indicative of $E2$ rotational transitions. It is noteworthy how close the ratios of the quantities $B_e(2)$ for the $(1/2\rightarrow 5/2)$ and $(1/2\rightarrow 3/2)$ transitions come to the value 1.50 predicted from the rotational scheme.

We are indebted to Dr. T. Huus and Dr. A. Lundén for communication of their results prior to publication, and to Dr. A. Bohr and Dr. B. R. Mottelson for informative correspondence.

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Positron Spectrum from the Decay of the μ Meson*

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THE positron spectrum (Fig. 1) produced by the decay of the μ meson has been studied in detail, and also with much improved accuracy, with a 40-in. (pole base diameter) spiral-orbit spectrometer.

The experimental method that was adopted is similar to the one reported by one of us in 1951.[1] The 340-Mev deflected proton beam was used to produce π^+ mesons in the target. Some of the created π^+ mesons decayed inside the target into μ mesons that in turn disintegrated into positrons. Thus the target mounted coaxially with the symmetric magnetic field was the source of positrons. The energy spectrum of these created positrons was analyzed by means of the spiral-orbit spectrometer.[2]

Positrons were measured with momentum resolutions of $\pm 0.6\sim\pm 1.8$ percent at half intensity. They were detected as quadruple coincidences of signals from four plastic crystals (two of these crystals were $\frac{1}{4}$ by 1.5 by 2.5 in., and the other two $\frac{1}{4}$ by 3 by 3 in.). The counts were taken following a 2-μsec delay relative to the proton pulses and with four consecutive gates each having a 2-μsec width. This enabled us not only to check the half-life but also to reduce background, which usually came in as accidentals.

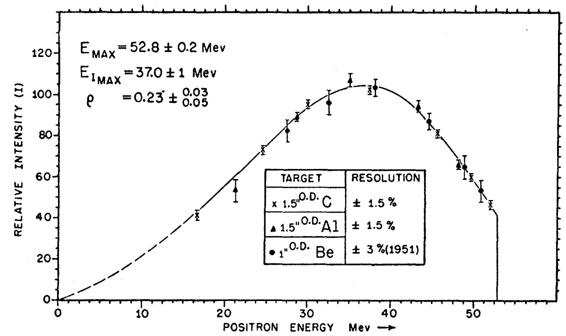

FIG. 1. Positron spectrum from "thick"-target data.

Measurements were made on four thin Be targets of different diameters and thicknesses, as the resolution is directly related to the effective diameter of the cylindrical or tubular targets, and also as the energy absorption of the positrons through the target itself is the other major correction to be applied. In addition to these, two thick targets (C and Al, each $1\frac{1}{2}$ in. outside diameter by 4 in. long) were studied. Each experiment was repeated from 4 to 10 times, and reproducibility of the results was checked.

The accuracy of each magnetic field setting was kept better than 0.1 percent by means of a proton nuclear resonance method during each measurement. As a result, the accuracy of the absolute $H\rho$ value of each measured point is considered to be better than 0.2 percent.

The results are summarized as follows:

(*A*) All the data (most of which have a reasonably small statistical error) can be fitted best to the theoretical curve with $\rho = 0.23_{-0.05}^{+0.03}$ (the constant introduced by Michel[3]), if proper corrections for absorption and resolution are applied, as is shown in Fig. 1.

(*B*) As illustrated in Fig. 2, all thin-target experiments show a definite sharp cutoff at the energy maximum.

(*C*) The absolute value of this maximum energy has been calculated as 52.8 ± 0.2 Mev.

(*D*) This corresponds to a μ-meson mass value of $m_\mu = 207\pm 0.8 m_e$.

(*E*) With the aid of the fundamental mass ratio,[4] $\pi^+/\mu^+ = 1.321\pm 0.002$, the mass of the π^+ meson can be established. This value is

$$m_{\pi^+} = 273.4\pm 1.1 m_e.$$

(*F*) The data obtained in 1951[1] were found to be in good agreement with the present data. (Unfortunately the mass value of the μ meson at that time was too high, and the results were therefore interpreted to show $\rho = 0$.)

(*G*) Since we have measured directly the cutoff at E_{max} from our experiment, our present results are not dependent on some other mass measurements.

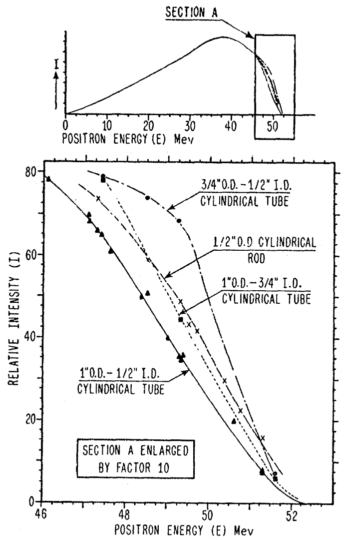

FIG. 2. Behavior of positron spectrum near E_{max} from four "thin" Be targets.

(*H*) The very good agreement of the mass value of the μ meson obtained with the assumption of the range energy relation[4] gives strong indication that the assumed relation is good for mesons to this order of accuracy.

