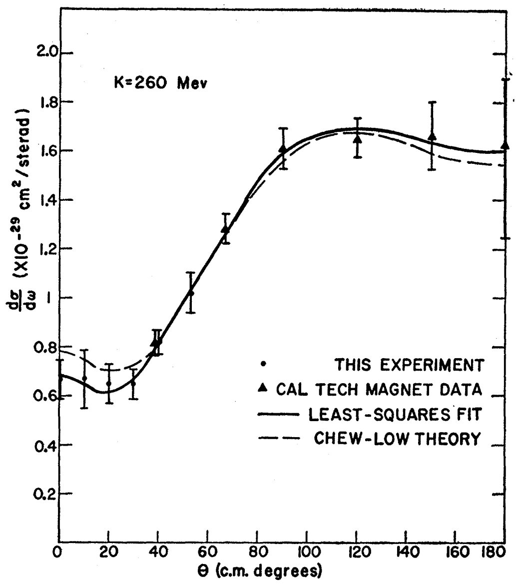

FIG. 2. Differential cross section for photoproduction of positive pions from hydrogen for a photon energy of 260 Mev.

tially identified by a coincidence $1+3+4-2-6$, where 2 is a Lucite Čerenkov counter that is insensitive to pions in the energy band detected by the telescope. This energy band is determined by selecting a carbon absorber that requires the pion to stop and decay in the fifth detector, where it is identified by a delayed coincidence with the μ-meson pulse. A lead scatterer 1.5 cm thick, placed halfway down the channel, helped materially to reduce the number of accidental counts due to electrons. Since the amount of material in the path of the meson is quite large, absolute measurements of cross sections by this method would be impractical. However, for measurements of the relative yield, in the restricted angular range where our measurements were made, the change in efficiency of the telescope can be readily estimated.

The angular distributions, measured in a range from 0° to 53° c.m. and normalized to the California Institute of Technology magnet data,[2] are shown in Fig. 2. The experimental points have been corrected for the relative change in efficiency of the counter telescope as a function of angle; the largest correction, between the 0° point and the 53° point, amounted to less than 6%. The solid line is a least-squares fit to an expression of the form

$$\sum_{n=0}^{4} \frac{A_n(\cos\theta)^n}{[1-(V/c)\cos\theta]^2},$$

where V is the velocity of the meson in the c.m. system. The dashed line is a theoretical curve taken from the Chew-Low theory, including some recoil terms, as evaluated by Moravcsik.[3] The table below compares the least-squares coefficients with those obtained from theory, when the total cross sections are normalized to 2π in both cases.

	A_0	A_1	A_2	A_3	A_4
Theory	0.56	−1.03	0.38	0.18	−0.083
Experiment	0.57	−1.03	0.36	0.15	−0.04

These measurements are being continued for higher-energy photons on hydrogen and deuterium.

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Experimental Situation on Parity Doubling

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IN a recent publication[1] we have presented experimental results which give clear evidence against theoretical models of the type proposed by Lee and Yang[2] in which K particles as well as Λ^0 and $\Sigma^{\pm,0}$ hyperons exist in two forms of opposite parity. The experiments show that just half of the θ^0 particles produced in association with the Λ^0 are of the type which decays into two pions with a mean life of 10^{-10} sec. The other half have a long lifetime. If there is no parity doubling, this result is immediately understood in terms of θ_1^0 and θ_2^0 which are related to the θ^0 and $\bar{\theta}^0$ mesons in the manner discussed first by Gell-Mann and Pais[3] and in the light of parity nonconservation by Lee, Oehme, and Yang.[4] Instead of the observed factor of one-half, the parity-doubling theories predict a factor of $\frac{1}{4}$ except under assumptions which appear not only artificial but also improbable.[1]

Nevertheless Treiman and Wyld[5] have recently revived the parity-doubling theories with a specific model in which the mean life of one of the K^+ states is very short compared to 10^{-8} sec. We wish to point out here that this proposal can be ruled out on experimental grounds. A mean life in the region $\sim 10^{-10}-10^{-9}$ sec would have been detected already in experiments with emulsions, especially the G-stack experiments.[6] For shorter times we appeal to our own work with the propane bubble chamber, where we have seen now $\sim$150 events of the sort $\pi^- + p \rightarrow \Sigma^- + K^+$, and where the K^+ has the long mean life of $\sim 10^{-8}$ sec. In the model of Treiman and Wyld, there would then be about an equal number of events in which the Σ^- is accompanied either by a very short-lived K^+ or by a K^+ which decays in the original star. This is in fact not observed. The experiment excludes the possibility of a K^+ produced in roughly equal amount, but with a mean life $< 2\times 10^{-9}$ sec. The proposal of Treiman and Wyld can therefore be ruled out definitely.

