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Bonnie E. Cushman

September 11, 1951

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Berkeley, California

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SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 17, 1951

Bonnie E. Cushman

Radiation Laboratory, Department of Physics
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September 11, 1951

Low Energy-like Nuclear Reactions with High Energy Particles-- Si-Chang Fung.

The question under investigation was how high an energy can a particle have and still stay in the nucleus. First to be studied for this purpose were the (d, p) and (d, n) reactions on bismuth, and the results obtained were combined in Fig. 1 with those of Kelley and Segrè, which were found at lower deuteron energies in the 60-inch cyclotron. The extent of the reaction was determined by counting the reaction products after the Po^{210} was separated from the Bi by extracting with a mixture of tributyl phosphate and dibutyl ether, a method good to one part in 100,000; the counts were reduced from 65,000/min to 10/min in the residue. Furthermore the Po was analyzed with an alpha counter and a good single peak was obtained. One can therefore be confident of the separation. The reproducibility of the results is shown by the following values in millibarns for the cross-over point of the curves:

	d, n	d, p
1. 180 Mev d	13.8	13.7
2. 140 Mev d	13.4	14.2

The method for calculating these figures was not given.

Aluminum was used as a monitor in determining the beam intensity, and energy losses due to alpha recoils in various arrangements of aluminum and graphite plates were carefully measured.

