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INCLUSION OF TRANSVERSE QUARK MOMENTA IN THE MODEL OF QUARK-GLUON STRINGS

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INTRODUCTION

The model of quark-gluon strings (MQGS [1-8]) based on the I/N expansion in QCD[9-11] describes multiple production processes in hadron and hadron-nucleus [4,8,12-17] collisions quite successfully. There are the analytic[2,4,6,7] and the Monte-Carlo version [18-20] of this model. However, the characteristics integrated over the transverse momentum p_t or at the average p_t are usually considered in the frame of this model. To derive the dependence of the observed values on p_t it is necessary to know the p_t -dependence of the distribution functions of quarks (diquarks) and their fragmentation into hadrons. The p_t-dependence of inclusive hadron spectra in the frame of the MQGS is considered in the Monte-Carlo version in refs.[18-20] and in the analytic version in ref. [14].

In the analytic version of the QGSM the division of the internal transverse momentum between quark-antiquark chains was supposed to be regular[14]. Therefore the weak dependence of the inclusive spectrum and the average transverse hadron momentum on their number and, consequently, on the Feynman variable x was derived in ref.[14]. The question arises if another analytic method of the inclusion of the internal transverse momentum k_t of the quark, antiquark, diquark into the MQGS is possible. In this paper another mechanism of the inclusion of the dependence of the quark (antiquark, diquark) distribution functions on k_t based on the consequent division of k_t is suggested, which gives a stronger dependence of hadron spectra on the number of q-$\bar{q}$ chains and p_t.

I. p_t -DEPENDENCE OF INCLUSIVE HADRON SPECTRA

As is known, the main contribution to the processes of type $hN \to h'X$, where h, h′ are the initial and final hadrons, are given by the cylinder-type graphs, cut in the S-channel. Taking into account the dependences of quark (antiquatk, diquark) distributions and fragmentation functions, one can write the invariant hadron spectrum corresponding to those graphs in the following form:

$$E\frac{d\sigma}{d^3p} = \sum_n \sigma_n \phi_n^h(x, p_t) \; ; \qquad (1)$$

where σ_n is the cross section of the n-Pomeron shower production or 2n quark-gluon strings decaying into hadrons; $\phi_n^h(x,p_t)$ is the distribution of hadrons, produced in the decay of 2n quark-gluon strings, over x and p_t, $x = 2p_z^*/\sqrt{S}$ is the Feynman variable, p_z^* is the longitudinal momentum of the produced hadron in the c.m.s. h-N;

$$\phi_n^h(x,p_t) = \int_{x_+}^{1} dx_1 \int_{x_-}^{1} \Psi_h(x;x_1,x_2,p_t), \tag{2}$$

$$\begin{aligned}\Psi_n(x;x_1,x_2,p_t) = a_h \{ & F^{(n)}_{qq,\bar q_v}(x_+;x_1,p_t) * \\ \times & F^{(n)}_{q_v}(x_-;x_2,p_t)/F^{(n)}_{q_v}(0,p_t) + F^{(n)}_{q_v}(x_+;x_1,p_t) * \\ * & F^{(n)}_{qq,\bar q_v}(x_-;x_2,p_t)/F^{(n)}_{qq,\bar q_v}(0,p_t) + 2(n-1) * \\ * & F^{(n)}_{q_{sea}}(x_+;x_1,p_t)\, F^{(n)}_{\bar q_{sea}}(x_-;x_2,p_t)/F^{(n)}_{\bar q_{sea}}(0,p_t),\end{aligned} \tag{3}$$

where $x_\pm = 1/2(\sqrt{x_t^2 + x^2} \pm x)$, $x_t = 2(m_h^2 + p_t^2)^{1/2}/\sqrt{s}$; m_h, p_t are the mass and the transverse hadron momentum respectively, $\sqrt{s}$ is the total energy of two colliding hadrons in their c.m.s.;

$$\begin{aligned}F^{(n)}_r(x_\pm;x_{1,2},p_t) = & \int d^2k_t\, f^{(n)}_r(x_{1,2};k_t) \times \\ \times & \tilde G_{r\to h}(x_\pm/x_{1,2}; p_t - \frac{x_\pm}{x_{1,2}}k_t);\ F^{(n)}_r(0,p_t) = \\ = & \int_0^1 dx' \int d^2k_t\, f^{(n)}_r(x',k_t)\, \tilde G_{r\to h}(0,p) = \tilde G_r(0,p_t),\end{aligned} \tag{4}$$

where the symbol r means the flavour of quarks, antiquarks (valence q_v, $\bar q_v$ or sea q_s, $\bar q_s$) and diquarks qq, respectively, $f_r^{(n)}(x, k_t)$ is the distribution function of the quark (antiquark, diquark) after n-Pomeron exchanges over its longitudinal momentum fraction x and the transverse momentum k_t; $\tilde G_{r\to h}(z, k_t) = z^* D_{r\to h}(x, k_t)$; $D_{r\to h}$ is the fragmentation function of the quark (antiquark, diquark) into the hadron h.

