Electron-Neutrino Angular Correlation in the Beta-Decay of He^6

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The recoil nuclei emitted during the beta-decay of He^6 have been detected by means of an electron multiplier tube, and the beta-rays counted by means of an end window Geiger counter. The energy spectrum of the recoils has been studied by recording coincidences between the two detectors as a function of the retarding potential between a set of grids in the path of the recoils. Beta-recoil ion coincidences have been observed when the angle between the directions of emission of the beta-particle and of the recoil ion was 180 degrees and also 162 degrees. In both cases the best agreement was obtained when the recoil spectra were compared with the curves predicted by the $1-(v/3c)\cos\theta$ electron-neutrino angular correlation.

I. INTRODUCTION

THE fact has recently been emphasized by Crane[1] and Sherwin[2] that the principal field to be exploited with neutrino recoil experiments is the determination of the neutrino-electron angular correlation functions. Hamilton[3] has published a paper giving the angular correlation functions expected for allowed and first forbidden transitions. Five different interactions between the nucleons and the electron-neutrino fields were considered. The point that Hamilton has emphasized is that the angular correlation changes much more, from one interaction to another, than does the shape of the beta-ray spectrum. Consequently, recoil experiments have something to offer in this direction which cannot be obtained as well from the usual beta-disintegration studies.

Sherwin[4] has reported the results of his investigations of the momentum spectra of the recoil ions from very thin, perhaps monolayer, sources of P^{32} and Y^{90}. He has concluded that the $1-(v/c)\cos\theta$ angular correlation expected for either the scalar or pseudoscalar interactions agreed with the experimental curves for P^{32}. However, a function of the form $[1-(v/c)\cos\theta]^2$ fitted the observed data reasonably well. In the case of Y^{90} he concluded that the $[1-(v/c)\cos\theta]^2$ correlation was preferred rather than the $[1-(v/c)\cos\theta]$ relation. The correlation functions are given in terms of the velocity of the electron v, the velocity of light c, and the angle between the directions of emission of the electron and neutrino.

The use of a radioactive gas rather than a monolayer source eliminates any possible distortion of the shape of the recoil spectrum due to energy lost by the recoils in escaping from the surface of the source. He^6 is an almost ideal isotope for use as a geasous source and may be produced in quantities sufficient for the study of the recoil spectra. The most convenient reaction for producing He^6 is $Be^9(n,\alpha)He^6$ with neutrons of energies greater than about 0.6 Mev. He^6 is assumed to decay through the emission of an electron and a neutrino according to the scheme, $He^6 \rightarrow Li^6 + \bar{e} + \nu$, with a single beta-spectrum[5] of maximum kinetic energy of 3.5 ± 0.6 Mev. The recoil spectrum corresponding to this beta-decay should consist of Li^6 ions with energies up to about 1410 ev.

II. PRODUCTION OF He^6

The He^6 was produced by neutron bombardment of one pound of 200-mesh beryllium powder in a can placed near the Be target of the University of Chicago cyclotron. According to the results of Sherr,[6] no appreciable production of N^{16} through the reaction $O^{16}(n,p)N^{16}$ will occur if neutrons emitted at 90° with respect to the deuteron beam are used. Since there was a possibility of this reaction occurring in the alcohol used as a carrier, the source was placed in a

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[1] H. R. Crane, Rev. Mod. Phys. **20**, 278 (1948).
[2] C. W. Sherwin, Nucleonics **2**, 16 (1948).
[3] D. R. Hamilton, Phys. Rev. **71**, 456 (1947).
[4] C. W. Sherwin, Phys. Rev. **73**, 216 (1948); **73**, 1173 (1948).
[5] T. Bjerge and K. Broström, Nature **138**, 400 (1936); Dansk. Math.-Fys. Medd. **16**, 8 (1938).
[6] R. Sherr, Phys. Rev. **69**, 21 (1946).

position such that mainly 90° neutrons entered the Be powder.

