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ANGULAR DEPENDENCE OF THE LOW-ENERGY PHOTOPIONS
IN THE BACK HEMISPHERE

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Experimental angular distributions of photopions in kinematic region, where the production of photoprotons has a cumulative character, are given. The obtained angular spectra are necessary to estimate the contribution in the cumulative proton production due to absorption of slow π -mesons produced in the same target-nucleus.

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УГЛОВАЯ ЗАВИСИМОСТЬ МАЛОЭНЕРГИЧНЫХ ФОТОПРОТОНОВ В
ЗАДНЕЙ ПОЛУСФЕРЕ

Приводятся экспериментальные угловые распределения фотопротонов в кинематической области, где образование фотопротонов имеет кумулятивный характер. Полученные угловые спектры необходимы для оценки вклада в образование кумулятивных протонов вследствие поглощения медленных Π -мезонов, рожденных в том же ядре-мишени.

Ереванский физический институт

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To explain cumulative particle production a number of theoretical models [1,2,3,4,5] is suggested, which assume, as a rule, existence in the nucleus of exotic states (such as the presence of large momenta (~ 1 GeV/c) in nucleon one-particle state [1], strong pair, triple and other correlations [2], existence [3] or formation during [4] and after [5] interaction of nucleon cumulation in nuclei, and so on). However, it is difficult at present to explain all experimental data available on cumulative production with these models. Nevertheless it seems necessary to make attempts as to estimate the contribution of other processes, required no special assumptions. As such processes the contribution of final state interaction may be distinguished. In Ref. [6] an attempt was made to estimate the role of secondary rescatterings of non-cumulative protons on nuclear nucleons, which bring to a "turn" for cumulative region. However, experimental dependences of cumulative particle yield on the atomic number of the nucleus are difficult to be explained by this mechanism (the yield must decrease for a small A region, since the number of rescatterings reduces with decrease of A, which is not

observed in the experiment).

In Ref. [7] an assumption is made on a possible large contribution in the production of cumulative protons due to absorption of slow particles produced at interaction of the incident particle with the quasi-free nuclear nucleon (π , K , ρ -meson absorption). For example, if a stopped π -meson is absorbed by a nucleon pair (quasi-deuteron), then the secondary proton average momentum is $P_p^{\max} = 0.4$ GeV/c, and in the case of absorption by a pair of ρ -mesons $P_p^{\max} = 0.9$ GeV/c.

For correct counting of contributions of secondary slow meson absorptions, it is necessary to know the yield of these particles, particularly, their angular distributions.

In this work experimental distributions of photoproduction yield of low-energy π^\pm -mesons from different nuclei irradiated with bremsstrahlung γ -quanta with a maximum energy of 4.5 GeV are given (experimental results on cumulative proton photoproduction given in Refs. [8,9,10] were obtained under similar conditions). The data are given for the back hemisphere, since the contribution of these π^\pm -mesons in the cumulative proton yield seems to be largest.

π^\pm -mesons (without definition of the charge sign) were identified with a range telescope [11] in the 45 - 160 MeV kinetic energy range. Mass spectra of detected particles from C^{12} nucleus at different energies are given in Fig.1. As one can see, π -mesons and protons resolve with nearly 100% efficiency. The number of π -mesons was found over

area under the peak " π " in Fig.1.

The π^+ -meson yield was corrected for nuclear absorption (9 + 48%) and multiple scattering (53 + 72%) in the target and substance of the telescope, for decrease of the number of incident γ -quanta due to pairproduction in the target (15% for C^{12} and 17% for Pb^{208}), for the decay (8.6% - 12%) and for the telescope detection efficiency.

Dependences of the invariant cross section $f = \frac{E_2}{P^2} \cdot \frac{d^2\sigma}{d\Omega \cdot dP}$ of π^+ -meson photoproduction from the lab detection angle are given in Fig.2.

Statistical errors do not exceed the sign sizes.

The given angular distributions are fairly close to angular distributions of cumulative photoprotons detected under similar conditions [8].

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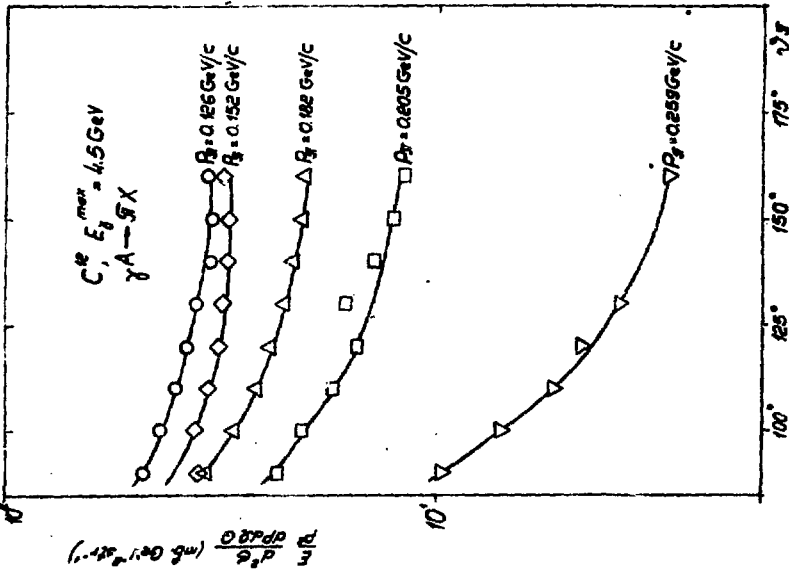


