to low energy charged primary particles which would then account for the relatively large increase, 50 percent of intensity in the stratosphere of May 11 compared to the absence of a measurable effect (less than two percent) at sea level.

Johnson and Korff[6] measured the total cosmic-ray intensity at 64,000 ft. elevation during a solar flare of July 27, 1938 but found no change from the normal within the accuracy afforded by their apparatus. The measurement was made with a counter telescope so that at this elevation a large fraction of the counts would be due to electrons produced by the higher energy primary particles of the cosmic radiation.

We wish to thank the Office of Naval Research for arranging these balloon flights with the General Mills Aeronautical Laboratory and Mr. C. B. Moore of the latter laboratory for his great assistance.

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The Beta-Spectra of Zn^{62} and Cu^{62}

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THE beta-spectrum of the ten-minute Cu^{62} isotope has recently been studied by Becker, Kirn, and Buck[1] in a beta-spectrometer using sources of copper foil which had been irradiated with 22-Mev x-rays from the Illinois betatron. The method of observation required the use of rather thick sources (11 mg/cm²). Also because of the short lifetime of Cu^{62} a number of samples had to be used making it necessary to normalize each observed interval with the preceding one.

A more convenient method of observing the Cu^{62} spectrum would be to use its parent Zn^{62} as a source. Zn^{62} was reported by Miller, Thompson, and Cunningham[2] as a K-capture activity with a half-life of 9.5 hours; thus the Cu^{62} formed by the decay of Zn^{62} would appear to decay with this longer lifetime. A sample of Zn^{62} was prepared by bombarding a thick copper target with 100-Mev deuterons in the 184-inch Berkeley cyclotron. The Zn^{62} was separated by first electroplating out the majority of the copper and then performing a chemical separation on the remainder using 100 micrograms of carrier. The source was prepared by mounting a portion of the sample of ZnS on a backing of Formvar film so that the total source thickness was less than 0.1 mg/cm². The beta-spectrum is shown in Fig. 1. There are three features in this

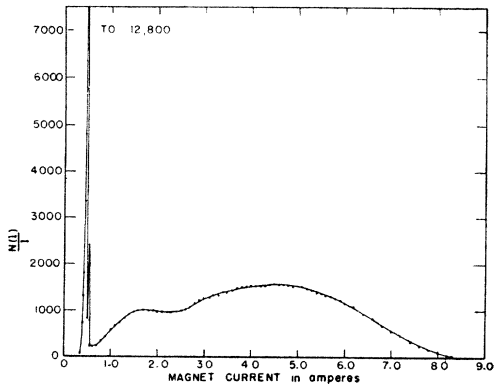

FIG. 1. The momentum spectrum of the positrons and conversion electrons from a source of Zn^{62} and its daughter Cu^{62}.

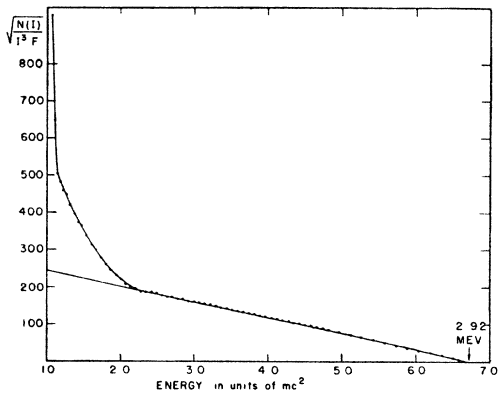

FIG. 2. The Fermi plot of the positron spectrum from a source of Zn^{62} and Cu^{62}.