The He^6 gas was swept out of the powder by ethyl alcohol vapor and carried through about 50 feet of $\frac{1}{4}$-inch O.D. copper tubing to the recoil chamber. The radioactive gas diffused into the recoil chamber after the alcohol had been removed in a trap cooled with liquid nitrogen. The total pressure of the residual gases and the radioactive gas in the chamber during the experiments was about 5×10^{-6} mm of Hg. Attempts were made to localize the volume of the He^6 gas by introducing the gas through a jet into the recoil chamber. The results indicated that the He^6 was not concentrated by means of the various jets that were tried. Although the jet action might have been improved by the use of a recoil chamber of large dimensions plus large capacity pumps, it was decided that a more efficient use of the gas could be made without a jet system. In the final apparatus the pressure of the He^6 gas was nearly constant throughout the recoil chamber.

III. APPARATUS

A schematic diagram of one of the recoil chambers is shown in Fig. 1. The beta-rays were defined either by the system of slits in tube *AB* or by the openings in tube *DC*, and the accompanying beam of recoil ions was defined by the slits 1, 2, and 6. In order to reduce the scattering of the beta-rays, the slit systems were fabricated from aluminum. The tubes *AB* and *CD* were made gas tight by Al foils in order to prevent the He^6 gas from diffusing into the region near the Geiger counter. Side tubes were provided to equalize the pressure during the initial evacuation of the system.

The beta-rays from the decay of He^6 were recorded by an end window Geiger counter with a mica window of 5.8 mg/cm². This counter could be moved to a postion of either *A* or *D*. The first three electrodes of the electron multiplier used to count the recoil ions are shown in Fig. 1. Ions emerging from grid 6 were accelerated by a potential difference of 4.5 kv between this grid and the first electrode of the multiplier tube.

A retarding potential method was used for the energy analysis of the recoil ions. The retarding voltage was applied to grid 4 located between the grids 3 and 5 which were at ground potential. In addition, a fourth grid near the opening into the multiplier tube reduced, but did not eliminate entirely, the penetration into the retarding potential system by the field from the multiplier tube electrodes.

The entire recoil apparatus, including the multiplier tube and the can containing the beryllium powder, was evacuated by means of a three-stage oil diffusion pump. A pressure of 10^{-5} to 10^{-6} mm of Hg was maintained in the multiplier tube and recoil chamber. An increase in the concentration of the He^6 gas was obtained by a reduction of the pumping speed by use of a valve in the vacuum manifold. In practice the pumping speed was reduced until the pressure in the recoil chamber increased to about 10^{-5} mm of Hg.

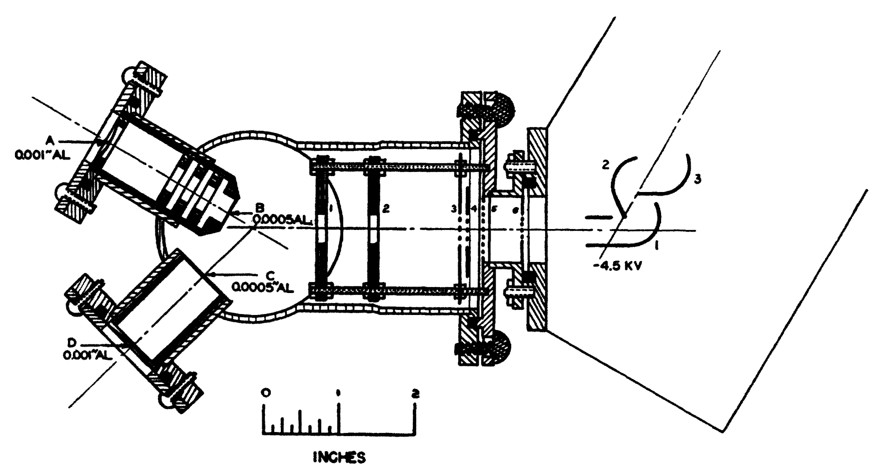

FIG. 1. A schematic diagram of the apparatus used for the retarding potential measurements of the energy spectrum of the recoil ions produced in the beta-decay of He^6. The recoils were counted by the electron multiplier tube and the beta-particles by a Geiger counter at window *A*. The retarding voltage was applied to grid 4.

