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A b s t r a c t

The probabilitions of production of different kinds of particles and their momentum distribution for (NN) - collision at E = 3 BeV are calculated by the method of statistical theory.[1] - [3]

The results of calculation are compared with the experiment [8] - [10].

The statistical theory of multiple production of strange particles was considered in [I] - [3]. For (π N) -collisions this theory satisfies the experiment rather well if the energy of colliding particles is high enough. [4], [5]

At present it is possible to compare the theoretical calculations with the experiments for (NN) - collisions as well. The calculated statistical weights of different channels of reaction for (NN) - collisions at the energy E = 3 BeV are given in Table I. (reference 6). The statistical weights are expressed in per cents. The calculations are made in the same suppositions as in [I] - [3] and in the same symbols.

When supposing that effective inelastic cross-section for (pp) - collisions at E = 3 BeV is equal to σ_{in} = 26 mb [7] then the K^+-particle production cross-section in (pp) - collisions is equal to σ_K^+ = I,0 mb for $V = V_2$ case, and σ_K^+ = 0,05 mb for $V = V_3$ case, and the cross-section of production of all strange particles is equal to σ_{st} = I,5 mb for $V = V_2$ case and σ_{st} = 0,07 mb for $V = V_3$ case.

In paper [8] which is obviously the most detailed one for the present time, the magnitude

$$\frac{d^2\sigma_K^+}{dp\,d\Omega} = (4,5 \pm 0,9) \cdot 10^{-32} \frac{cm^2}{ster.\,mev}$$

was obtained for the effective K^+- particle production cross-section with the momentum equal to p = I,9 (μ_π (μ_π = I40 MeV) at the angle θ = I80° (in the c.m. system) for (pp) - collisions at E = 3 BeV. In order to integrate over all the momentum we calculated momentum distribution $W^+ = W^+(p)$ of K^+ - mesons produced I). The results of calculations for $V = V_2$ case in the c.m. system are

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I) When calculating the spectra we partially used the nomograms of L.G. Zastavenko (to be published).

given in Fig. I. The calculated π - meson spectrum turns out to be somewhat softer than the corresponding spectrum for E-mesons. The softening of π - meson spectrum is due to the pions produced during the decay of the isobar state $P = T = 3/2$ (See the physical meaning of the notion "isobar" in the statistical theory of multiple particle production[II]). In supposition of isotopic angular distribution in the c.m. system for $V = V_2$ case we have

$$\sigma_K^+ = 4\pi \cdot 4{,}5 \cdot 10^{-32} / W^+(1{,}9) \simeq 0{,}33\ mb \qquad 2)$$

(considering that $\int_0^{P_{max}} W^+(P)\,dP = 1$). The calculation for $V = V_3$ case gives almost equal value of the cross-section. However, this value is different by one order from the cross-section calculated for $V = V_3$ case by the data of Table I. As well as in case of (π N) collisions, $V = V_3$ case leads to contradictions. For $V = V_2$ case σ_K^+ which was calculated if the momentum distributions were taken into account is three times less than that calculated by Table I. This discrepancy may be explained by the fact at low energies E $\lesssim$ 3 BeV the energy of the strange particles produced in (NN) - collisions is close to that of the threshold, whereas their number is small. Therefore the statistical methods may yield only the orders of the magnitudes. This circumstance is especially essential for the calculation of spectra, which are very sensitive to the assumption about the form of the matrix element. So, it should be expected, that $\sigma_K^+ \simeq 1{,}0\ mb$ which follows from Table I, will be very likely to be closer to the experimental data than the value $\sigma_K^+ \simeq 0{,}33\ mb$ obtained by integrating of the

2) In [8] they give $\sigma_K^+ \simeq 0{,}2\ mb$. The difference is due to the fact that we considered a number of additional effects such as resonance (π N) interaction in $P = T = 3/2$ state and different statistical weights of $N \Lambda K$, $N \Sigma K$ .... reactions.

calculated spectrum[3)].

If one assumes that there exists the resonance interaction of K - mesons similarly as it occurs for pion interaction with nucleons then the spectrum of K - mesons produced in (p -p) - collisions will become softer, whereas the magnitude of the cross-section σ_K^+ calculated o in accordance with such a spectrum appreciable increases. This possibility is now, however, purely speculative.

In our opinion at present one cannot state for sure that the cross - section for the production of strange particles in (p-p) - collisions is considerably less than than in (π N) - collisions at equal energy values in c.m.s. (of [8 - 10]).

A very small magnitude of the cross-section σ_{st} for (p-p)-collisions observed in [9] is likely to be accounted for the insufficient statistics.

3) The same holds for (π N) - collisions for equal c.m.s. energy. (E$\sim$ 2 BeV).

F I G U R E S

Momentum distribution ($W^{+}=W^{+}(p)$) of K^{+} - particles produced in (p-p) - collisions at E = 3 BeV; $V = V_2$ (solid curve).