FIG. 2a

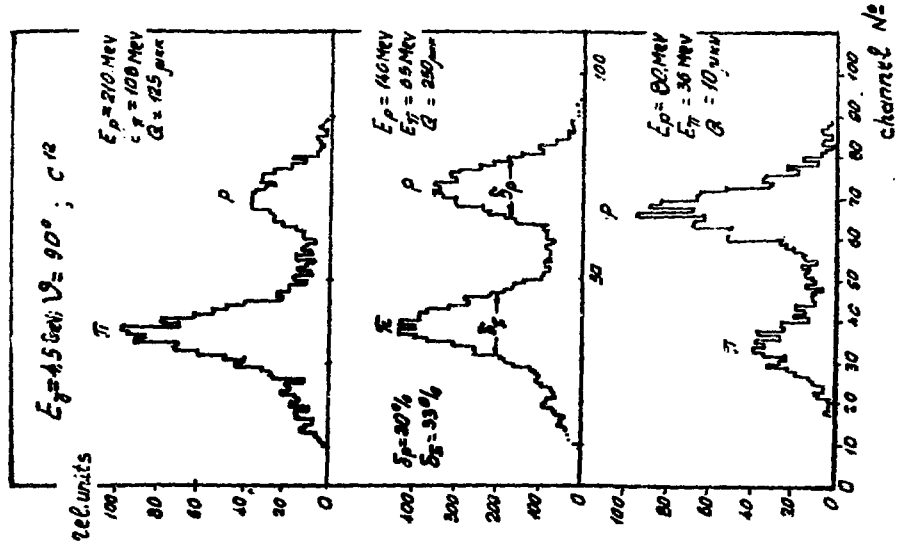


FIG. 1

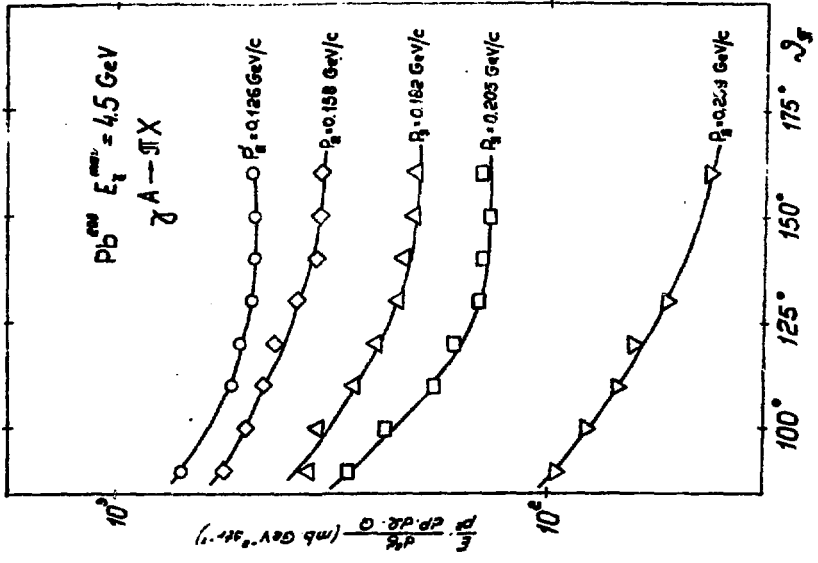


FIG. 20

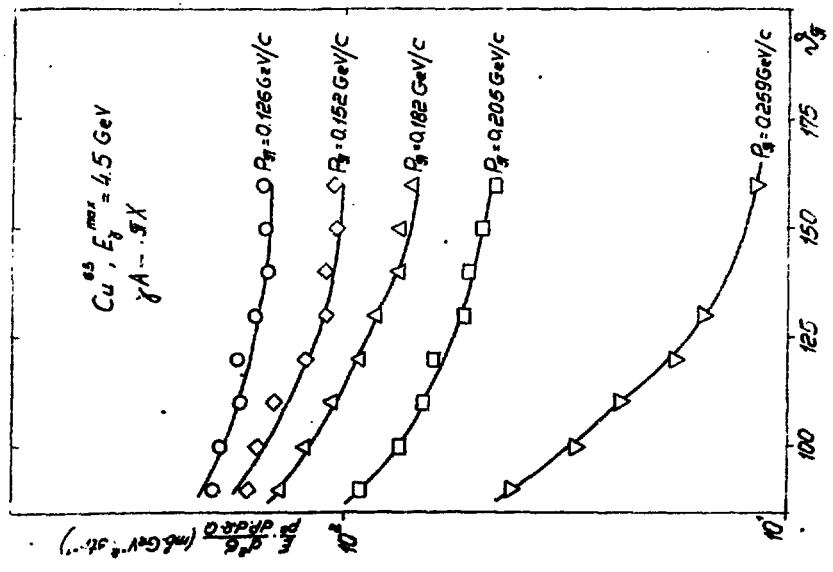


FIG. 2b

FIGURE CAPTIONS

Fig.1 Mass spectrum of particles detected with a range telescope: "π" - π[±]-meson peak, "P" - proton peak.

Fig.2 Angular dependence of the invariant cross section $f = \frac{E}{p^2} \cdot \frac{d^2G}{d\Omega dP}$ for the reaction $\gamma A \rightarrow \pi X$ on nuclei at γ -quanta maximum energy 4.5 GeV: a, b, c - cross sections on C¹², Cu⁶³, Pb²⁰⁸, respectively.

ϕ - π[±]-meson momentum 0.126 GeV/c,

ϕ - 0.152 GeV/c, $\bar{\phi}$ - 0.182 GeV/c,

ϕ - 0.205 GeV/c, $\bar{\phi}$ - 0.259 GeV/c.

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