To derive the p_t-dependence of the functions $F_r^{(n)}$ and therefore the invariant inclusive spectrum (1) it is necessary to know the dependence of the distribution functions $f_r^{(n)}$ and the fragmentation functions of quarks $D_{r\to h}(z, k_t)$ on k_t.

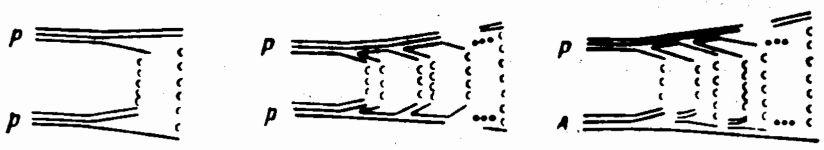
In ref. /14/ it was supposed that the valence and sea quarks and the diquark in the proton have the internal transverse momenta which add up to zero. The distribution of quarks (antiquarks and diquarks) was represented in the factorized form $f_r(x, k_t) = \tilde f_r(x) g_r(k_t)$, so it will also be factorized in the n-chain, i.e.,

$$f_r^{(n)}(x,k_t) = \tilde f_r^{(n)}(x)\, g_r^{(n)}(k_t). \tag{5}$$

The distribution $g_r^{(n)}(k_t)$ was found as the product of the probabilities to find the quark (antiquark, diquark) with the transverse momentum k_t in every n-chain, i.e. as the product of functions $g_r(k_{it})$, the transverse momentum conservation law taken into account $\sum_{i=1}^{n} k_{it} = 0$, integrated over all k_{it} except one. This means that quark (diquark) transverse momentum of the ends of a 2n-string would be divided between these strings.

Another method of the division of the internal transverse momentum between the quarks (valence and sea) is proposed in this paper, the method is similar to the consequent energy division between n-Pomeron showers in the h-p interaction /6/.

As in ref. /14/ we shall represent the quark function in the factorized form. We shall consider the graph of the "cut cylinder" type, fig.1a, corresponding for example in p-p collision to the production of one Pomeron shower or the decay of two quark-gluon strings /2-5/, for example in the p-p collision. The hadron production can be represented in the following manner: each of two colliding protons is divided into a quark and a diquark with the opposite transverse momenta; after the colour interaction between them and the diquark and the quark respectively of another proton two quark-gluon strings are produced in the chromostatic constant field; then they decay into hadrons. This process of the division of three quarks into a diquark and a quark is repeated n times during production of n-Pomeron showers or 2n quark-



a b c

Fig.1. a — graph of the "cut cylinder" type in the s-channel of the p-p scattering, corresponding to production of two q-$\bar q$ chains; b — graph corresponding to production of n-Pomeron showers or 2n q-$\bar q$ chains in the reaction PP → hX; c — the same as in Fig.1b but for the process PA → hX.

antiquark chains and therefore the diquark or the quark at the ends of every string (see fig.1b) acquires the nonzero transverse momentum. There are the more division stages the greater is the momentum. The calculation procedure of the quark (diquark) distribution after the n divisions can mathematically be represented in the following manner. According to what was mentioned above we have:

$$g_r^{(n)}(k_t) = \int \prod_{i=1}^{n} g_r(k_{it})\, \delta^{(2)}(k_t - \sum_{i=1}^{n} k_{it})\, d^2 k_{it} \,. \qquad (6)$$

If, for example, $g_r(k_{it})$ is the Gauss distribution normalized to 1, i.e. $g_r(k_{it}) = \frac{\gamma}{\pi} e^{-\gamma k_{it}^2}$; then we have from (6):

$$g_r^{(n)}(k_t) = \frac{\gamma_n}{\pi} e^{-\gamma_n k_t^2} \;; \quad \gamma_n = \gamma/n \,. \qquad (7)$$

But in the case of the regular division $\gamma_n = \gamma/(2-1/n)$ /14/. It is seen that in our case the distribution of quarks (antiquarks and diquarks) over k_t in the n-chain (see (7)) more strongly depends in n than in ref. /14/. A change in the quark (diquark) transverse momentum k_t at every stage of the above-mentioned process gives, in principle, a change in the longitudinal momentum k_z. At large energies of the initial proton, for example, about 100 GeV, the change in k_z can be neglected if we are not interested in hadrons produced with very small x. Then the x-distribution of quarks (diquarks) can be taken in the form derived in refs. /6/.

