of the Λ, but instead spoils the coplanarity of the K^0.

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[10] A picture of a possible Ξ^0 was submitted by the Pic du Midi group to the Proceedings of the Second United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, 1958 (United Nations, Geneva, 1958).

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SEARCH FOR ENHANCEMENT OF BREMSSTRAHLUNG PRODUCED BY 575-Mev ELECTRONS IN A SINGLE CRYSTAL OF SILICON*

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Dyson and Überall[1] and Purcell[2] have predicted that considerable deviation from the Bethe-Heitler formulas for high-energy bremsstrahlung and electron pair production is expected in case the target material is crystalline. The basis of this effect is the low momentum transfer $\vec{q}$ to the Coulomb field in these processes. Bremsstrahlung by a 600-Mev electron leading to a 300-Mev photon leads to a momentum transfer to the Coulomb field down to a minimum value of 500 ev/c. Hence if such a transfer $\vec{q}$ corresponds to a reciprocal lattice vector of the crystal, the screened Coulomb field of the various atoms acts coherently and the production amplitude is enhanced. Detailed calculations of this effect have been carried out by Überall[3]; this experiment was aimed at checking these predictions.

A single-crystal plate of silicon of 0.013-in. thickness was placed in the analyzed beam of the Stanford electron linear accelerator. The crystal was mounted in a double goniometer to permit rotation of the crystal about two coplanar perpendicular axes perpendicular to the beam. The zero position of the goniometer was adjusted to correspond to the (100) plane of the crystal perpendicular to the beam; this orientation was established by Laue back-reflection photographs using a standard metallographic camera.

X-rays radiated in the crystal were detected by letting them produce photopions of specified energy in a polyethylene target. The positive pions were counted in a scintillation counter after magnetic analysis via the μ-decay positrons. The counting rate was examined as a function of "scanning" the goniometer over a range of approximately ±0.04 radian about both axes in steps of approximately 0.010 radian. About 1500 counts per point were taken. No statistically significant dependence of x-ray intensity on crystal orientation was found.

This result was assessed quantitatively by folding the functions computed by Überall into the angular resolution of the experiment as defined by the multiple scattering of the primary beam in the crystal target itself. Since this scattering involves small momentum transfers also, one could expect crystal coherence effects here as well, and therefore measured rather than computed scattering angles were used in the computation of the "expected" x-ray intensity variation as a function of angle between the crystal planes and the incident electron beam angle.

Figure 1 is a map of the counts obtained as a

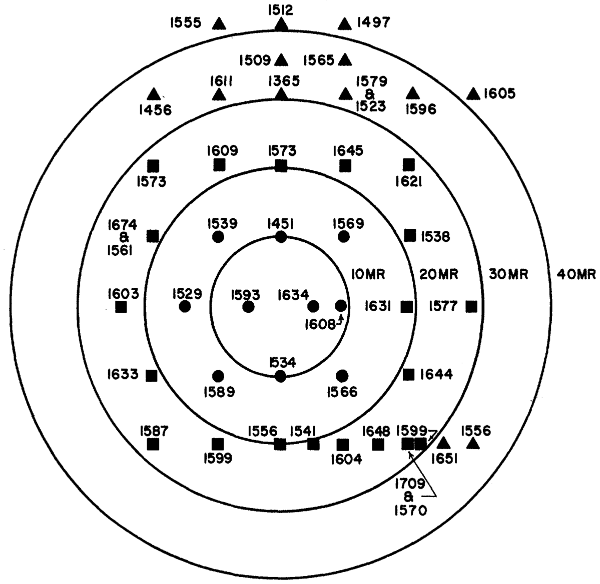

FIG. 1. The circles shown are lines of equal angle between the direction of the incident electron beam and the [100] axis of the Si crystal in which bremsstrahlung is produced. The angles are shown in milliradians (mr). Each point represents the measured intensity in counts of bremsstrahlung near an energy of 235 Mev.

function of crystal orientation about two orthogonal axes. Drawn on this figure also are circles of expected equal intensity. Clearly no significant correspondence exists. Qualitatively, the mean value of the central points (circles), in a zone of 8×10^{-3} radian mean angular displacement, is 1556 ± 13; the average of the points (squares) in a zone of mean angular displacement of 0.02 radian, is 1602 ± 9; and the average of points (triangles) in a zone of mean angular displacement of 0.035 radian is 1541 ± 10. The "expected" counts should be in the ratio 22: 19.5: 17.4, using the Überall calculation for a crystal temperature at absolute zero.

We find it difficult to account for this discrepancy. The effect of lattice vibration has been discussed by Überall, and on the basis of his calculations is insufficient to suppress the effect to the extent needed to fit the data. More detailed calculations on this point are in progress.[4] The question whether sufficient radiation dislocation could have occurred during bombardment has been examined; assuming an activation energy of 25 ev for a dislocation, only 5×10^{-6} of the Si atoms would have been affected. The crystals were furnished to us via Professor J. W. M. DuMond, California Institute of Technology, by Mr. W. R. Runyon of the Texas Instrument Company, Dallas. Mr. Ronald Willems, California Institute of Technology, kindly ran x-ray "rocking curves" on the crystals used: the angular half-width at half-maximum is only 8×10^{-4} radian; this is negligible for our considerations. Laue back-reflection pictures taken before and after our bombardments showed no observable deterioration.

We are unable to suggest an explanation for this result other than possibly the lack of validity of some of the approximations made in the calculations on the effect of lattice vibrations, or possibly of the Born approximation.

We are greatly indebted to Mr. Richard Bush, of the Stanford Department of Metallurgical Engineering, for the use of the Laue camera. We are also indebted to Professor J. W. M. DuMond for furnishing the crystals and for valuable advice. We wish to thank Dr. G. L. Pearson of Bell Telephone Laboratories, for informing us about the techniques of lapping single crystals of Si and their chemical etching.

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NONMESONIC/MESONIC DECAY RATIO OF HELIUM HYPERFRAGMENTS*

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In order to understand the decay interactions of the bound Λ^0,[1-6] it is important that the nonmesonic/mesonic ratio (Q) in the decay of hyperfragments be experimentally well determined. Previously reported experimental values of Q for ${}_\Lambda\mathrm{He}$ (2.3 ± 1.0; 1.1 ± 0.5)[7,8] disagree with the existing calculations[4,5] ($4 \leq Q \leq 10$). Notwithstanding the present uncertainties in the theoretical work, which have been recently discussed by Dalitz,[5] certain refinements in the experimental work are desirable. It is known that K^- capture stars are prolific sources of hyperfragments. Thus problems of contamination in the event samples are diminished and the increased number of events allow the results of kinematic analysis of the nonmesonic events to be studied. Track thickness ionization measurements in the Ilford fine-grain $K5$ and $L4$ emulsion allow the use of a rigid event-selection criterion.

In this emulsion experiment we have obtained 33 examples of nonmesonic decay of ${}_\Lambda\mathrm{He}$, which were produced in K^--capture stars, had ranges $\geq 59\ \mu$, and decayed with the formation of two visible prongs. (The K^- mesons were produced at the Bevatron; they interacted at rest.) The 33 events were selected by means of track-thickness[9] (profile) and gap-count measurements on the connecting tracks. The results of the profile calibration measurements made on known charge 1 and 2 tracks are shown in Fig. 1. The dotted line is seen to separate the $Z = 1$ and $Z = 2$ calibration points at all dip angles to the extent that an individual $Z = 1$, 2 track can be charge identified to ~95% level-of-confidence. No $Z = 3$ calibration was necessary since the range distribution of the