Title
SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 13, 1950

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Henry P. Kramer

May 8, 1950

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Excitation Functions for Ni and Cu. S. Goshal

Cu^{63}, containing 34 neutrons and 29 protons, upon capturing a proton momentarily becomes a nucleus containing 34 neutrons and 30 protons. Ni^{60}, having 32 neutrons and 28 protons, momentarily turns into a nucleus containing 34 neutrons and 30 protons when it captures an alpha particle. It has been the purpose of this research to investigate the difference between the behaviour of the combination of 34 neutrons and 30 protons when it arises from proton bombardment of Cu^{63} and the behaviour of the same combination of neutrons and protons when it is formed by alpha bombardment of Ni^{60}.

The relative frequencies of occurrence of three pairs of reactions were observed by counting the distinctive activities produced. The first of these pairs of reactions resulted in the formation of Zn^{63} by the expulsion of a neutron from the compound nucleus, the second, in the formation of Zn^{62} by the emission of 2 neutrons from the compound nucleus, and the third, in the formation of Cu^{62}, by the emission of 1 proton and 1 neutron.

The results of the experiments are set down in the graph of Fig. 1 which shows the production cross-sections as functions of energy of the initiating particles.

An interesting feature of the data obtained is the decided difference between the probability of ejecting a proton together with a neutron and the probability of ejecting two neutrons. This is not in accord with the hypothesis of approximately equal probabilities advanced by Weisskopf. The magnitude of the measured difference in cross sections, $\sigma(x,p-n) / \sigma(x,2n) \cong 4$ is approximately the same as that measured by K. Strauch when he excited Zn^{64} with x-rays from the synchrotron.

Yields of π^+ Mesons from Various Elements Bombarded by X-Rays. R. Mozley.

An apparatus has been set up which counts the number of π^+ mesons produced by the synchrotron x-ray beam as a function of energy and angle and measures the half-life for $\pi-\mu-\beta$ decay.

The counting arrangement is shown schematically in Fig. 2. The x-ray beam passes through a target where it produces mesons. At 90° to the direction of the beam a counting telescope is set up which consists of an Al absorber, and three stilbene crystals. Negative mesons are eliminated in the absorber by star formation. Particles ejected from the target at 90° must possess a certain minimum energy to pass through the absorber and be counted by coincidence between the first and second crystals. Particles whose energy exceeds a certain maximum will leave the second crystal and pass into the third. If this happens, they will fail to be counted since the second and third crystals are connected in an anti-coincidence circuit. In this manner energy discrimination is established. In order to identify mesons, advantage is taken of the fact of their decay. If a particle triggers the coincidence between the first and second crystals and fails to produce a pulse in the third crystal, then it is counted as a meson if and only if several micro-seconds after it has triggered the second crystal counter a second pulse appears which is attributable to the decay electron. The time of appearance of the second pulse is measured by a series of consecutive electronic gates which turn on and off at periods of two microseconds starting 0.5 microseconds after the appearance of the first pulse. Because of the length of resolving time with respect to the time elapsing between the production of a π^+ and the appearance of the μ^+ meson, pulses produced by the π^+ and the μ^+ mesons cannot be distinguished in time and are lumped by the apparatus in the first pulse announcing the presence of the π^+ meson.

Two meson energies 72 and 43 Mev have been recorded at the present time. Counts have been taken at 90° for targets of C, Cu, Sn, Pb, B, and Li. The target thickness has been so adjusted in each case that it constitutes the same range for mesons of the given energy. With lithium as a standard, cross sections have been tabulated with respect to Z. An indication of the shape of the resulting graphs is given in Fig. 3.

To measure fluctuations in the beam intensity and therefore in the background, pulses from the third crystal are counted. Thus the results presented are independent of fluctuations in the beam. The average background constituted about 20 percent of the count.

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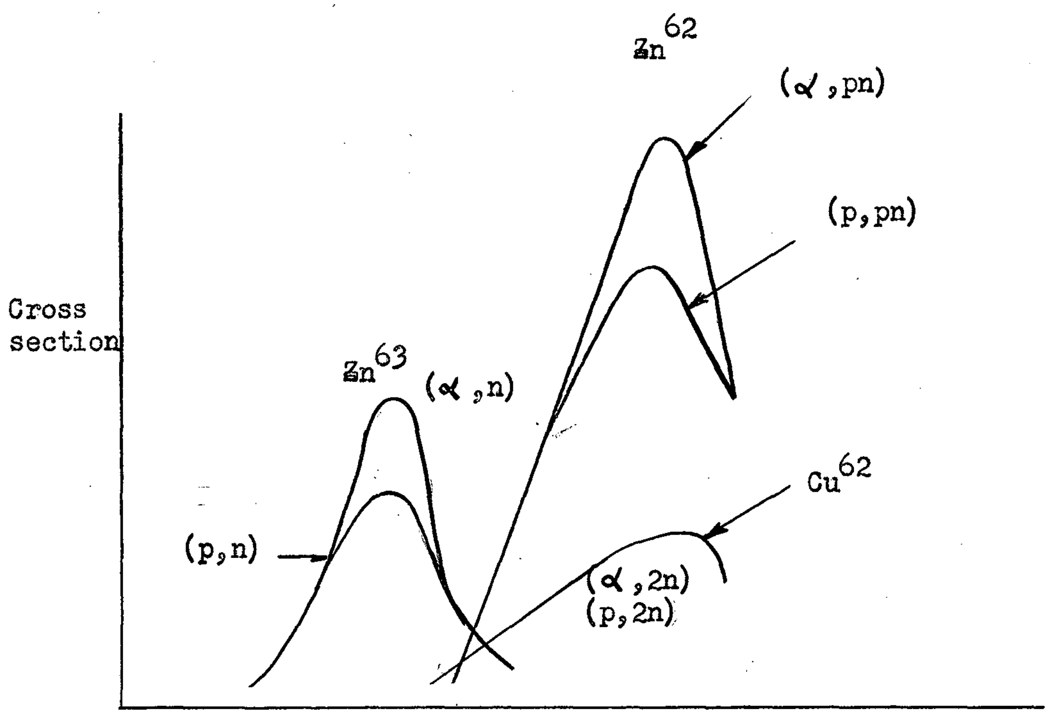