(*I*) From our present data we are not able to exclude the possibility of the spin values of $\frac{3}{2}$ for the μ meson.

We have been informed of the values $\rho=0.6$, 0.5, and ~ 0, obtained in the recent measurements (each with a different method) at Columbia,[5] Massachusetts Institute of Technology,[6] and Los Alamos.[7] As the discrepancies of the ρ values are quite serious, during the last five months we have made a close examination of the possible systematic errors that we might have overlooked. Our present analysis of our data cannot account for this serious difference in ρ value.

We would like to acknowledge the interest, and particularly the effort in obtaining the funds for the construction of the 40-inch spiral-orbit spectrometer, of Professor E. O. Lawrence and Dr. Walter Barkas.

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Gamma Transitions in W^{182}†*

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A RATHER complicated γ-ray spectrum follows the β^- decay of Ta^{182}.[1] Sixteen transitions have been previously measured here with the curved crystal spectrometer.[2] Recent coincidence work by Mihelich[3] showed the relation between some high-energy lines and the first excited state of W^{182}. Using the precision axial focusing β spectrometer and the curved crystal spectrometer, a new investigation of the decay has been made. The Ta^{182} sources were produced by irradiation of metallic Ta in the Material Testing Reactor[4] (MTR, Arco, Idaho). The β-spectrometer sources were prepared by evaporation of the radioactive Ta (100 $\mu g/cm^2$) on mica. Most of the lines were studied with a momentum resolution of 2.5×10^{-3}. The L_I, L_{II}, and L_{III} conversion lines were resolved for all transitions below 264 kev. Their intensity ratios, together with the absolute conversion probabilities determined from β and γ-spectrometer data allows, in many cases, a unique

TABLE I. γ transitions in W^{182}.

Energy (kev)	Intensity γ ray	Intensity Total	Absolute conversion coefficients α_K	α_{LI}	α_{LII}	α_{LIII}	Multi-polarity
33.360±0.010	Weak	Weak	···	···	···	···	($E1$)
42.710±0.010	Weak	Weak	···	···	···	···	($E1$)
65.714±0.010	9	40	···	2.8	0.4	0.23	$M1(+E2)$
67.736±0.010	100	131	···	0.17	0.07	0.07	$E1$
84.667±0.010	6	53	···	1.85	0.6	0.5	$M1(+E2)$
100.092±0.012	46	247	1.5	0.13	1.4	1.35	$E2$
113.655±0.014	9	29	1.75	0.38	0.07	···	$M1$
116.398±0.014	2	(2)	···	···	···	···	···
152.408±0.023	43	46	0.07	···	···	···	$E1$
156.369±0.024	14	(15)	Small	···	···	···	($E1$)
179.360±0.030	19	31	0.41	0.17		0.05	$M1+E2$
198.305±0.036	9	13	0.24	···	0.11	0.07	$E2$
222.051±0.044	45	48	0.06	0.01	···	···	$E1$
229.266±0.046	24	28	0.16	···	0.05	0.03	$E2$
264.086±0.060	27	32	0.11	···	0.04	0.02	$E2$
927 ±1	···	2	···	···	···	···	($E3$)
960 ±1	···	2	···	···	···	···	($E3$)
1003 ±1	···	10	···		$K/L=7.0$		$E2$
1122 ±1	120	121	0.005		$K/L=6.7$		$E2+M1$
1155 ±1	8	8	0.004		···		($M2$)
1189 ±1	56	56	0.006		$K/L=6.5$		$E3+M2$
1222 ±1	115	115	0.003		$K/L=6.0$		$E2$
1231 ±1	58	58	0.003		···		$E2$
1289 ±1	···	(22)	···		$K/L=6.6$		($E3+M2$)
1375 ±2	···	(1)	···		···		($E3$)
1437 ±4	···	(1)	···		···		···
1454 ±4	···	(1)	···		···		($E3+M2$)

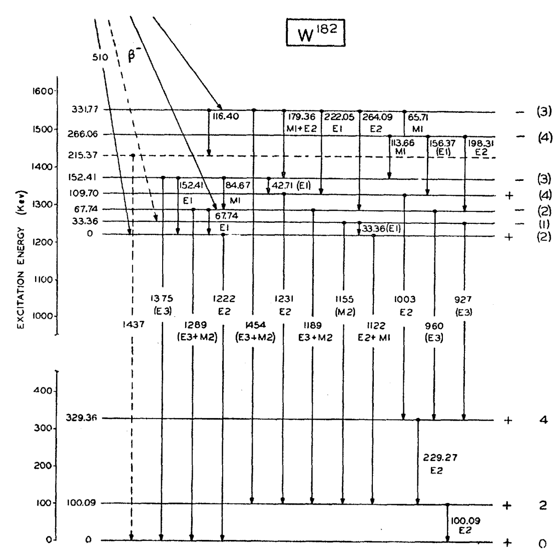

FIG. 1. Proposed energy level scheme for W^{182}. Data in parentheses ( ) are uncertain.