We wish to emphasize what we have stated before[1]: It is very difficult, if not impossible, to reconcile any parity-doubling model with experiment, unless this model is constructed in such a fashion that the two parity states have equal lifetimes and identical decay modes.

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Resonance Fission of U^{235}†

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As a portion of a wider program, we have had recent occasion to compare fission-product activity ratios produced by the thermal-neutron fission of U^{235} with the ratios produced in the neutron fission of U^{235} in a "slowing-down," or dE/E, spectrum.

The thermal-neutron fission were obtained by irradiation of U^{235} in the thermal column of the Los Alamos Water Boiler reactor and the resonance fissions by irradiation of U^{235} wrapped in 0.017 inch of cadmium metal and located near the central ball of the reactor.

Table I presents the average values and standard deviations in the ratios of the activity of various fission products to that of Mo^{99}, as obtained in four observations for thermal fission and two observations at each of two locations for the resonance fission. The cadmium ratios for the various locations are relative. The "*R*" values for the cadmium-wrapped experiments are obtained by dividing a given activity ratio by the ratio obtained for thermal fission. Since the Mo^{99} fission yield is assumed to be nearly invariant, the values of R are a measure of the relative change of yield of other fission products with neutron energy.

The consistent decrease in the R values with mass number from Zr^{97} to Cd^{115} leads to the interpretation that the valley of the mass yield curve is deeper for the resonance fissions than for the thermal, and that some of the fissions in the resonance case followed a fission mode even more antisymmetric than the average thermal fission. The constancy of the values of R for Zr^{97} may be taken as a measure of the experimental precision.

The neutron fission excitation function of U^{235} shows many resonances in the epithermal region which might give rise to the effect noted here. Work is in progress on the determination of the absolute values of the cadmium ratios of the various locations in the Water Boiler reactor, and with this information some conclusion may be possible as to which resonance is responsible for the majority of the fissions in the wrapped samples.

It is noteworthy that Wheeler[1] has suggested, on theoretical grounds, that the resonance fission of U^{235} might exhibit different modes of fission with fission from the various resonance levels.

The authors are grateful to Dr. G. A. Cowan for his continued interest and encouragement.

Note added in proof.—In planning further experiments, the question arose that some of the observed effect could have been caused by (γ,f) from the Cd capture gamma rays. Experiments with Cd-wrapped U^{238} show that only a very small portion of the fissions could have been caused by (γ,f).

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Table I. Ratios of activity of various fission products to that of Mo^{98}, for thermal fission and for resonance fission. R is obtained by dividing a given activity ratio by the ratio obtained for thermal fission.

Fission product	Thermal fission Cd ratio =1000 Activity/(Mo^{99} activity) Average	Std. dev.	Resonance fission (cadmium-wrapped) Cd ratio =8 Activity/(Mo^{99} activity) Average	Std. dev.	R	Resonance fission (cadmium-wrapped) Cd ratio =30 Activity/(Mo^{99} activity) Average	Std. dev.	R
Zr^{97}	2.8_8	2.3%	2.8_8	3.5%	1.00	2.8_2	2.7%	0.98
Pd^{109}	$5.9_9\times10^{-3}$	1.3%	$5.8_9\times10^{-3}$	1.8%	0.98	$5.9_7\times10^{-3}$	1.8%	1.00
Ag^{111}	0.98×10^{-3}	1.8%	0.87×10^{-3}	0.9%	0.89	0.90×10^{-3}	2.4%	0.92
Pd^{112}	1.07×10^{-3}	0.6%	$0.90_8\times10^{-3}$	0.6%	0.85	0.92×10^{-3}	0.9%	0.86
Cd^{115}	$3.7_3\times10^{-3}$	0.7%	$3.1_4\times10^{-3}$	2.8%	0.84	$3.1_0\times10^{-3}$	1.8%	0.83
Cs^{136}	1.72×10^{-4}	0.8%	1.69×10^{-4}	0.7%	0.98	1.65×10^{-4}	1.1%	0.96