Functions of quark and diquark fragmentation into hadrons must be known for the calculation of inclusive spectra and other observed values. We shall represent them in the factorized form as in ref. /14/

$$\tilde{G}_{r\to h}(z, k_t, p_t) = G_{r\to h}(z, \tilde{k}_t)\, \tilde{g}_{r\to h}(\tilde{k}_t); \quad \tilde{k}_t = p_t - z k_t \,; \qquad (8)$$

where $\tilde{g}_r(\tilde{k}_t)$ is the function depending on $\tilde{k}_t$ alone, and the function $G_{r\to h}(z, k_t)$ is defined in ref. /12/ in the following manner:

$$G_{r\to h}(z, \tilde{k}) \sim (1-z)^{-\alpha_R(0) + 2\alpha'_R(0) k_t^2} \equiv (1-z)^{-\alpha_R(0)} \exp\left(-2\alpha'_R(0)\, k_t^2 \ln \frac{1}{1-z}\right) ; \qquad (9)$$

where $a_R(0) = 0.5$ is the Regge-trajectory at $t = 0$, $a'_R(0) = 1$ $(\mathrm{GeV}/c)^{-2}$ is its slope.

It is possible to take the Gauss function as $\tilde{g}_{r\to h}(\tilde{k}_t)$, as in ref. /14/:

$$\tilde{g}_{r\to h}(\tilde{k}_t) = \frac{\tilde{\gamma}}{\pi} e^{-\tilde{\gamma}\tilde{k}_t^2} \;; \qquad (10)$$

$F_r^{(n)}(x_\pm, x_{1,2}, p_t)$ and the inclusive hadron spectrum (1) in the P-P collision can be calculated using (7-10) and taking the quark (antiquark, diquark) distribution functions over x from ref. /14/ we can choose the following functions as $g_r(k_t)$ and $\tilde{g}_{r\to h}(\tilde{k}_t)$:

$$g_r(k_t) = \frac{B_r^2}{2\pi} e^{-B_r k_t} \;; \quad \tilde{g}_{r\to h}(\tilde{k}_t) = \frac{\tilde{B}^2}{2\pi} e^{-\tilde{B}_r \tilde{k}_t} \;; \qquad (11)$$

where B_r, $\tilde{B}_r$ are the parameters, related to the average values $\langle k_t \rangle$ and $\langle \tilde{k}_t \rangle$ as $B_r = 2/\langle k_t \rangle$; $\tilde{B}_r = 2/\langle \tilde{k}_\perp \rangle$. Similarly we can calculate the invariant spectra as functions of both x and p_t of hadrons in the meson-nucleon collisions.

Note that laws of the energy-momentum, charge baryon number and strangeness conservation help to find the parameters in the fragmentation functions $D_{q(qq)\to h}$ as suggested in ref. /5,6/. In our case, when those functions depend on x and k_t, it is necessary to integrate both over dx and d^2k_t in the corresponding sum rules determining the above-mentioned laws. This yields somewhat different parameter values.

Therefore the considered manner of the transverse momentum division between the quark-gluon strings leads to a rather marked sensitivity of the quark (diquark) k_t-distribution functions of their number. It is known that the contribution of the multipomeron chains to the inclusive hadron spectra in the hadron-hadron collisions is only significant in the region of small x and at $x \geq 0.3$ it is negligibly small /1-3,5/. But they can't be neglected in the whole region of x in the hadron-nucleus collisions /4/.

