are given in the table. The mesons observed are those which would be produced at an angle of 90° in the center-of-momentum system of a photon of energy "k" and a single nucleon initially at rest.

T_π(Mev, lab)	43	71	103	147	200
N_-/N_+	1.25 $\pm$0.03	1.15 $\pm$0.03	1.09 $\pm$0.02	1.13 $\pm$0.03	1.16 $\pm$0.07
"k" (Mev)	207	247	293	363	451

Ratios measured at laboratory angles of 29° and 140° will also be reported.

* Supported in part by the U. S. Atomic Energy Commission.
[1] Walker, Teasdale, and Peterson, Phys. Rev. 92, 1090 (1953).

F5. Photostar Production Up to 500 Mev.* VINCENT PETERSON, *California Institute of Technology.*—The production of stars in G-5 nuclear emulsions by high-energy bremmstrahlung photons is being studied for various maximum synchrotron energies (k max) up to 503 Mev. The beam was monitored by a thick wall Cornell-type ionization chamber whose energy sensitivity varies slowly with k(max). The total star yield was counted and corrected for measured scan efficiency and pre-exposure background. Results obtained from several runs give for the integral cross section for producing stars of 3 or more prongs (errors are standard deviations):

k max in Mev	σ (mb per equiv. quantum)
309	2.85$\pm$0.30
376	4.60$\pm$0.34
420	5.11$\pm$0.30
503	5.95$\pm$0.35

The excitation function per photon *vs* photon energy may be derived from the integral curve. The data are consistent with, but do not necessarily prove that, the photostar cross section exhibits the resonance shown by the free nucleon photomeson production cross sections.

* This work was supported in part by the U. S. Atomic Energy Commission.

F6. Photoproduction of Mesons from Hydrogen Near Threshold.* VINCENT PETERSON AND I. GEORGE HENRY, *California Institute of Technology.*—Mesons produced by 500-Mev bremsstrahlung photons incident upon a high-pressure hydrogen gas target were observed at laboratory angles of 30°, 51°, 73°, 104°, and 140°. Tungsten slits defined the target volume, and the low-energy mesons were detected at the end of their range in C-2 nuclear emulsions. Corrections for decay, nuclear absorption, slit penetration, and scattering from collimator walls are small. Duplicate scanning reduced efficiency corrections below 5 percent. Measured meson background was $1\frac{1}{2}$ percent. Minimum detectable target meson energy is 11.3 Mev at 73°. The absolute cross section at this angle, measured continuously between 167- and 233-Mev photon energy wlth ~10 percent statistics per point, is in good agreement with the CIT counter data[1] taken above 200 Mev. Below 200 Mev the data furnishes additional evidence[2] for preponderance of S-wave interaction, as does the angular distribution at 187 Mev. The yield of negative (i.e., star producing) mesons at 73° is 11$\pm$2 percent of the positives, with negligible background. Analyzed gas impurities appear to account for less than 1 percent. The negative mesons energies are dynamically allowed by pion-pair production.

* This work was supported in part by the U. S. Atomic Energy Commission.
[1] Walker, Teasdale, and Peterson, Phys. Rev. 92, 1090(A) (1953).
[2] G. Bernardini and E. L. Goldwasser, Phys. Rev. 94, 729 (1954).

F7. The High-Energy Photodisintegration of the Deuteron. Procedure.* A. V. TOLLESTRUP, J. C. KECK, and W. R. SMYTHE, II, *California Institute of Technology.*—The reaction $\gamma+D\rightarrow p+n$ is being investigated in the energy region from 100 to 450 Mev at laboratory angles from 38 to 160 degrees. A high-pressure low-temperature deuterium gas target is irradiated by 500-Mev synchrotron x-rays, and the emitted protons are identified by their ionization and range in a scintillation counter telescope. The proton energy, as determined by its range in copper, and the angle of emission fix the energy of the interacting photon. Energy momentum considerations serve to exclude the disintegrations in which free mesons are produced. Care must be taken to exclude those protons produced by other particles in the material of the telescope and also a correction for nuclear absorption of the protons in the wall of the target and in the telescope must be made. Backgrounds obtained with the target evacuated were in general ess than 5 percent.

* This work was supported in part by the U. S. Atomic Energy Commission.

F8. The High-Energy Photodisintegration of the Deuteron. Results.* J. C. KECK, A. V. TOLLESTRUP, AND W. R. SMYTHE, II, *California Institute of Technology.*—The photodissociation of the deuteron is being investigated by the technique described in the preceding paper. Measurements of the differential cross section in the center-of-mass system have been made for angles of 170, 150, 130, 110 degrees for photon energies in the laboratory system from 100 to 450 Mev. The energy distributions at a given angle are characterized by a weak minimum at 150 Mev followed by a maximum at 250 Mev. At 450 Mev the cross section is a factor of 5 smaller than at the maximum. The cross section decreases from 110° to 170° at all energies. The magnitude of the cross section at 250 Mev and 110 degrees is 5 ub/ster in agreement with results of workers at Cornell. The results suggest a connection with the process of photomeson production which may be interpreted in terms of the idea of an excited state of the nucleon which can decay either by meson production or collision with the second nucleon in the deuteron.

* This work was supported in part by the U. S. Atomic Energy Commission.

F9. Magnetic Analysis of the $O^{18}(d,p)O^{19}$ and $N^{15}(d,p)N^{16}$ Reactions.* JACQUES THIRION, RENÉ COHEN, AND WARD WHALING, *Kellogg Radiation Laboratory, California Institute of Technology.*—Enriched isotopic targets have been used with a double focusing magnetic spectrometer to measure the energy of the protons emitted from the (d,p) reactions with O^{18} and N^{15}.[1] At $\theta=140°$ and deuteron bombarding energy 2.18 Mev, three groups of protons were observed from the $O^{18}(d,p)O^{19}$ reaction with Q values 1.732$\pm$0.008, 1.632$\pm$0.008, and 0.263$\pm$0.010 Mev. More energetic proton groups were not observed, and we attribute these Q values to the ground state and excited states at 0.100 and 1.469 Mev in O^{19}. The proton spectrum shows no other states in O^{19} with excitation energy$\leqq$2.4 Mev. At $\theta=60°$ and deuteron bombarding energy 2.0 Mev three proton groups were observed from the $N^{15}(d,p)N^{16}$ reaction with preliminary Q values 0.158, -0.022, and -0.118 Mev. These Q values indicate a level spacing in N^{16} similar to that found by Ahnlund and Meleikowsky[2] for the first, second, and third excited states of N^{16}. Further work is in progress to observe more energetic protons accompanying the ground-state transition in the presence of an interfering group of protons from the $N^{14}(d,p)N^{15}$ reaction.

* Assisted by the joint program of the U. S. Office of Naval Research and the U. S. Atomic Energy Commission.
[1] We are indebted to A. O. C. Nier for furnishing the enriched O^{18}.
[2] Curt Meleikowsky (private communication).

F10. An Easily Reproducible Thermal Neutron Density Standard. RENÉ COHEN,* *Centre d'Etudes Nucléaires de Saclay.*—The use of a copper foil whose thickness is greater than the range of the ^{64}Cu β particles with a 4π beta counter enables one to have a very reproducible ($\pm$1.5 percent) standard of thermal neutron density. The standard thermal density we