrons of energy 5 kev and higher. The source was prepared from radioactive solutions supplied from Oak Ridge. It has a surface density of not more than 50 $\mu$g/cm$^2$ on Zapon film of about 30 $\mu$g/cm$^2$.

The spectrum consists of two low-energy groups of beta rays and many internal conversion lines of 116, 447, 618, 655, 687, 760, 759, 883, and 932 kev gamma rays, which were designated as strong and medium groups;[1] weak groups could not be detected because of the thin sample used in the present work. Since the Fermi plot of the spectrum of the 530-kev beta ray does not fit a straight line but is convex toward the energy axis, we endeavored to fit various shape factors, as given by Konopinski and Uhlenbeck,[9] to these data. The $(ft)$ value of this group is first forbidden. Then, in order to fit the data to a theoretically forbidden shape, it is necessary to multiply the allowed $F(z,w)$ by a certain coefficient $C_1$, given by Konopinski and Uhlenbeck,[9] and see if the plot $(N/C_1\cdot F)^{\frac{1}{2}}$ against the total energy gives a straight line. The Fermi plots corrected with the correction factors of $C_{1SV}/|\int\mathbf{r}|^2$ and $C_{1TA}/|\Sigma B_{ij}|^2$ did not fit a straight line. We tried further to fit with various shape factors of second forbidden, $C_{2SV}/|\Sigma R_{ij}|^2$, $C_{2V}/|\Sigma A_{ij}|^2$, $C_{2TA}/|\Sigma S_{ijk}|^2$, $C_{2A}/|\Sigma T_{ij}|^2$, and $C_{2T}/|\Sigma A_{ij}|^2$, where certain values of $\Sigma S_{ijk}$ and $\Sigma A_{ij}/\Sigma T_{ij}$ are assumed. But none of these corrected Fermi plots gave good results.

Therefore, we assume that the 530-kev beta-ray spectrum is complex, consisting of two groups. The best fit to the data for the Fermi plot is obtained in the energy range $W \geqq 1.60$ with $W_0=2.038$, where $W$ is the energy in units of $m_0c^2$ and $W_0$ is the maximum energy in units of $m_0c^2$. The full shape of the 530-kev beta-ray group can be constructed from this straight line in the Fermi plot, which is shown in Fig. 1 as the $\beta_3$ group. The differences between the measured and constructed values at each energy give the second beta-ray group which also fit a straight line in the Fermi plot in the energy range $W \geqq 1.23$, with $W_0 = 1.615$. The full shape of this $\beta_2$ group can also be constructed from the Fermi plot, as shown in Fig. 1. The remaining soft beta-ray group can also be con-

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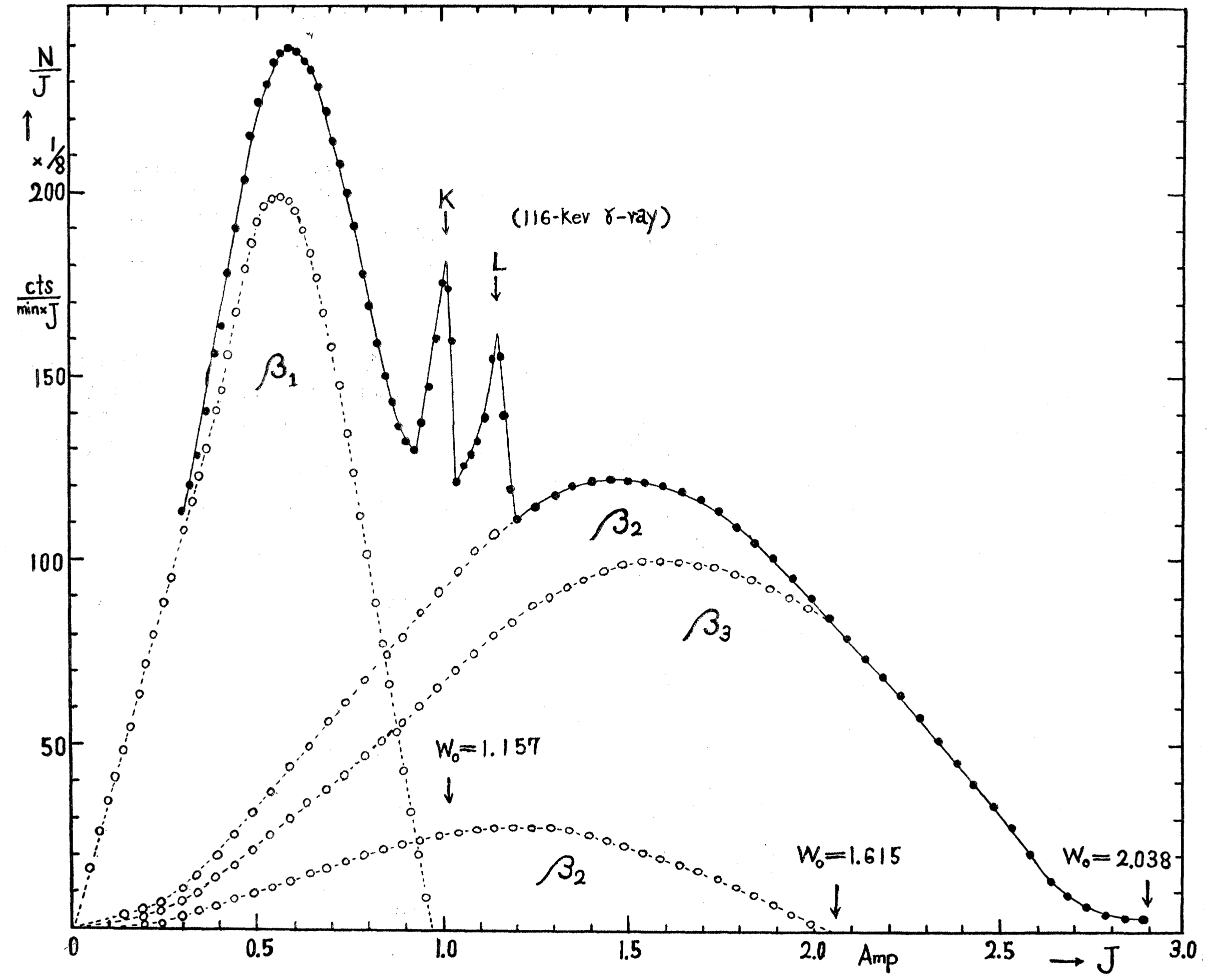

FIG. 1. Beta-ray spectrum of $Ag^{110}$, where $\beta_1$, $\beta_2$, and $\beta_3$ show the beta-ray groups with end points of 80 kev, 314 kev, and 530 kev, respectively. The full line shows the measured values, and the dotted lines those constructed from the Fermi plot.

structed using the above shapes of the $\beta_2$ and $\beta_3$ groups, as shown in Fig. 1, which fits a straight line in the Fermi plot with $W_0 = 1.157$.

In conclusion, three soft beta-ray groups of allowed type are found, with end points of 80 kev, 314 kev, and 530 kev. The ratio of their intensities is measured as 10.7:3.2:15.3. Further investigations will be necessary to determine the decay scheme of $Ag^{110}$.

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