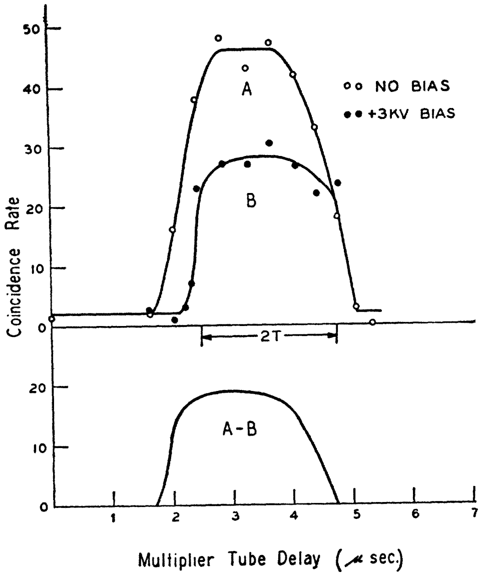

FIG. 2. The time response of the twofold coincidence circuit used during the measurements of the shape of the energy spectrum of the recoils emitted at 180 degrees from the beta-rays. The curve $A-B$ represents the number of coincidences resulting in recoil ions which could be stopped by the retarding voltage. The resolving time of the coincidence circuit is given by $2T$.

IV. COINCIDENCE CIRCUITS

The time of flight of the recoil ions, measured from the instant the beta-ray pulse was recorded, varied from about 0.45×10^{-6} sec. for 1400-volt recoil ions to 1.5×10^{-6} sec. for 100-volt recoils. In order to record the recoil spectrum from the maximum energy down to 100 volts or even lower, the minimum resolving time of the coincidence circuit was limited to a value of about 1×10^{-6} sec. This limitation of the resolving time proved to be most serious, since the high coincidence counting rate resulting from chance coincidences between beta-counts and recoil counts prevented the full use of the available production of He^6.

The circuits for recording the coincidences between the pulses from the beta-detector and the recoil detector consisted of two identical channels, each containing a pulse shaping network, a precision delay circuit, and a blocking oscillator. The outputs of the two blocking oscillators were fed into a diode coincidence circuit of the type described by Howland, Schroeder, and Shipman.[7] Since a continuously adjustable delay was needed, the multivibrator type of delay was used rather than a delay line. The delay multivibrators were of the cathode coupled type discussed by Chance.[8] In practice the delay in the channel connected to the Geiger counter was held constant at 10^{-5} sec., and the delay in the multiplier tube channel adjusted to obtain the required timing. The resolving time of the coincidence circuit was determined by the sum of the widths of the pulses from the two blocking oscillators. Resolving times ranging from 2×10^{-7} sec. to 2.2×10^{-6} were available.

The first measurements of the time response of the coincidence circuits were made with a coincidence chamber similar to that shown in Fig. 1, but having a beta-ray port in a position to permit the observation of coincidences caused by recoils emitted in a broad beam centered about 180 degrees with respect to the beam of disintegration electrons. The curves shown in Fig. 2 were obtained by recording the number of coincidences for various delays between the time of arrival of the pulses from the multiplier tube and the Geiger counter. Since the concentration of He^6 in the coincidence chamber did not remain constant during the course of an experiment, it was necessary to use either the Geiger counter or the multiplier tube as a monitor. The multiplier tube proved to be more reliable than the Geiger tube because of the extremely low background rate compared to the counting rate due to recoil ions produced near the first electrode of the multiplier tube.

Curve A of Fig. 2 represents the number of coincidences observed at various delays in the absence of a retarding potential, whereas curve B represents the number observed with a retarding potential of 3 kv. Since a retarding potential of this value should have been more than enough to prevent the recoils from passing through the grid system and into the multiplier, the counts observed resulted from recoils produced in the region between grid 5 and the first electrode of the tube. The disintegration electron in coincidence with a given recoil ion entered the Geiger tube after passing through the grid system. The curve $A-B$ represents the contribution to the total coincidence count from the

[7] B. Howland, C. A. Schroder, and J. D. Shipman, Jr., Rev. Sci. Inst. 18, 551 (1947).