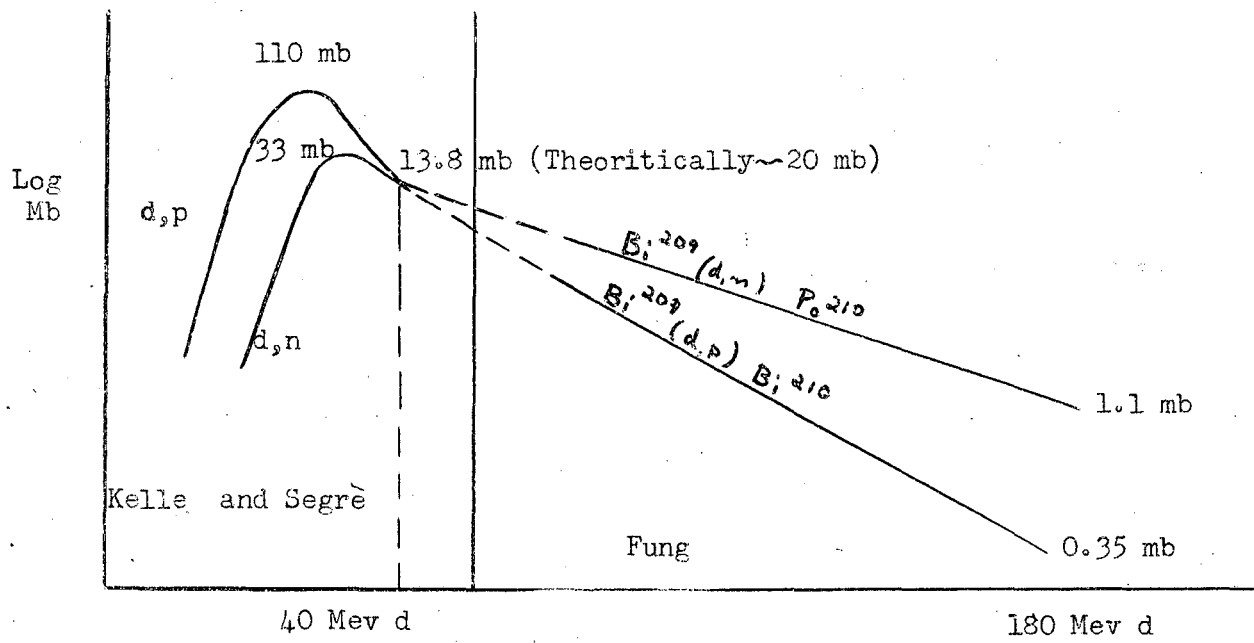


Fig. 1

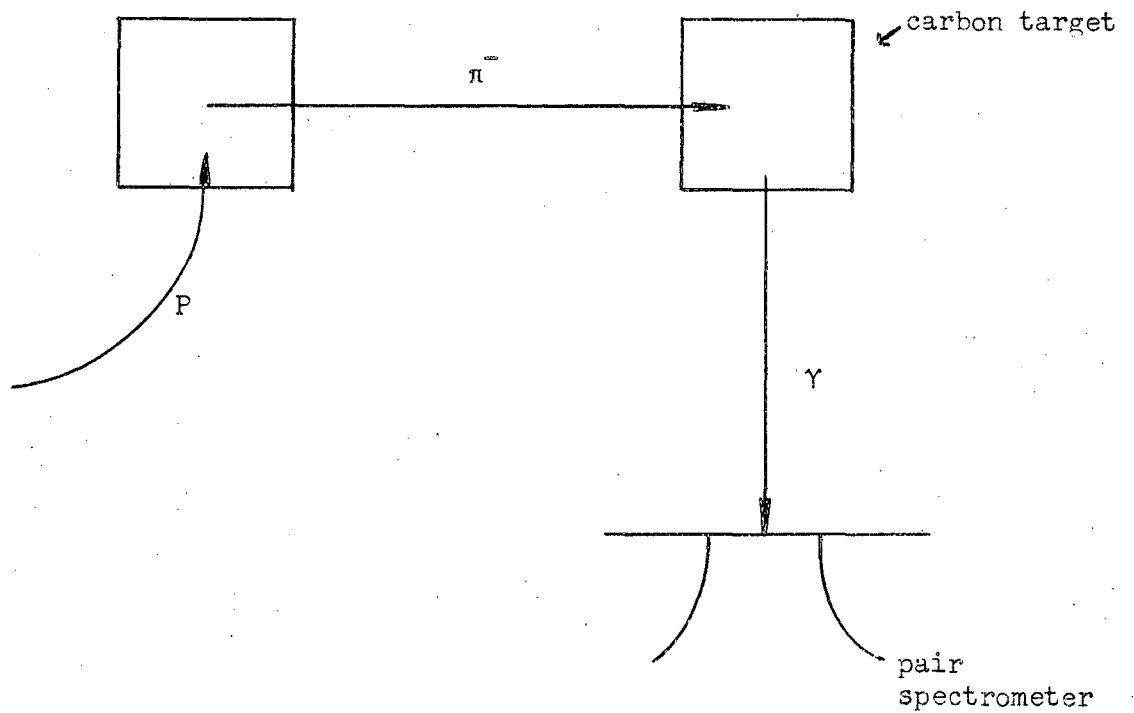


Fig. 2

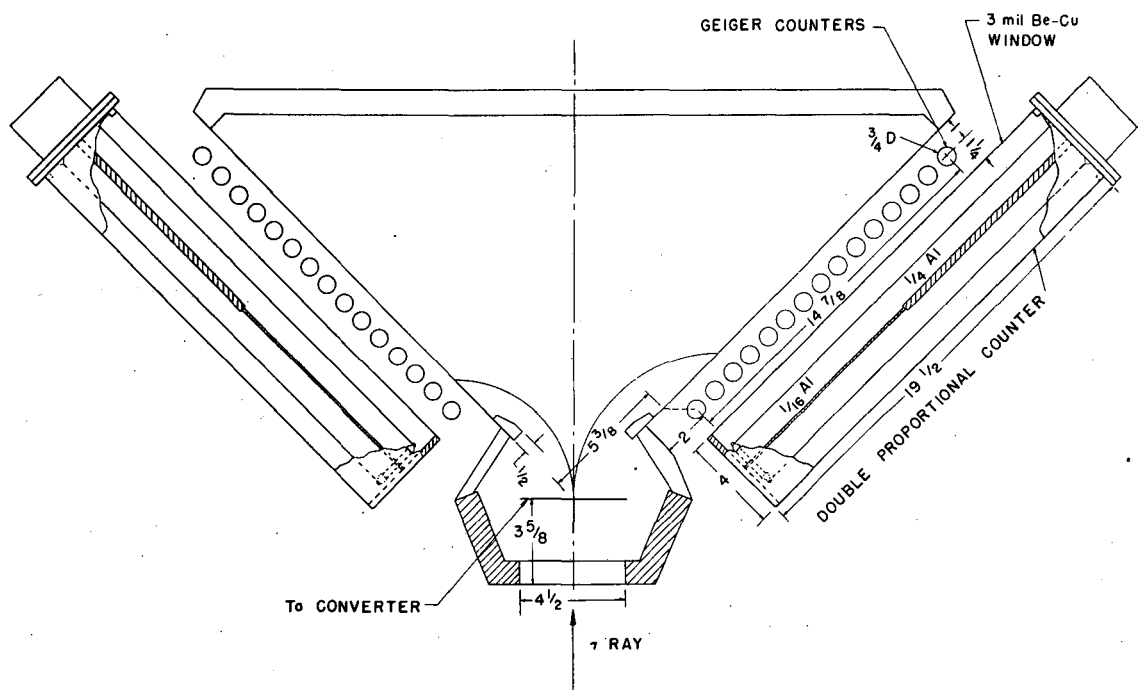
Maniac - W. K. H. Panofsky

The absorption of π^- particles in various materials, and in particular carbon, has been studied for some time now with the arrangement shown in Fig. 2. About 1.5% of the π^- 's produce γ rays while the rest give stars, and from the branching ratio one can get a rough idea of the mean free path of the π^- 's in the element, e.g. carbon, nucleus. Since gammas can be produced also by π^0 decay from protons on carbon, this effect, too, must be measured. However, because of the difficulties involved in accounting for gamma rays from other processes it was decided recently to examine the gamma produced in the same nucleus in which the π^- was formed.

