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(For oral presentation at the Washington meeting of the American Physical Society, April 29, 30 and May 1, 1948)

ABSTRACT

Production of Mesons by the 184-inch Berkeley Cyclotron. Part II. Mass Determination. C. M. G. Lattes and Eugene Gardner, Radiation Laboratory, Department of Physics, University of California, Berkeley. The mass of the mesons produced by the 184-inch Berkeley cyclotron has been determined by measuring the bending in the magnetic field and the range in emulsion. The radius of curvature of the trajectory is found by measuring the distance from the target to the point at which the meson enters the emulsion and the angle which the track makes with the edge of the plate. From the first 50 meson tracks measured we find a mass of 313 ± 16 electron masses. It is highly probable that these mesons are the heavy mesons described by Lattes, Occhialini, and Powell[1]. The mass determination which we have made was done with apparatus intended only for survey work, and some of the error is associated with lack of precision of location of the photographic plates. There was an aluminum foil of thickness 0.001 inches in front of the plates. It is thought that much better accuracy will be possible with better apparatus and a thinner foil.

[1] C. M. G. Lattes, G. P. S. Occhialini, and C. F. Powell, Proc. Roy. Soc., in the press.

This paper is based on work performed with the support of the Atomic Energy Commission under Contract W-7405-eng-48 with the Radiation Laboratory, University of California, Berkeley, California.

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Production of Mesons by the 184-inch Berkeley Cyclotron. Part II. Mass Determination.

C. M. G. Lattes and Eugene Gardner, Radiation Laboratory, Department of Physics. University of California. Berkeley.

The first observations of negative mesons were made near the edge where the mesons enter the plates. The meson tracks were followed from the edge of the plate in a distance of 300 or 400 microns. Most of these tracks end in an observable star, but a few do not. It is thought that all of these mesons give up their energy to a nucleus, but that in some of the cases no star is observed because the only particles given off are neutrons or high energy protons. In addition to the meson tracks which are found near the edge of the plate, there are meson tracks which are found at distances of 2 or 3 mm from the edge. The mesons found at this distance from the edge have a smaller mass than those found near the edge. It is thought that these lighter mesons come from the target, since they would not have enough energy to get so far from the edge of the plate if they came from the decay of the heavier mesons. It is observed that the lighter mesons do not make stars as frequently as the heavy ones, and the stars which are formed are not as large on the average. This is illustrated in Table I, which gives the mass of the meson and the number of prongs of the star formed by the meson. Values for 52 individual mesons are given.

The first determination of the mass of the negative mesons was made by measuring the bending in the magnetic field and the range in emulsion. The value obtained for the first 50 meson tracks was 313 ± 16 electron masses. An independent measurement of the mass has now been made by means of grain count. Proton tracks found on the same plates are used as standards. A weighted average from the first 19 meson tracks gives 340 ± 35 electron masses. Table II gives masses of individual mesons as found from grain count. Some work has been done on the measurement of the mass of the light negative meson by grain count.

Table I. Mass of Meson and Number of Prongs of Star Formed by Meson

Mass	No. of Prongs	Mass	No. of Prongs
140	0	270	0
144	0	270	5
163	0	278	3
171	1	280	1
170	1	281	2
185	0	281	1
186	0	282	3
187	1	294	0
187	0	301	6
191	0	301	2
191	0	304	2
195	2	311	3
203	0	313	3
202	2	314	2
210	0	323	0
217	0	330	0
220	0	334	2
228	0	340	0
211	0	343	2
205	0	350	2
227	2	349	3
239	1	360	2
233	1	363	1
240	0	367	1
249	0	387	1
254	0		
264	1		

By observing the angles which the meson tracks make with the edge of the plate, it is possible to find the angular distribution of the mesons as they leave the target. A prelinimary survey indicates that the distribution is fairly uniform up to about $\pm 50^{\circ}$ from the beam direction. An obstruction in the apparatus prevents mesons at largest angles in one direction from reaching the plate. In the other direction, mesons are observed up to nearly 90° from the beam direction.

Table II. Masses of Individual Mesons as Found by Grain Count.

359
307
322
460
405
370
321
343
273
321
342
410
368
280
326
368
440
287
363