[8] B. Chance, Rev. Sci. Inst. 17, 396 (1946).

region between grid 4 and the Al window in front of the Geiger counter. This explanation is in agreement with the observation that the low energy edge (short delay time) of curve *A–B* is displaced to the left of the knee (at a delay of 2.5×10^{-6} sec.) of curve B by about 0.8×10^{-6} sec. This delay corresponds to the time required for a 300-volt Li^6 ion to travel the length of the coincidence chamber. Apparently, there are relatively few ions present in the recoil spectrum with energies less than 300 volts.

In Fig. 3 are shown a set of delay curves obtained with the Geiger counter at window *A* in the apparatus of Fig. 1. The cylinder in front of the counter did not have the system of slits as indicated in the diagram, but was closed at the inner end with an Al foil as shown in *C*. The curves have the same significance as those of Fig. 2. It was hoped that curve *B* would be absent with this arrangement, since disintegration electrons originating from the region between the multiplier tube and grid 4 could not enter the Geiger counter without having been scattered at least once. The presence of curve *B* can be explained in terms of electrons produced beyond grid 4 and entering the Geiger counter after having been scattered from the inner surface of the cylinder *AB*. Additional measurements indicated that most of the observed coincidences represented by curve *A–B* were due to disintegrations occurring between slits 1 and 2 of Fig. 1.

V. COUNTING EFFICIENCY OF THE MULTIPLIER TUBE

Since the multiplier tube was operated with the first electrode at a potential of −4.5 kv with respect to the recoil chamber, the energy of the Li^6 ions arriving at this electrode varied from 4.5 kev to 5.9 kev. In order to interpret correctly the observed shape of the recoil spectra, a knowledge of the relation between the efficiency of the multiplier tube and the energy of the ions was required. This relation was obtained from an investigation of the efficiency of a multiplier tube used to count Li ions from a spodumene source. The method of measuring the efficiency of the tube was similar to that used by Allen[9] for an experiment on electron counting.

[9] J. S. Allen, Rev. Sci. Inst. 18, 739 (1947).

When the discriminator bias of the scaler input circuit was set at a value low enough to permit essentially all the pulses to be recorded, the efficiency was observed to be constant for Li ions with energies from 2.5 to 6.5 kev. The energies referred to are those acquired by the ions upon arrival at the first electrode of the multiplier tube. Approximately 90 percent of the ions in this energy range striking the first electrode were recorded. In view of these results, it was possible to operate the multiplier tube in the He^6 experiment under conditions such that the counting efficiency was independent of the energy of the recoils.

VI. BETA-RAYS FROM He^6

A determination of the maximum energy of the He^6 beta-spectrum was made by the absorption method. The He^6 gas was pumped continuously through a cell consisting of a one-inch length of $\frac{7}{8}$-inch I.D. brass tubing. This cell had a 1-mil thick Al window at either end. Two end window Geiger counters were used, one as a monitor of the number of betas passing through

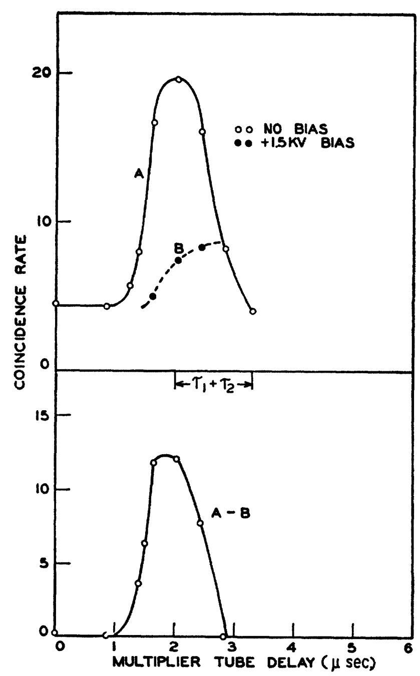

FIG. 3. The time response of the twofold coincidence circuit used during the measurements of the shape of the energy spectrum of the recoils emitted at 162 degrees from the beta-rays. The resolving time of the coincidence circuit is given by T_1+T_2.

