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MESONS PRODUCED BY NEUTRONS FROM THE CYCLOTRON

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In photographic plates exposed to high energy neutrons from the 184-inch Berkeley cyclotron, we have observed stars in which one of the outgoing particles is a meson. This type of star is well known from cosmic ray studies[1], and the only new feature is that the stars we are

[1] Lattes, Muirhead, Occhialini, and Powell, Nature 159, 694 (1947)

studying were initated by particles from the cyclotron. The arrangement of apparatus is shown in Fig. 1. As indicated in the figure, the neutrons used for bombarding the plates are produced in the cyclotron when a beam of 345 Mev protons strikes an internal target. The plates are placed in a position similar to that used in cloud chamber studies[2] of mesons

[2] W. Hartsough, E. Hayward, and W. M. Powell, Phys. Rev. 75, 905 (1949)

produced by neutrons from the cyclotron.

An example of a photographic emulsion star in which one of the outgoing particles is a meson is shown at point A of Fig. 2. The star at A consists of two tracks, a proton (upper track) and a π^--meson (lower track). From the grain density changes along the tracks it is clear that both proton and meson were moving from left to right. The meson came to rest in the emulsion at point B and initiated a one-prong star; the one prong is the straight heavy track which begins at B. This event was found in a preliminary survey of meson production by neutrons from the cyclotron.

The survey indicated that the neutron beam offered excellent opportunities for meson work, and systematic studies are being planned. Inasmuch as it may be some time before any results are available from these studies, we shall give additional details of the preliminary survey. In this survey we scanned hastily an area of 8 sq. cm. of one plate which was exposed as shown in Fig. 1. The plate used was an Ilford C.2 unbacked emulsion with a thickness before development of 300 microns. The exposure time was about 5 minutes at a distance of about 60 feet from the target. We found a total of 5 stars in which one of the outgoing particles was a meson. In addition, there were 4 meson tracks which could not be followed back to the points at which the mesons were formed. In the same plate area we found 5×10^4 stars at which no meson tracks were observed. We hesitate to use these numbers to estimate the cross section for the production of mesons by neutrons because of the uncertainty in the meson count. In this survey we made no attempt to find all of the mesons or to estimate the fraction of the total that might have been missed. Even with a more careful search we would not expect to see the higher energy mesons with this plate, since the C.2 emulsion does not record mesons of energy greater than about 10 Mev.

We are indebted to Professor Ernest O. Lawrence for his continued interest in this work. We also with to thank Professor R. L. Thornton for many helpful discussions. The first work on this problem was done by Professor C. M. G. Lattes, who has kindly given us the benefit of his experience. The photomicrograph shown in Fig. 2 was prepared by Mr. A. J. Oliver. This work was done under the auspices of the Atomic Energy Commission.

Figure Captions

Fig. 1 - Sketch showing position of photographic plate for exposure to neutrons from the cyclotron. (Not to scale.)

Fig. 2 - Photographic emulsion star in which one of the outgoing particles is a π^--meson. Meson is formed at A and comes to rest at B.