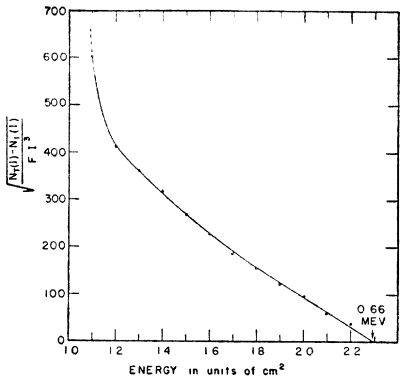

FIG. 3. The Fermi plot of the positron spectrum of Zn^{62} after the contribution of the daughter Cu^{62} has been subtracted.

spectrum, a high energy positron component arising from the decay of Cu^{62}, a lower energy positron component arising from the decay of Zn^{62}, and two conversion lines corresponding to the K and L conversion peaks of a 41.8±0.2 kev gamma-ray following the decay of Zn^{62} since the energy separation of the K and L lines is equal to the separation of the K and L binding energies in copper. At this low energy the absorption of the 0.4 mg/cm² Nylon window of the Geiger counter has considerable effect so that the K conversion line is absorbed more than the L conversion line. Hence the observed ratio of the number of K and L conversion electrons would set a lower limit of the actual ratio. The observed ratio is 6.4 and would correspond to either an electric or magnetic dipole transition. A Fermi plot of the positron spectrum is shown in Fig. 2. The upper limit of the Cu^{62} positron spectrum is 2.92±0.02 Mev, slightly higher than the value of Becker. Subtraction of the extrapolated straight line Fermi plot for Cu^{62} from the total spectrum gives the Fermi plot for Zn^{62} shown in Fig. 3. The upper energy limit is 0.66±0.01 Mev. The curvature in this Fermi plot can be attributed to a small amount of back-scattering from the much more intense Cu^{62} spectrum. The measured half-life is 9.33 hours. Comparison of the number of positrons in both the Zn^{62} and Cu^{62} spectra indicates that Zn^{62} decays about 10 percent of the time by positron emission and the remainder by K-capture. According to the Fermi theory of beta-decay positrons should be emitted 25 percent of the time. This sort of discrepancy is common because of the strong energy dependence of the probability for positron emission. The nuclear matrix elements should be the same for positron emission and K-capture. Perhaps a slight error in the determination of the upper energy limit would account for the discrepancy. However, another possibility is the lack of

knowledge of the branching ratio of Zn^{62} decay where the decay might take place to two states separated by 41.8 kev. This would be difficult to determine without experimental knowledge of the conversion coefficient. The Cu^{62} has a $f\tau_{\frac{1}{2}}$ value of 13.4×10^4 and Zn^{62} has a $f\tau_{\frac{1}{2}}$ value of 5.3×10^4 (taking into account the decay by K-capture and positron emission) which classifies both spectra as allowed.

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The Sn^{117} Isomeric Activity

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THE 14-day tin activity has recently been assigned to Sn^{117} by Mihelich and Hill[1] and by Mallary and Poole[2] who activated electromagnetically enriched isotopes of tin with slow neutrons.

A sample of Sn^{117} of high specific activity was prepared for observation in a magnetic lens spectrometer by bombarding a thick target of antimony with 100-Mev deuterons in the 184-inch Berkeley cyclotron. The Sn^{117} activity was separated from the antimony target by selective precipitation as sulfides thus requiring the addition of a relatively large amount (5 mg) of tin carrier. A source was prepared by mounting the SnS_2 on a Formvar film backing so that the total source thickness was about 1 mg/cm^2. The observed spectrum is shown in Fig. 1. Two conversion peaks are present at 127.0 and 152.5 kev corresponding to the K and L conversion for a transition with an energy of 0.157 ± 0.002 Mev. This value is slightly smaller than the value of 0.159 Mev obtained by Mihelich and Hill.

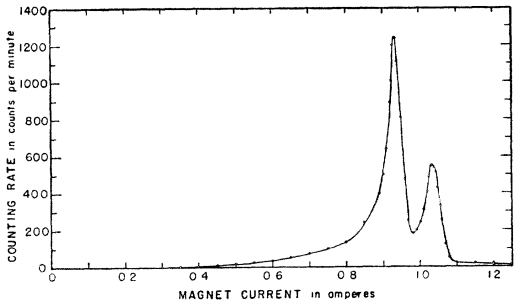

FIG. 1. The observed spectrum of conversion electrons from Sn^{117} before correction for the finite resolution of the spectrometer.