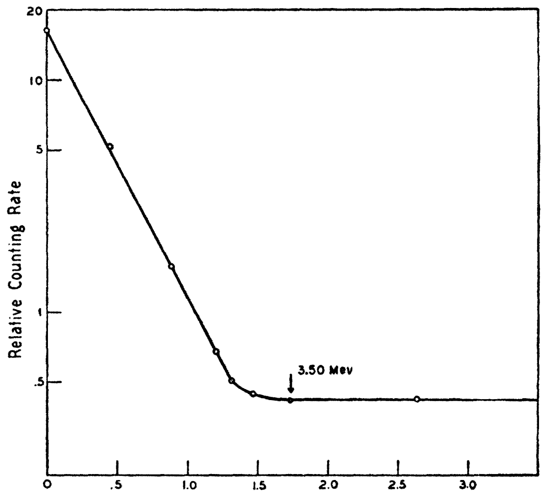

FIG. 4. Absorption in aluminum of the beta-rays from He^6. The counting rate beyond the end point of the spectrum is a background due to gamma-radiation from the cyclotron.

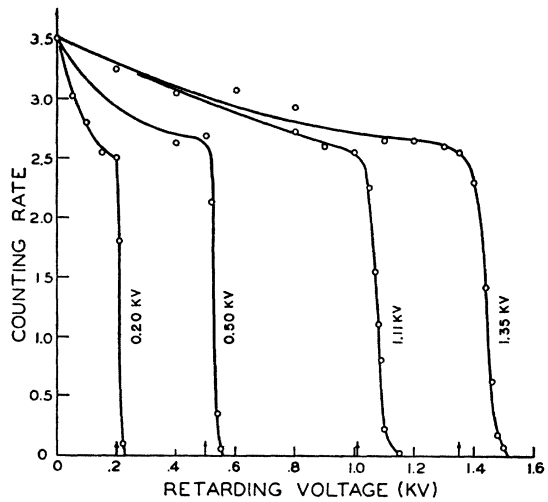

FIG. 5. A series of retarding potential curves for Li ions from a spodumene source. The initial energy of the ions is indicated on each curve. These curves were used to supply the corrections applied to the similar curves obtained for the recoil ions produced in the decay of He^6.

one of the windows and the other to measure the absorption of the beta-rays in Al.

The absorption in Al of the beta-rays of He^6 is shown in Fig. 4. A Feather analysis of the absorption curve gave an absorption limit of 1.74 g/cm² corresponding to an end point of 3.50 Mev, as calculated from Feather's equation, or 3.47 Mev from the relation given by Glendenin.[10] A value of 1.6 g/cm² has been reported by Sherr[11] for the range of the beta-rays of He^6. When the spread of the data near the end point of Sherr's curve is considered, the range of 1.74 g/cm² probably is within the experimental accuracy of his measurements. The value of 3.50 Mev will be used for the end point of the He^6 beta-ray spectrum in the computation of the recoil spectra resulting from this decay process. The largest deviation of the counting rate from a constant value was 3.6 percent for absorbers beyond the end point of the beta-spectrum. Since this departure was just twice the relative probable error in the counting rate, this counting rate was assumed to be a background due entirely to the gamma-radiation from the cyclotron.

VII. RETARDING POTENTIAL CORRECTIONS

Because of the use of the retarding potential method of energy analysis, the measured recoil spectra must be subjected to a considerable correction. The need for this correction is based upon the fact that the recoil ions go through the retarding potential grid system in parabolic paths and also experience a focusing action resulting from the inhomogeneous fields near the grid wires. As a result, the ion beam diverges, and a fraction of the beam fails to enter the multiplier tube. Jacobsen and Kofoed-Hansen[12] have emphasized the fact that the low energy end of the recoil spectrum will be greatly exaggerated if a suitable correction is not applied.