Energy of initiating particle.

Schematic of Yield of Zn^{63}, Zn^{62} and Cu^{62} from Bombardment with α-Particles and Protons as a Function of Energy.

Fig. 1

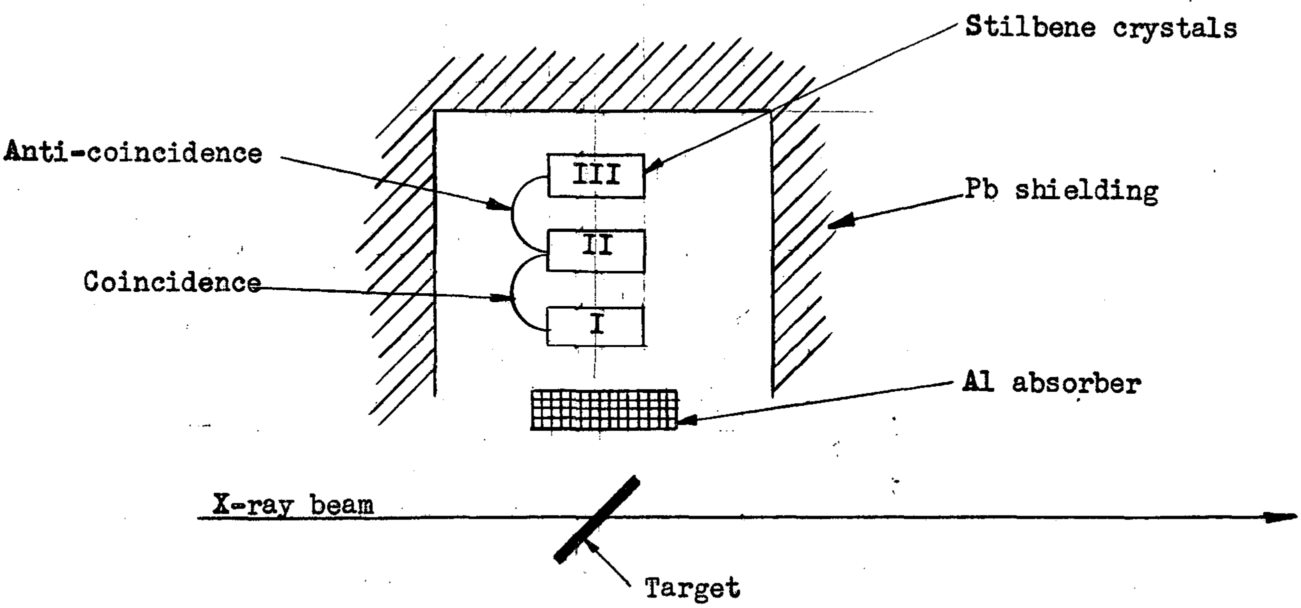

Fig. 2.

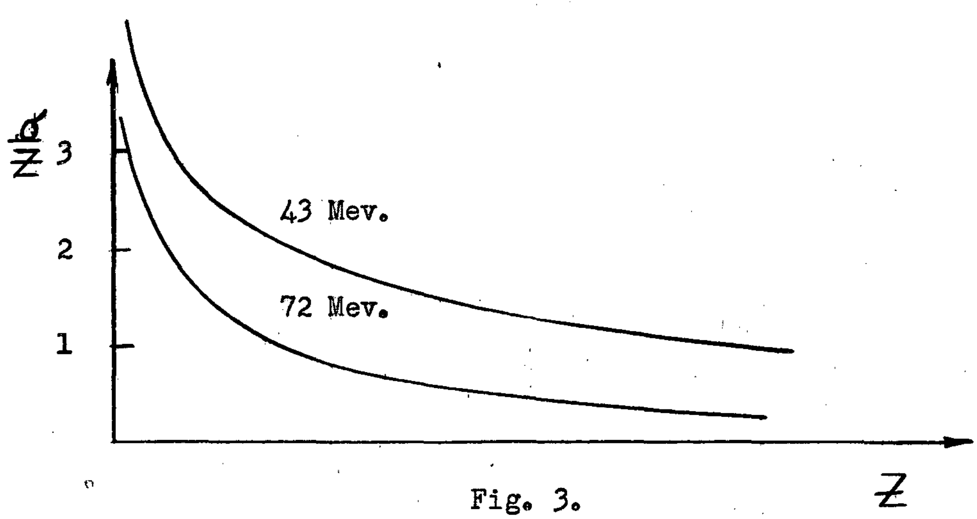

Fig. 3.

π^+ Production Cross Section vs. Atomic Number
(on the arbitrary scale of ordinates. σ(Li)=1)