For comparison there are given the total momentum distribution of K^{+} and K^{0} - particles (dashed curve) and the momentum dis - tribution of the pions produced in (p-p) - collisions (dotts and pions).

All the spectra are normalized to unity and reffered to the c.m.s. of the colliding nucleons. The momentum is expressed in the units of the pion mass μ_{π} = 140 MeV.

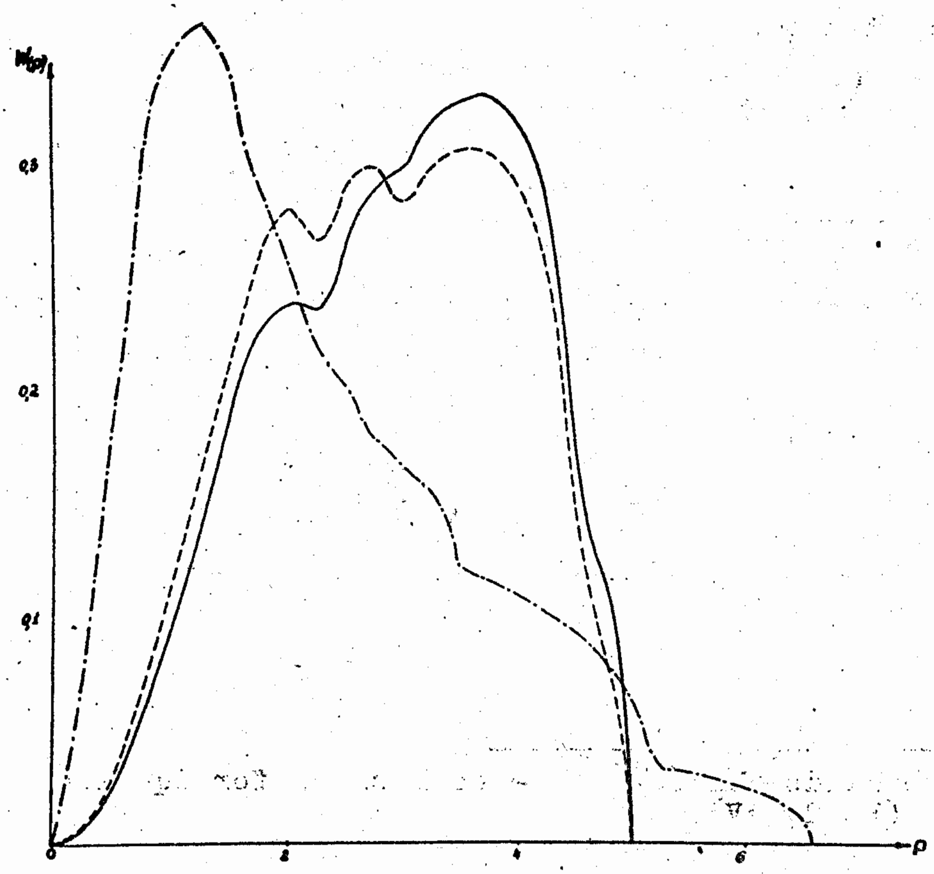

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TABLE I

Secondary Particles	(pp)- collision		(pn)- collision	
	V_2	V_3	V_2	V_3
$2N$	I,74	I,82	2,70	2,88
$2N\pi$	22,2	23,3	I9,6	20,8
$2N2\pi$	44,2	46,3	48,0	5I,0
$2N3\pi$	24,3	25,5	2I,5	22,8
$2N4\pi$	I,87	I,96	I,75	I,86
$2NK\tilde{K}$	0,00092	0,00096	0,00II	0,00I2
$N\Lambda K^+$	I,85	0,0867	I,43	0,0684
$N\Lambda K^o$	0	0	I,43	0,0684
$N\Sigma^+K^+$	0,903	0,0424	0	0
$N\Sigma^+K^o$	0,903	0,0424	0,722	0,0344
$N\Sigma^oK^+$	0,602	0,0282	0,5I2	0,0242
$N\Sigma^oK^o$	0	0	0,5I2	0,0242
$N\Sigma^-K^+$	0	0	0,722	0,0344
$N\Sigma^-K^o$	0	0	0	0
$N\pi\Lambda K^+$	0,264	0,0I24	0,239	0,0II2
$N\pi\Lambda K^o$	0,445	0,0209	0,239	0,0II2
$N\pi\Sigma^+K^+$	0,I2	0,0056	0,I30	0,0050
$N\pi\Sigma^+K^o$	0,I2	0,0056	0,I02	0,0054
$N\pi\Sigma^oK^+$	0,I2	0,0056	0,096	0,0045
$N\pi\Sigma^oK^o$	0,I2	0,0056	0,096	0,0050
$N\pi\Sigma^-K^+$	0,I6	0,0075	0,I02	0,0069
$N\pi\Sigma^-K^o$	0	0	0,I30	0,0035