An attempt was made to determine the type of correction required with the retarding potential system shown in Fig. 1. A Pt filament coated with spodumene was placed inside the recoil chamber at the intersection of the lines *AB* and *CD*. Li ions were accelerated from this source to a coarse mesh grid and passed through the grid system in a broad beam. With this arrangement retarding potential curves were obtained for beams of Li ions of known energies. A series of retarding potential curves obtained in this manner is shown in Fig. 5. The initial energy of the ion beam is indicated on each curve. It is evident that corrections have to be applied to the observed cut-off potential and also to the

[10] L. E. Glendenin, Nucleonics **2**, No. 1, 12 (1948).
[11] R. Sherr, Phys. Rev. **69**, 21 (1946).
[12] J. C. Jacobsen and O. Kofoed-Hansen, Danske. Math.-Fys. Medd. **23**, paper 12 (1945).

shape of the curves in the region from zero retarding potential to the knee of a particular curve.

The procedure followed in applying the connections to the retarding potential curves of the recoils from the decay of He^6 was to multiply the applied retarding voltage by a correction factor obtained from the curves of Fig. 5. As a result, the corrected energy of the recoils was approximately 6 percent lower than that corresponding to the applied retarding potentials.

In order to compare the observed retarding potential curves with those predicted for various neutrino-electron angular correlation functions, a differential distribution curve giving the number of recoils per unit energy interval as a function of the recoil energy was computed for a given correlation function. By means of graphical integration the differential plot was converted into an integral, retarding potential curve. Since these computations had to be performed, it was more convenient to apply a correction to the theoretical curves rather than to the observed data. In effect, a hypothetical beam of recoil ions having a distribution predicted by a given angular correlation function was sent through the retarding potential system. The retarding potential curve expected from this operation was exaggerated at the low energy end by the appropriate correction and then compared with the observed data.

The actual form of the correction was obtained from the calibration data of Fig. 5 under the assumption that these curves represented the shape of the retarding potential curves of the corresponding energy intervals in the He^6 recoil spectrum. Later experiments indicated that the effective He^6 source was nearer the multiplier tube than the spodumene source. This would require somewhat larger corrections than those actually applied.

VIII. He^6 RECOIL SPECTRA

The first measurements of the shape of the spectrum of the recoils from the decay of He^6 were made with an apparatus similar to that of Fig. 1, but with a beta-ray port at 180 degrees with respect to the recoil counter. In order to determine the proper delay to be introduced between the Geiger counter and the multiplier tube the delay curves shown in Fig. 2 were used. The pulses from the multiplier tube were delayed by 3.3×10^{-6} sec. (measured from an arbitrary zero of time). With this delay, the total resolving time of 2.25×10^{-6} sec. for the response of both coincidence circuits was sufficient to allow practically the entire recoil spectrum to be recorded.

In the 180-degree arrangement the location of the effective He^6 source was made difficult by the fact that electron-recoil ion coincidences occurring at any point in a roughly cylindrical volume could be recorded. This volume was defined by the slit system, the retarding potential grids, and the Al window for the beta-rays. An estimate of the actual location of the source was obtained by recording the coincidence rate as a piece of Al foil was moved inside the recoil chamber from a position near the Geiger counter to a position near the retarding potential grids. The Al foil served as a baffle for the recoil ions, but was transparent to the beta-rays. As a result of this experiment it was concluded that

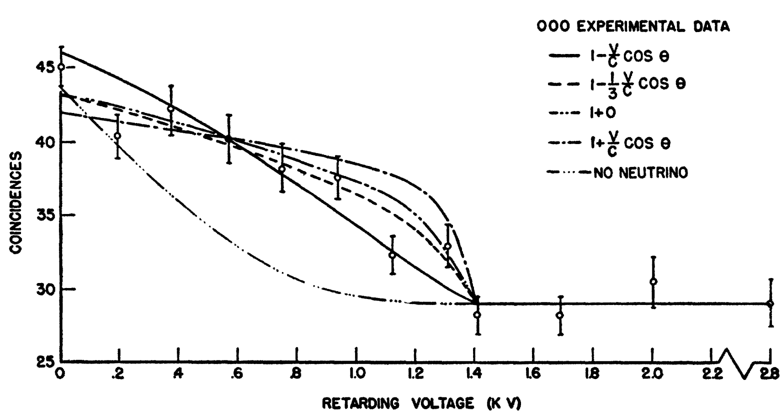

FIG. 6. Experimental and theoretical retarding voltage curves for the recoil ions produced in the decay of He^6. The beta-ray counter was in a position to record electrons emitted at an angle of 180°±15° with respect to the direction of the beam of recoil ions.