Therefore it is interesting to consider the proposed method of the inclusion of transverse momenta of quarks in MQGS in the case of h-A interactions. If we choose the dependence of the distribution functions of quarks, diquarks and ther fragmentation into hadrons on k_t in the form as in the case of the p-p collision, then the following expression for the inclusive spectrum of particles produced in the p-A interaction can be written: For the analysis of the particle production in p-A collision the idea of the eikonal, Glauber approximation can be used but in the frame of MQGS. The spectrum of inclusive particle produced in p-A interaction is written in the following form:

$$\mathcal{F}_A(x, p_t) \equiv E_A \frac{d\sigma_A}{d^3p} = \sum_\nu N_\nu \phi_\nu(x, p_t) \,, \qquad (12)$$

where

$$N_\nu = \frac{1}{\nu!} \int (\sigma T(b))^\nu \exp(-\sigma T(b))\, d^2 b , \qquad (13)$$

are the so-called effective numbers, σ is the inelastic cross section of h-N interaction.

There the contribution of the decay of quark-gluon strings formed between sea quarks, antiquarks of the initial proton and sea antiquarks, quarks of the target nucleus nucleons respectively is neglected. This is justified if we do not consider the region of very small x /1-5/. Moreover we suppose that the hadrons are formed behind the nucleus /4,16/ .

II. RESULTS AND DISCUSSIONS

We shall compare first the results yielded by the suggested method of the inclusion of the transverse quark momentum in the MQGS and by the model /14/. It is clearly seen from the analysis of the x-dependence of the average hadron momentum $< p_t >$. We shall consider for example $< p_t >$ of hadrons in the p-p collision. Its expression can be written in the following form:

$$<p_t> = \int E \frac{d\sigma}{d^3 p} p_t\, d^2 p_t \Big/ \int E \frac{d\sigma}{d^3 p} d^2 p_t \; ; \qquad (14)$$

If energies are high, for example, E_0 = 100 (GeV), it is easy to sea that at $p_t \lesssim 0.5$ (GeV/c) the variable $x_- = 1/2 * (\sqrt{x^2 + 4p_t^2/s} - x)$ is approximately equal to zero in the whole region of x except very small values $x \lesssim 0.01$. Therefore expression (2) can be represented in a simple form:

$$\phi_n^h (x, p_t) = \int_{x_+}^{1} \Psi_n (x_+; x_1, p_t)\, dx_1 \; ;$$

$$\Psi_n (x_+ ; x_1, p_t) = a_h \{ F_{qq}^{(n)} (x_+ ; x_1, p_t) + \qquad (15)$$

$$+ F_{q_v}^{(n)} (x_+ ; x_1, p_t) + 2(n-1)\, F_{q_{sea}}^{(n)} (x_+ ; x_1, p_t) \} .$$

Substituting (16) into (1) and using the above-mentioned procedure of the calculation of the inclusive spectrum we obtain the following expression for $<p_t>$:

$$<p_t> = \left(\frac{\pi}{\gamma}\right)^{1/2} \sum_n \sigma_n \int_{x_+}^{1} \tilde\phi_n (x_+, x_1)\, dx_1 \Big/ \sum_n \sigma_n \int_{x_+}^{1} \phi_n (x_+, x_1)\, dx_1 . \qquad (16)$$

Here the following notation is introduced

$$\tilde\phi_n (x_+ ; x_1) = a_h \{ r_n F_{qq}^{(n)} (x_+, x_1) + r_1 F_{q_v}^{(n)} (x_+, x_1) +$$

$$+ F_{q_{sea}}^{(n)} (x_+, x_1) \sum_{k=r}^{n-1} r_k + F_{\bar q_{sea}}^{(n)} (x_+, x_1) \sum_{k=2}^{n} r_{k-1} \} ;$$

$$r_k = [1 + (\frac{x_+}{x_1})^2 \frac{\tilde\gamma}{\gamma_k}]^{1/2} \Big/ [1 + \frac{2\alpha_R(0)}{\tilde\gamma} (1 + (\frac{x_+}{x_1})^2 \frac{\tilde\gamma}{\gamma_k}) \ln \frac{1}{1 - x_+/x_1}]^{1/2} \; ; \qquad (17)$$

$$\phi_n (x_+, x_1) = a_h \{ F_{qq}^{(n)} (x_+, x_1) + F_{q_v}^{(n)} (x_+, x_1) +$$

$$+ 2(n-1)\, F_{q_{sea}}^{(n)} (x_+, x_1) \} g_n \; ;$$

$$g_n = [1 + \frac{2\alpha_R'(0)}{\tilde\gamma} (1 + (\frac{x_+}{x_1})^2 \frac{\tilde\gamma}{\gamma_k}) \ln \frac{1}{1 - x_+/x_1}]^{-1} .$$