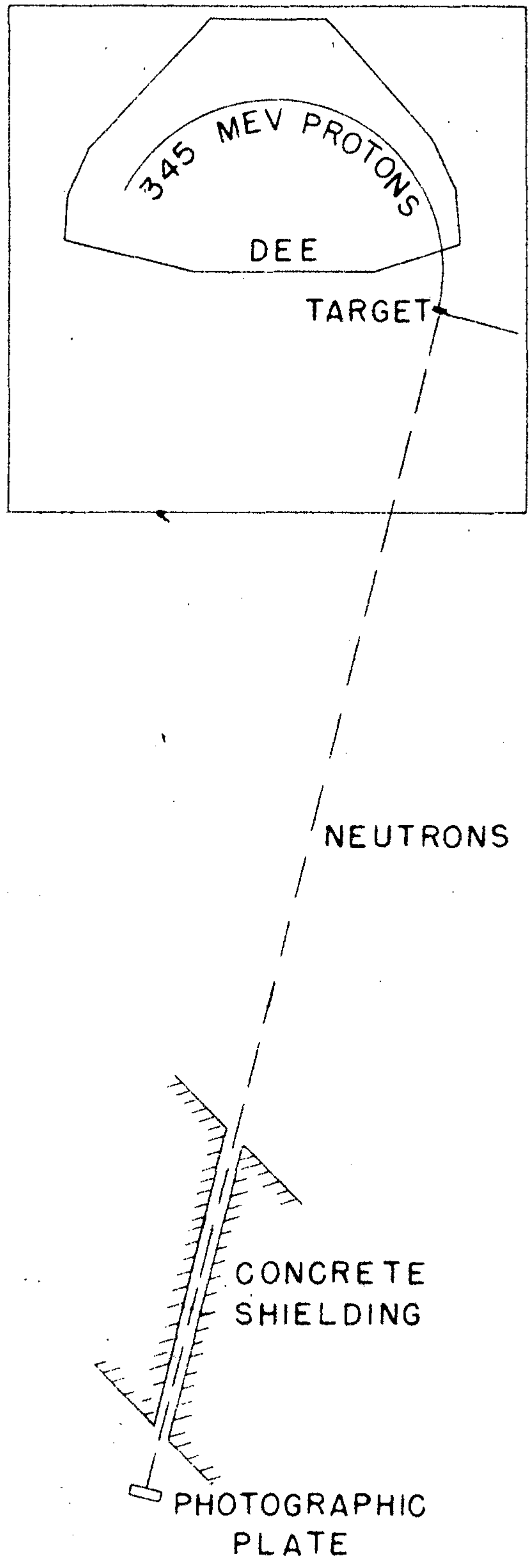

FIG. 1

SKETCH SHOWING POSITION OF PHOTOGRAPHIC PLATE FOR EXPOSURE TO NEUTRONS FROM THE CYCLOTRON. (NOT TO SCALE.)

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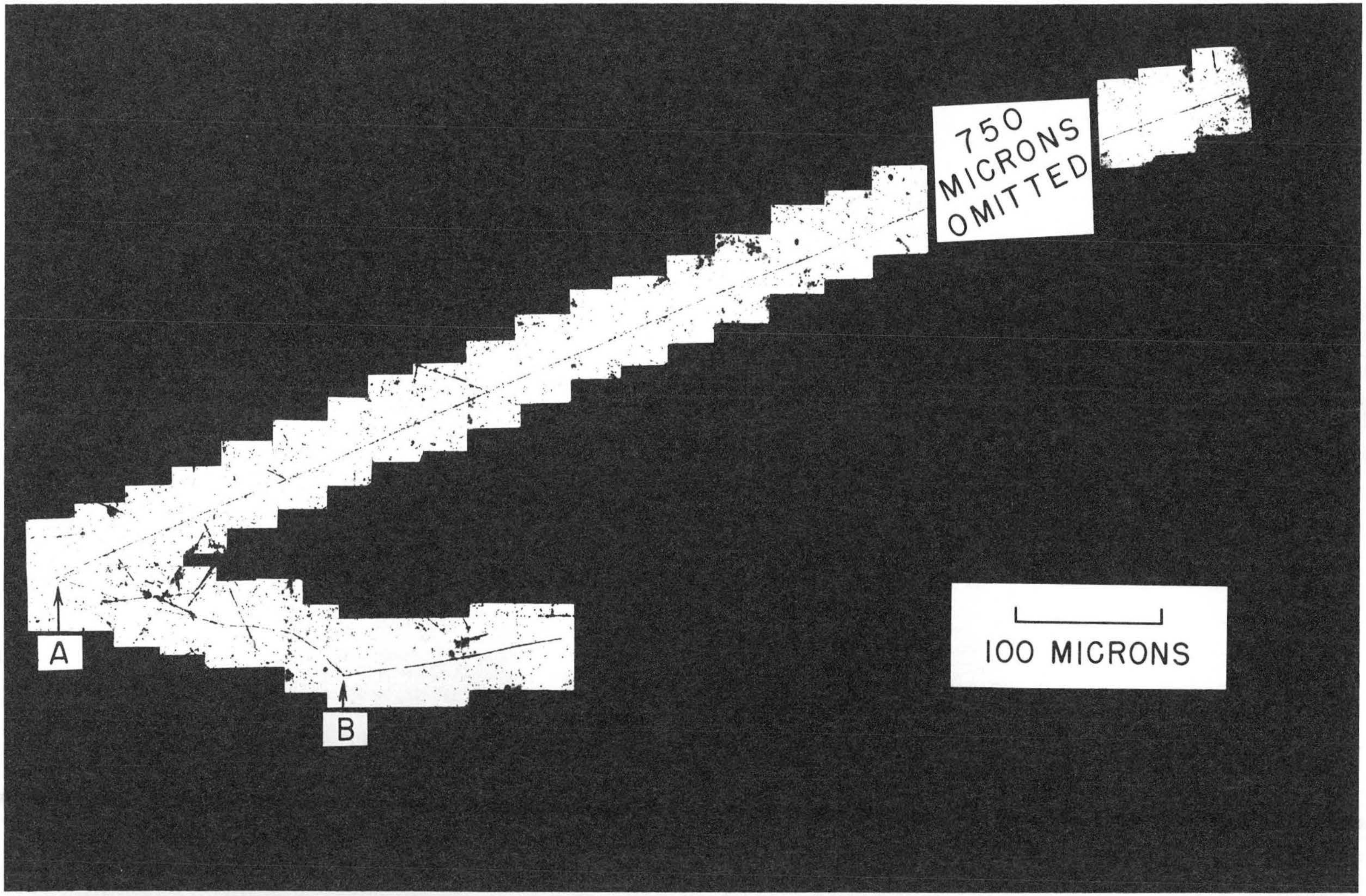

FIG. 2

PHOTOGRAPHIC EMULSION STAR IN WHICH ONE OF THE OUTGOING PARTICLES IS A π^--MESON. MESON IS FORMED AT A AND COMES TO REST AT B.