Angular Distribution of the μ-Decay as Test of Parity Conservation.

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It has been shown by LEE and YANG [1] that if parity is not conserved in weak interactions, angular asymmetries may arise in some decay processes. For instance, in the π-μ decay, as a result of the non-conservation of parity, the muon could be polarized parallel to its direction of motion; in the subsequent decay the distribution of the angle θ of the electron with this direction, chosen as polar axis, is then predicted to be asymmetric.

In order to detect such an effect, an experiment using π-μ-e events in nuclear emulsions is in progress in which the spatial angle θ between the directions of emission of the μ-meson and of the electron is measured. The 1000 μm thick emulsions have been exposed to the π^+ beam of the Chicago synchrocyclotron. The plates were shielded from external magnetic field, which, as pointed out by FRIEDMAN and TELEGDI, would cause Larmor precession of the muon, thus destroying the possible polarization [2]. Special care has been taken to avoid systematic errors in the angular distribution, which may originate from a biased selection of the events or from the systematic loss of electrons emitted in a particular direction. The first cause of errors has been practically eliminated by scanning the plates under low magnification only for π-μ and not for μ-e events. The second source of errors may arise from the cases: *a*) no visible electron track at the end of the μ-meson; *b*) misinterpretation of crossing minimum tracks. Both *a*) and *b*) were reduced by discarding all events in which the μ-meson stopped at less than 50 μm from the surfaces of the emulsions. *a*) is then negligible, as only in 8 out of 2011 cases a minimum secondary was not observed. The bias introduced by *b*) is difficult to be estimated but believed to be also quite small. In the central region of the emulsion both *a*) and *b*) may slightly favour small values of θ, due to the presence of the ending μ track.

In Fig. 1 is given the observed distribution of θ for a total number of 2003 events. The best fit to the points is

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(1) T. D. LEE and C. N. YANG: *Phys. Rev.*, **104**, 236 (1956).

(2) Our plates have been exposed together with those used by Friedman and Telegdi in a similar experiment. For details on the exposure and on the possible influence of the magnetic field, see ref. (3).

(3) J. I. FRIEDMAN and V. L. TELEGDI: submitted to *Phys. Rev.* in January 1957.

given by the expression $1 - 0.095 \cos\theta$; the backward-forward excess is of 0.044 ± 0.022.

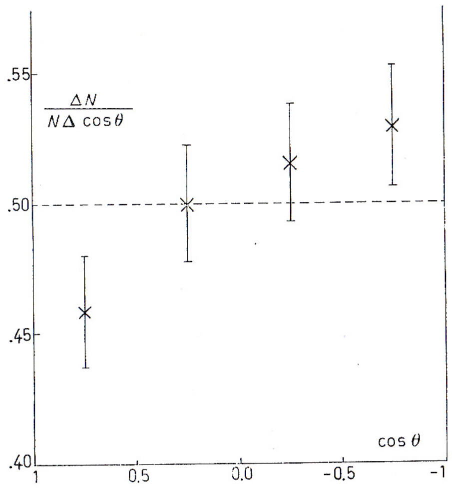

Fig. 1.

From this preliminary result the existence of an asymmetry in the π-μ-e decay cannot be concluded with certainty. However, it is worth mentioning that a backward excess in this decay has now already been observed in three experiments, including the present one: FRIEDMAN and TELEGDI [3] using emulsions exposed in the same conditions as ours have found a backward excess of 0.062 ± 0.027, and the Columbia University group [4] has also obtained a similar result using electronic techniques.

These combined evidences seem to indicate strongly that the Lee and Yang asymmetry effect in the π-μ-e decay really exists.

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(4) R. L. GARWIN and L. M. LEDERMAN: privately communicated to us by Prof. TELEGDI.

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