The so-called "sea-gull" effect, i.e. the dependence of the average hadron transverse momentum $<p_t>$ on x, in particular, for $\pi^\pm$-mesons produced in p-p interactions at high energies, calculated by (16) is represented in Fig.2. The strange dependence of these functions and, therefore, $<p_t>$ on the number of the quark-antiquark chains is shown by expression (17), because $\gamma_k = \gamma/k$. It gives rise to a stronger dependence of $<p_t>$ on x than in ref. /14/ (see Fig.2). But unfortunately, the existing experimental data, represented in Fig.2, have rather large errors, therefore it is impossible to decide unambiguously which transverse momentum division method is correct. To decide about it from the analysis of inclusive spectra of hadrons produced in h-P collisions is even more difficult, because the experimental data have larger errors. The A-dependence of the invariant $\pi^\pm$-meson spectra produced in P-A collisions on x at different p_t is presented in Fig.3 showing the sufficient description of the experimental data.

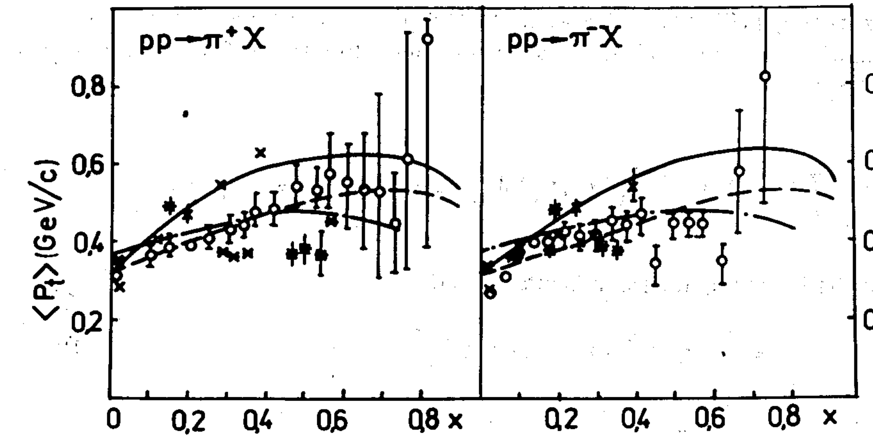


Fig.2. The "sea-gull" effect for the reaction PP→ → $\pi^{\pm}$ X, the curves are the calculations by (16), (17) and from ref./14/ : the full curve corresponds to $\tilde{\gamma}_c$ = = 40 $(GeV/c)^{-2}$, γ = 3 $(GeV/c)^{-2}$; the dashed is for $\tilde{\gamma}_c$ = 40 $(GeV/c)^{-2}$, γ = 6 $(GeV/c)^{-2}$; the dash- and dott curve is from ref./14/; the experimental data: ● — $\sqrt{s}$ = 45 (GeV/c)/24/, × — P_0 = = 175 (GeV/c)/15/, ○ — for the kinetic energy T_0 = 65 (GeV)/26/.

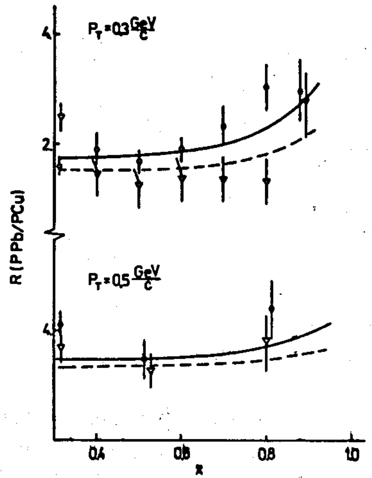


Fig.3. Ratios of emissions of secondary $\pi^{\pm}$-mesons in P-Pb and P-Cu collisions at p_T = 0.3 (GeV/c) and p_t = 0.5 (GeV/c) at P_0 = 100 (GeV/c) experimental data: ○ — π^+-mesons (solid curves), ∇ — π^--mesons (dashed curves)/27/.