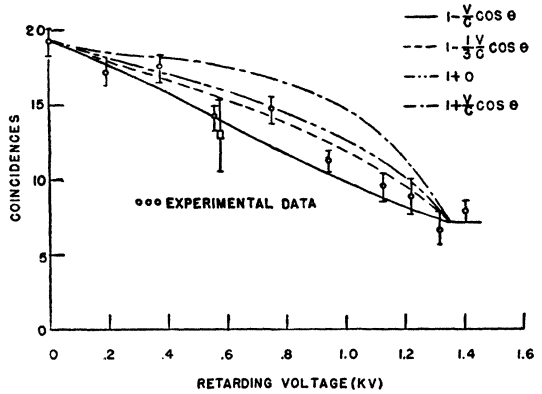

FIG. 7. Experimental and theoretical retarding voltage curves for the recoil ions from the decay of He^6. The beta-ray counter was in a position to record electrons emitted at an angle of $162°\pm8°$ with respect to the direction of the beam of recoil ions. The open circles represent data recorded without baffles in front of the Geiger counter. A measurement made with a set of baffles which reduced the beta-ray scattering is represented by the open square at a retarding voltage of approximately 0.6 kv.

most of the coincidences originated in a region extending from grid 3 to slit 1 of Fig. 1. In order to compute the retarding potential curves expected for various electron-neutrino angular correlation functions, it was assumed that the beta-rays entered the Geiger counter in a conical beam of 15 degrees half-width and that the recoil ions entered the multiplier tube in a beam of parallel rays.

The retarding potential curves for the recoils from the decay of He^6 as obtained with the 180-degree arrangement are shown in Fig. 6, where the number of coincidences per 3.2×10^4 multiplier tube counts is plotted against the retarding voltage. A correction has been applied to the applied voltage as described in Section VII. The constant number of coincidences observed for retarding potentials greater than 1.4 kv was due partly to coincidences originating between the grid system and the multiplier tube. The number of chance coincidences caused by the relatively high beta- and positive ion counting rates averaged about 4 and is included in the constant background.

The presence of the large chance coincidence count was a serious limitation to the accuracy of the experiment. In practice the neutron yield from the cyclotron occasionally varied enough during a run to change the chance rate by 50 percent or more. The rather large deviations of some of the experimental points from a smooth curve probably were caused by this variation in the chance coincidence rate. This effect could have been reduced by decreasing the rate of production of He^6, but with an almost corresponding decrease in the true coincidence rate.

The no neutrino curve of Fig. 6 was computed with the assumptions that the momentum of the nucleus is equal and opposite to that of the beta-particle and that the shape of the beta-spectrum is correctly given by the Fermi distribution. The additional curves were computed for four possible neutrino-electron angular correlation functions, including the case of a constant angular correlation. The computed curves have been corrected for the distortion of the shape of the recoil spectrum as a result of the use of the retarding potential method of energy analysis. The end point of the He^6 beta-spectrum was taken to be at 3.5 Mev in computing these curves.

Additional retarding potential measurements were made with the Geiger counter at window A of the recoil chamber shown in Fig. 1. In order to reduce the chance coincidence rate the resolving time of the coincidence circuits was reduced to a value of 1.3×10^{-6} sec. The delay curve for the coincidences observed with this arrangement is shown in Fig. 3. A delay of 2×10^{-6} sec. (arbitrary zero of time) in the multiplier tube circuit was used during the measurements of the recoil spectrum.

The data obtained with the slit system removed from the tube A–B are represented by the open circles in Fig. 7, where the number of coincidences per 6.4×10^4 multiplier tube counts has been plotted against the retarding voltage. With this arrangement most of the coincidences originated in a region extending about one cm on either side of slit 1 as shown in Fig. 1. In computing the theoretical curves of Fig. 7 it was assumed that the beta-rays coming from this

TABLE I. Expected correlations for allowed transitions.

