about one-third that of the 9.2-hr. activity in the proton bombardment of samarium suggesting allocation to mass 150.

A europium activity of half-life 27 hours, decaying by positron-emission, was reported to be formed by $(n,2n)$ reactions in europium[3] while recently a 15-hr. activity was produced by bombardment of europium with 23-Mev gamma-rays, presumably by (γ,n) reaction;[4] no radiation characteristics were given for these activities. Allocation of the 15-hr. activity to mass 150 seems therefore to be fairly certain.

In addition to very long-lived activities (5.3-yr. Eu^{154} and 5.2-yr. Eu^{152}), two additional activities of half-lives 14±1 days and 54±1 days were observed in the chemically separated europium fraction. The radiation characteristics were obtained by resolution of decay and aluminum, beryllium, and lead absorption curves after subtraction of the experimentally determined contributions of the long-lived activities. The 14-day activity decays with emission of soft electrons of about 100-kev energy, L and K x-rays, and a hard gamma-ray of around 1-Mev energy; the curves were rather difficult to resolve. The 54-day activity showed electrons of approximately 0.4-Mev energy, L and K x-radiations, and gamma-rays of energies about 0.4 Mev and 1.0 Mev. The ratios of various radiations of the 54-day activity corrected for counting efficiencies of x- and gamma-radiation, absorption in counter windows, etc., were ~0.4 Mev e^-:L x-ray:K x-ray:~0.4-Mev gamma-ray:1.0-Mev gamma-ray=~0.05:~0.7:1:~0.3:~0.3.

No positrons were observed in the radiations of either the 14-day or the 54-day activity and both presumably decay by orbital electron capture with gamma-rays arising from subsequent transitions. Marinsky and Glendenin have independently reported[5] similar activities in the europium fraction from deuteron bombarded samarium and have allocated the 14-day and 54-day activities to masses 149 and 147, respectively. The present data agree closely with this earlier work.

Of the europium isotopes which could be formed by (p,n) reactions in samarium, only Eu^{144} and Eu^{148} have not yet been observed; both might be expected to have short half-lives. In the present work half-lives less than a few hours would not have been detected.

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The Stars Initiated by Gamma-Rays

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WHILE the stars initiated by π-mesons, alpha-particles,[1] deuterons,[2] protons,[3] and neutrons[4] have been investigated by the photographic emulsion method, little is known about the stars initiated by gamma-rays. The following is a brief report of an experiment on the stars initiated by 300-Mev synchrotron gamma-rays.

Ilford C2 plates, 100-μ thick and insensitive to electrons, were exposed directly in the beam of gamma-rays about 3.3 meters from the synchrotron target. The intensity of the beam at the axis of the beam measured by a Victoreen Condenser r-meter behind a one-eighth-inch thick lead converter was about 600 r per hour. An exposure of a few minutes was most suitable to get a clear picture of the stars. An area of about 7.5 cm² was scanned and 750 stars were observed. That at least most of them are not due to π-mesons emitted by gamma-rays is clear from the difference in features of the stars in this case from that of π-meson stars. The fact that the most of the stars are obviously not associated with π-meson tracks also provides strong evidence that they are not due to π-mesons. A probability consideration shows that it is highly improbable that they are due to neutrons emitted by gamma-rays from the glass plate on which the emulsion is fixed or from the emulsion itself.

TABLE I. Distribution of prongs.

		2	3	4	5	6	7
Number of prongs		2	3	4	5	6	7
Number of events		103[a]	64	57	24	4	1
Relative number of events relative to 3-prong star	gamma-rays	160	100	89	38	6.4	1.6,
	π-mesons	180	100	51	12	—	—

[a] This figure is subjected to a larger error compared with other figures since two-prong stars are easily confused with a single track suffering a large angle scattering. Only such cases were counted where either the grain density is obviously different in both prongs or it was obvious from the change in grain density that the both prongs started from the point where they meet.

Two hundred and fifty-two stars obtained from one-third of the total area scanned were examined rather carefully. About 4 or 5 of them were suspected to be due to π-mesons. The distribution of prongs in the stars observed is shown in Table I. Prongs shorter than 5μ are not counted. The stars with four or more prongs are more abundant in this case than in the meson-produced stars.

To show the energy distribution of prongs more or less quantitatively the prongs were classified in five groups A, B, C, D, and E according to their energies. The energy of each prong was estimated by its range or by the visual comparison of the grain density with that of tracks of known residual ranges. In the latter case the accuracy is very low. The results are shown in Table II.

The exact comparison with the case of π-meson is difficult because of the large error involved in these figures. But it seems[5] that the prongs are on the average more energetic in this case than in the case of π-mesons.

TABLE II. Energy distribution of prongs.

A	B	C	D	E
>4500μ	4500–600μ	600–50μ	50–5μ	<5μ
60–30 Mev	30–10 Mev	10–2 Mev	2–0.2 Mev	<0.2 Mev
39	109	427	181	67

The cross section of the process averaged over all kind of atoms except hydrogen is estimated to be 4×10^{-28} cm². In this estimation the result of Blocker, Kenny, and Panofsky[6] was used, assuming that the r-value of the intensity at the beam axis 1 meter from the synchrotron target determined by us would give the same value as measured by the Berkeley method. The small difference in energy is also ignored. The error arising from these circumstances together with those arising from the inaccuracy involved in this experiment was estimated to be a factor of 5. The cross section is close to that for the π-meson production.

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