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*$a'_{l.e.}$ is the asymmetry coefficient for the low-energy part of the decay positron spectrum.

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RANGES OF Na^{24} *RECOIL NUCLEI AND THE MECHANISM OF CERTAIN PHOTONUCLEAR REACTIONS*

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PHOTONUCLEAR reactions at high photon energies (~100 to 200 Mev) are usually described by means of the so called "quasi-deuteron" model, according to which the reaction is represented in the form of three successive processes: (1) absorption of a gamma quantum by a pair of nucleons of the nucleus,[1] (2) intranuclear nucleon cascade produced by these nucleons,[2] and (3) evaporation of particles from the excited nucleus that is formed after the cascade.[3]

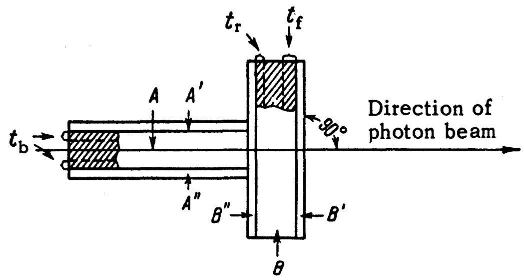

FIG. 1. Irradiation geometry. A and B – specimens; A', A'', B', and B'' – films to gather the recoil nuclei from the specimens; t_b – effective thickness for recoil nuclei from specimen A; t_f and t_r – effective thicknesses for recoil nuclei emerging from specimen B in the forward and reverse directions relative to the γ-quanta beam.

One of the most direct methods of verifying this model is to measure the ranges of the recoil nuclei.[4] In our experiments, we measured a quantity proportional to the range, namely the effective thickness t of the specimen for Na^{24} recoil nuclei produced by photonuclear reactions from aluminum, silicon, phosphorus, and sulphur. The value of t was determined from the expression $t = N/a_0$, where N is the number of recoil nuclei per square centimeter of a specimen whose thickness is greater than the maximum range of the recoil nuclei, while

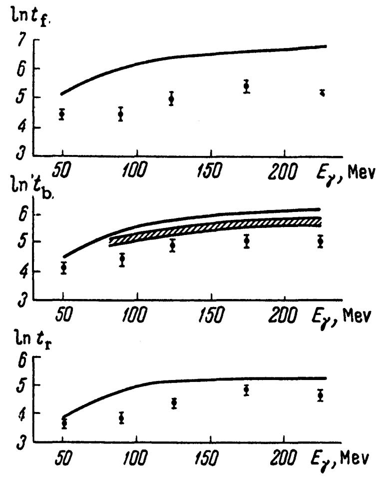

FIG. 2. Dependence of the effective thicknesses t_f, t_b, and t_r for the Na^{24} recoil nuclei, produced in the reaction Al^{27} (γ, 2pn), on the energy E_γ of the gamma quanta. ● – experimental values of the mean effective thickness in the photon-energy intervals (35 – 80, 80 – 100, 100 – 150, 150 – 200, and 200 – 260 Mev). Solid curve – calculated from the compound-nucleus theory. Cross-hatched curve – calculated by the "quasi-deuteron" model.

Average Effective Thicknesses for Na^{24} Recoil Nuclei at $E\gamma_{max}$ = 260 Mev.

Reaction	t_f (micrograms/cm²)		t_b (micrograms/cm²)			t_r (micrograms/cm²)	
	Experimental	Compound nucleus	Experimental	Compound nucleus	"Quasi-deuteron" model	Experimental	Compound nucleus
Al^{27} (γ, $2pn$)	125±3	515±50	102±3	271±30	180±30	72±3	122±15
Si^{28} (γ, $3pn$)	80±8	530±50	80±16	200±20	160±30	40±8	48±5
P^{31} (γ, $4p3n$)	80±8	680±70	50±16	250±30	160±30	20±8	44±5
S^{32} (γ, $5p3n$)	40±8	660±70	20±8	240±30	—	0±8	40±5

a_0 is the total number of recoil nuclei produced per unit mass of the specimen. To determine N, the investigated specimens were coated with triacetate films 20 microns thick. These films served to gather the Na^{24} recoil nuclei from the specimen. Stacks made up of the specimens and films were placed in the bremsstrahlung beam of the 260-Mev synchroton of the Physics Institute of the Academy of Sciences, both parallel and perpendicular to the beam (Fig. 1), and exposed for 10 to 15 hours. Ten to 15 hours after the end of the exposure, only the characteristic activity of Na^{24} was observed on the films and specimens. The ratio N/a_0 was calculated from the measured activities of Na^{24} by introducing corrections for the decay and for the self absorption. The experiments with aluminum were carried out at maximum bremsstrahlung energies ($E\gamma_{max}$) of 80, 100, 150, 200, and 260 Mev. The experiments with silicon, phosphorus, and sulphur were carried out at $E\gamma_{max}$ = 260 Mev.

The experimental results are shown in Fig. 2 and in the table, which lists also the values of t_f, t_b and t_r (see Fig. 1), calculated with the compound-nucleus model, and tentative values of t_b calculated with the "quasi-deuteron" model. As can be seen from Fig. 2 and from the table, the values of t calculated with the compound-nucleus model are several times greater than the experimental ones. This shows that a model that assumes the formation of a compound nucleus with subsequent evaporation of the nucleons cannot be used to explain the reactions investigated. The values t_b calculated by the "quasi-deuteron" model are also considerably greater than the experimental ones. Further experiments and refinement of the calculations should show whether these discrepancies can be eliminated by a suitable modification of the "quasi-deuteron" model or whether deep photofissions of this kind must be explained by introducing a substantially different mechanism of interaction, for example a mechanism that takes into account the interaction between the gamma quanta and the alpha particles or the more complicated fragments of the nuclei.

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ISOTOPIC INVARIANCE IN ANTI-HYPERON PROCESSES

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In this note we consider formation and interaction processes of anti-hyperons with nucleons and light nuclei on the basis of isotopic invariance.

As was shown by Amati and Vitale,[1] the most convenient process for the identification and study of the anti-hyperons is not the nucleon-nucleon collision, but the reaction involving a beam of K particles:

$$K + N \rightarrow \tilde{Y} + N + N. \tag{1}$$

Using K^+ particles and protons in reaction (1), we get two channels for the charge states (with formation of $\tilde{\Sigma}$ anti-hyperons):

$$\begin{aligned} K^+ + p &\rightarrow \tilde{\Sigma}^0 + p + p, \quad &(a)\\ &\rightarrow \tilde{\Sigma}^- + p + n. \quad &(b)\end{aligned} \tag{1'}$$