Interaction	Correlation function
Scalar:	$P_1(\theta)=1-(v/c)\cos\theta$
Polar vector: Fermi rules.	$P_2(\theta)=1+(v/c)\cos\theta$
Tensor: Gamow-Teller rules.	$P_3(\theta)=1+(v/3c)\cos\theta$
Axial vector: Gamow-Teller rules.	$P_4(\theta)=1-(v/3c)\cos\theta$
Pseudoscalar:	$P_5(\theta)=1-(v/c)\cos\theta$

source entered the Geiger counter in a conical beam with apex at the center of this source. The beam had a half-width of 8 degrees, and the mean angle with the beam of recoil ions was 162 degrees. The computed curves have been corrected for the distortion expected through the use of the retarding potential method of energy analysis.

In order to reduce the scattering of the beta-rays from the inside surface of the tube in front of the Geiger counter, the system of defining slits shown in tube A–B was used with the Geiger counter at A. With this arrangement the half-width of the beam of beta-rays was 6 degrees, and the mean angle with the beam of recoil ions was 154 degrees. Although the coincidence rate was extremely low, coincidences were obtained at retarding potentials of 0, 600, and 1500 volts. The number of coincidences observed at a retarding potential of 600 volts is shown by the open square of Fig. 7. An appropriate adjustment of the ordinate scale has been made so that the numbers of coincidences observed at 0 and at 1400 volts agree with the corresponding values of the computed curves. The fact that the number of coincidences observed at 1500 volts agreed within the statistical error with that expected from chance coincidences indicated that the scattering of the beta-rays had been greatly reduced.

IX. CONCLUSIONS

Since the change of nuclear spin during the decay of He^6 is probably from $I=0$ to $I=1$, the transition is forbidden according to the selection rules of the original Fermi theory of beta-decay. In order to explain the fact that the experimental values of the lifetime and maximum beta-ray energy for this decay process indicate an allowed transition, it is necessary to assume Gamow-Teller selection rules. According to these rules an allowed transition is permitted for $\Delta I=1, 0$.

Hamilton[3] has calculated the expected correlation functions, giving the relative probability for the emission of a beta-particle and a neutrino with an angle θ between the two directions of emission. The correlations expected for allowed transitions are listed in Table I. If the Gamow-Teller selection rules explain the He^6 decay, either the $1+(v/3c)\cos\theta$ or the $1-(v/3c)\cos\theta$ correlation functions are possible choices of a function which should agree with the observed electron-neutrino angular correlation.

In the case of the 180-degree retarding potential curves shown in Fig. 6 the no neutrino curve is strongly contradicted by the experimental data. Because of the inaccuracy of the data it is not safe to say more than that the $1+(v/c)\cos\theta$, $1+(v/3c)\cos\theta$, and probably the $1-(v/c)\cos\theta$ correlations are ruled out. The best agreement is with the $1-(v/3c)\cos\theta$ correlation, although the isotropic distribution is not entirely ruled out. In the case of the 162-degree curves shown in Fig. 7, the best agreement is with a curve located between the $1-v/c\cos\theta$ and the isotropic distribution. The $1-(v/3c)\cos\theta$ correlation is a reasonably good choice for this curve. Because of the large statistical error in the datum represented by the open square, it is safe to conclude that only the curves above the $1-(v/3c)\cos\theta$ correlation curve are ruled out. However, since the average angle between the beta-rays and the recoil ions for this measurement was 154 degrees rather than 162 degrees, the data obtained at this angle should lie slightly below that obtained at 162° and represented by the open circles.

The results of this experiment seem to rule out the "no neutrino" assumption and give some indication of agreement with the $1-(v/3c)\cos\theta$ correlation predicted by the axial vector form of interaction which follows Gamow-Teller selection rules. As mentioned above, the He^6 decay is expected to be governed by this type of selection rule. It is hoped that further experiments with He^6 will lead to a more critical choice of the appropriate beta-interaction or combination of interactions.

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