π mesons are formed in greater number at the surface rather than in the interior of a nucleus; when one is formed inside there is a better chance of catching its products. The gamma spectrum is measured with a pair spectrometer as before (Fig. 3) but the rate at which this data is collected has been increased by the development of a 196 coincidence pair computer, the "maniac." This instrument handles 400 counts/hour/channel or 5,000 counts/hour. Its design and construction were discussed by both Dr. Panofsky and Dr. Darcy Walker.

Runs were made at various angles and energies (Fig. 4) but no matter how the averaging is done the mean gamma curve (Fig. 5) is unsymmetrical, which puts a limit on the number of non- π^0 γ 's, but at the same time indicates that the effect is not one of pure π^0 decay. (Mathematical proofs backing these conclusions were given.) Results with tungsten were the same as those from carbon, within the limits of experimental error.

See also UCRL 1270 - Abstract.



MU 794

Fig. 3

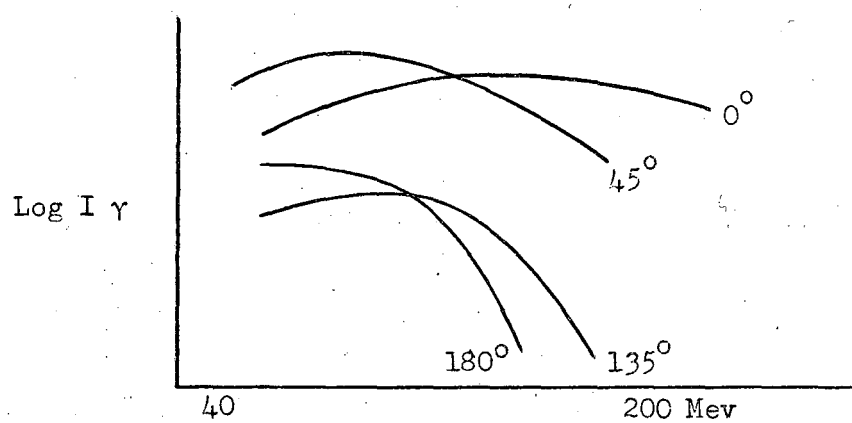


Fig. 4

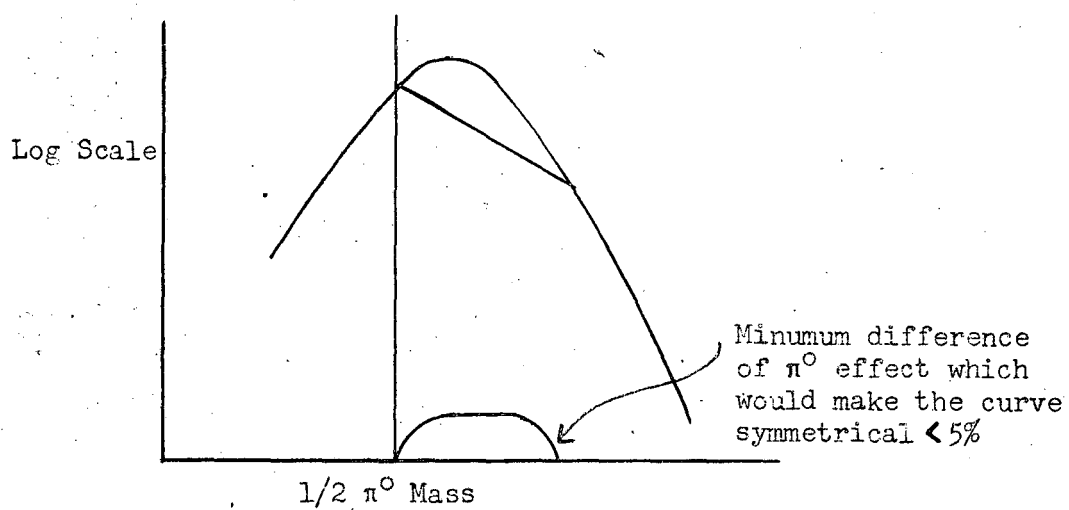


Fig. 5