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Summary of the Research Progress Meeting of September 7, 1950

Henry P. Kramer

September 13, 1950

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Radiation Laboratory
University of California
Berkeley, California

Summary of the Research Progress Meeting of September 7, 1950

Henry P. Kramer

Radiation Laboratory, Department of Physics
University of California, Berkeley, California

September 13, 1950

Electric Excitation and Disintegration of Nuclei. E. Guth.

A number of experiments have been carried out with the Van de Graaff machine at Notre Dame University on the excitation of nuclei by electrons and x-rays. The Van de Graaff makes available electrons accelerated to a maximum energy of 3.5 Mev with a beam current of 200-500 microamperes.

Three energy levels have been observed in In^{115} at 1, 1.4, and 1.47 Kev on excitation with x-rays. Work has been done on the excitation of Cd with electrons. The results are still too uncertain for a definite report. Separated isotopes of silver, Ag^{107} and Ag^{109} have been excited by means of x-rays. Very little difference was observed between these two nuclei that differ only in two neutrons. Some theoretical work is being done to determine the cross section for the excitement of nuclei through pure Coulombic interactions.

A New Isotope of Californium. A. Ghiorso.

Miller, Hamilton, Putnam, Haymond, and Rossi[1] have demonstrated the effective acceleration of stripped C^{12} nuclei in the 60-inch cyclotron at Berkeley by observing the yields from the reactions

$$_{79}Au^{197}(_{6}C^{12};6n)_{85}At^{203}$$

$$_{79}Au^{197}(_{6}C^{12};4n)_{85}At^{205}$$

Since Thompson, Street, and Seaborg had produced Cf^{244} (45 min. α, 7.15 Mev) by bombardment of curium with helium nuclei it was thought to be worthwhile to attempt production of this isotope of californium by bombarding uranium with

[1] UCRL-881

stripped carbon ions according to the reaction

$$_{92}U^{238}(_{6}C^{12};6n)_{98}Cf^{244}$$

Uranium metal was bombarded for an hour. The target was dissolved and a fraction containing all elements with atomic number greater than that of Pu was precipitated. Separation of this portion was carried out by means of an HCl resin exchange column. The drops from the column were then analyzed in the α pulse analyzer and followed. A new activity with a half-life of about 35 hours was found. Mass assignment of this activity to Cf^{246} was made on the basis, primarily, of α-systematics, i.e., the empirical correlation of α-energy and mass number. On the assumption that the reaction $U^{238}(C^{12};4n)Cf^{246}$ has the same cross section as that of the reaction $Cm^{242}(\alpha;2n)Cf^{244}$, namely 10^{-3} barn, the beam of C^{12} ions is 10^{8} ions/sec./cm^2. It is a reasonable expectation that the beam will be intensified by systematic improvements now under way.

Mass of π^-- and π^0-Mesons. L. Aamodt.

Experiments on the production of γ-rays by the interaction of π^--mesons with light nuclei are being continued. The γ-ray spectrum that has been observed to arise from the interaction of π^--mesons with deuterium gas under pressure is indicated in Fig. 1. On the hypothesis that γ-rays are produced by the reaction $\pi^- + {}_1D^2 = 2n + \gamma$ the yield of quanta fell below what was expected from the previous measurements on the yield from the reaction $\pi^- + {}_1H^1 = n + \gamma$. Two alternative explanations were advanced to explain the low yield: either, because of the longer mean free path of π^--mesons in deuterium gas, more π^--mesons decayed before participating in a nuclear event than in the case of hydrogen, or else, a number of the events occurred without the production of γ-rays, that is, according to the reaction $\pi^- + {}_1D^2 = 2n$. To decide between these two explanations, the pressure at which the deuterium gas was kept was halved. By this means, the density of the gas was decreased by a factor of 1.65. If the effect hinges on

the mean free path, the counting rate should have been decreased by a factor equal to the cube root of 1.65, that is, by a factor of about 1.19. Actually, the number of coincidence gates was decreased by a factor of 1.63 $\pm$ 0.14, the number of observed pairs by 1.6 $\pm$ 0.25 and the number of events actually counted by a factor of 1.74 $\pm$ 0.27. It is thus seen that the effect of decreasing the density is linear which is in accord with the second hypothesis that some of the interactions result in the production of two neutrons unaccompanied by electromagnetic radiation.

An increase in the resolution of the apparatus has permitted a better determination of the π^--meson mass: the value arrived at on the basis of data existing on August 22 was 271 $\pm$ 2.5 e.m. and that obtained on the basis of data on September 7 was 273.1 $\pm$ 2.5 e.m. From the experiments with hydrogen resulting in the observation of the Doppler shift spectrum of γ-rays arising on the decay of π^0-mesons, the mass difference $\pi^- - \pi^0$ was known. The value for the π^0 mass obtained from this difference and the newer determinations of the π^- mass is 262.6 $\pm$ 3.5 e.m. It ought to be recalled that mass determination is not the primary object of these experiments.

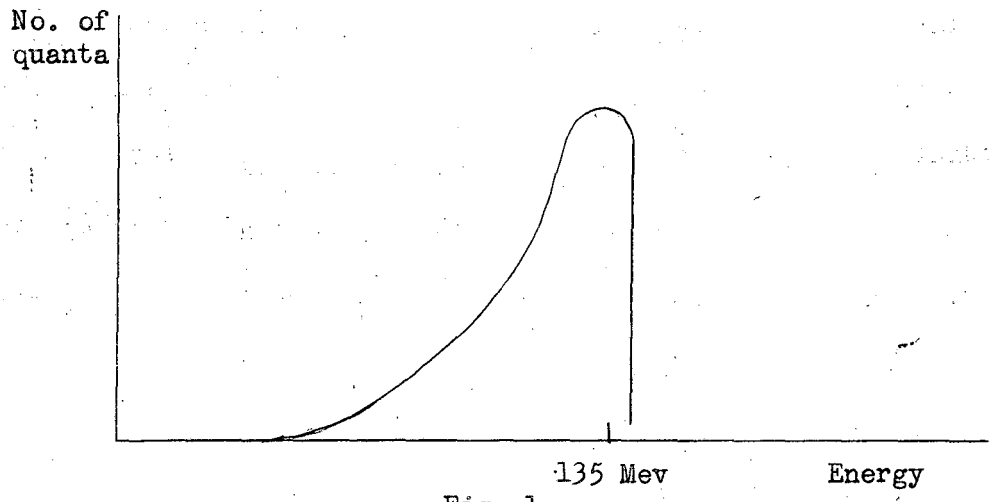

Fig. 1

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