From the half-life of 14 days and the energy of 0.157 Mev the transition corresponds to a transition of order five according to the classification of Axel and Dancoff.[3] The experimental ratio of the number of K and L conversion electrons is 2.2 taking into account the resolution of the spectrometer. With a value $l=5$ the theory of Hebb and Nelson[4] gives 0.95 as the theoretical K/L ratio for electric transitions and 2.85 for magnetic transitions. With $l=4$ the theoretical K/L ratio is 3.84 for magnetic transitions. Therefore in order to account for the experimental value of the K/L ratio, a mixture of 2^5 pole electric and 2^4 pole magnetic radiation must be postulated.

The author wishes to thank Professor A. C. Helmholz for helpful discussions during the course of the experimental work described in this and the preceding letter and also to thank the Radiation Laboratory of the University of California for making some of their facilities available to him.

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Magnetic Resonance in Antiferromagnetic Materials near the Curie Temperature*

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AN investigation[1,2] has been made of the magnetic resonance absorption of an antiferromagnetic material. Cr_2O_3 was selected for the initial experiments because it is a stable compound that has a Curie point at a convenient temperature. Honda and Sone[3] have reported a Curie temperature of 34°C for Cr_2O_3 while Foex and Graff[4] gave a higher value of 47°C.

The material was introduced into a rectangular cavity which formed one arm of a microwave bridge. The absorption was obtained by measuring the change of intensity of the reflection from the cavity which was slightly mismatched with respect to the line A d.c. magnetic field was set perpendicular to the microwave magnetic field. The procedure followed was to hold the frequency constant at 9300 Mc and sweep the d.c. magnetic field through the resonance peak at various temperatures, ranging from 150°C to liquid air temperature. A small field-dependent absorption has been eliminated from the data given below. We obtain, as a function of the temperature, the height of the absorption peak (h), and the value of the d.c. magnetic field (H_0) at the point of resonance.

We have found that h varies with the temperature of the powdered sample as shown by Fig. 1. It is noticed that h decreases abruptly at about 38°C indicating a drastic change in the nature of the absorption. Through the paramagnetic range, H_0 was constant at approximately 3450 oersteds.

Magnetic susceptibility measurements[5] made on the sintered Cr_2O_3 used are shown in Fig. 2. It is noticed for this material that the Curie temperature is 38°C, close to the point where the break in the resonance absorption occurs. It is believed, therefore, that the sudden decrease in the resonance absorption can be attributed to the change of Cr_2O_3 from the paramagnetic to the antiferromagnetic state.

The amount of absorption occurring below the Curie temperature depended upon the nature of the material. When the Cr_2O_3 was in a powdered form two absorption peaks were found. H_0 for one peak was independent of temperature and equal to the value found in the paramagnetic region. H_0 for the second peak decreased as the temperature decreased as illustrated in Fig. 3. At -64°C the two peaks are well resolved, occurring at 3450 and 660 oersteds, respectively. When the Cr_2O_3 was prepared as

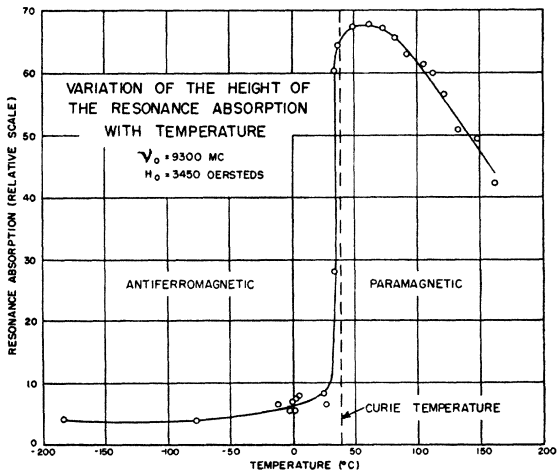

FIG. 1. Variation of the height of the peak (h) of the resonance absorption with temperature of powdered Cr_2O_3. The vertical broken line indicates the Curie point as determined by an independent measurement of the paramagnetic susceptibility on the sintered material investigated.