We shall give now the calculation results for the inclusive spectra of hadrons produced in the meson-proton and meson-nucleus interactions with participation of strange mesons which can be of interest in connection with the experiments that are carried out. The calculation results for K^-, K°-meson spectra in K^+-P and K^+-A collisions obtained with different forms of functions $g_\tau(k_t)$ and $g_{\tau\to h}(k_t)$: Gauss-type or form (11) are shown in Fig.4 (a-d). Note that the parameters in these functions did not change at different energies of the initial K-mesons. Fig.4 (a-d) show the sufficient description of the experimental data. The predictions of the x — behaviour of spectra at p_t = = 0.5 (GeV/c) are very interesting for future experiments. A rather sufficient

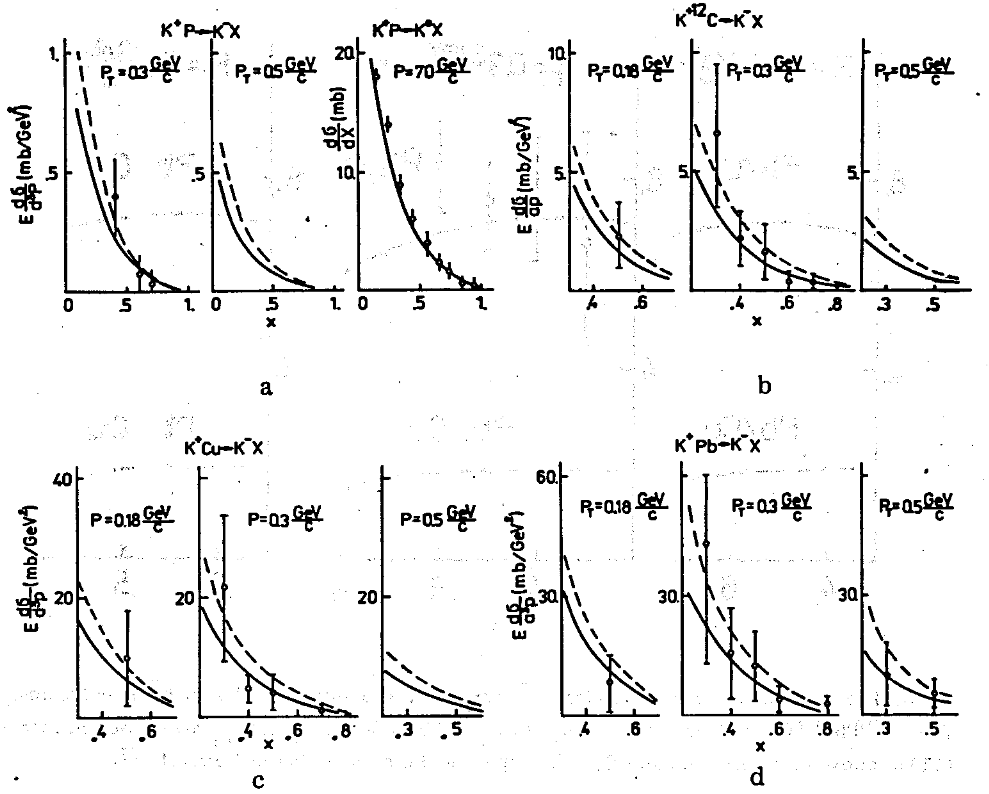


Fig.4. Spectra of secondary K^- and K^+-mesons in K^+P and K^+A collisions at P_0 = = 100 (GeV/c). The curves correspond to $g_\tau(k_t)\,\tilde{g}_{\tau\to h}(\vec{k}_t)$: dashed — (7), (10) at γ = = 2 $(GeV/c)^{-2}$ and $\tilde{\gamma}$ = 3γ; solid — (11) at B_τ = $\tilde{B}_\tau$ = 6.5 $(GeV/c)^{-1}$.

description of the A-dependence of the $\pi^{\pm}$-meson spectra on x at different p_t and the invariant K^--meson spectra in K^+-A interactions indicates the valid inclusion of nuclear effects (Figs 4 (b-d), 5). In our opinion, the comparison of the ratios of the K-meson spectra on different nuclei in relation to p_t calculated by our method of using the model /14/ can be an interesting characteristic demonstrating the difference between our method and the model /14/. The ratios R of the cross sextions of the processes $K^+Pb \to K^-X$ and $K^+\,{}^{12}C \to$ $\to K^-X$ in the interval p_t = 0÷2 (GeV/c) are presented in Fig.6. It is seen that the ratio $R(p_t)$ increases in our case at $p_t \gtrsim 1$ (GeV/c) and are approximately constant in the case of the regular division of p_t between 2n chains/14/. But there are not experimental data of this ratio $R(p_t)$. Therefore to varity those methods it is interesting to have the experimental ratio $R(p_t)$.

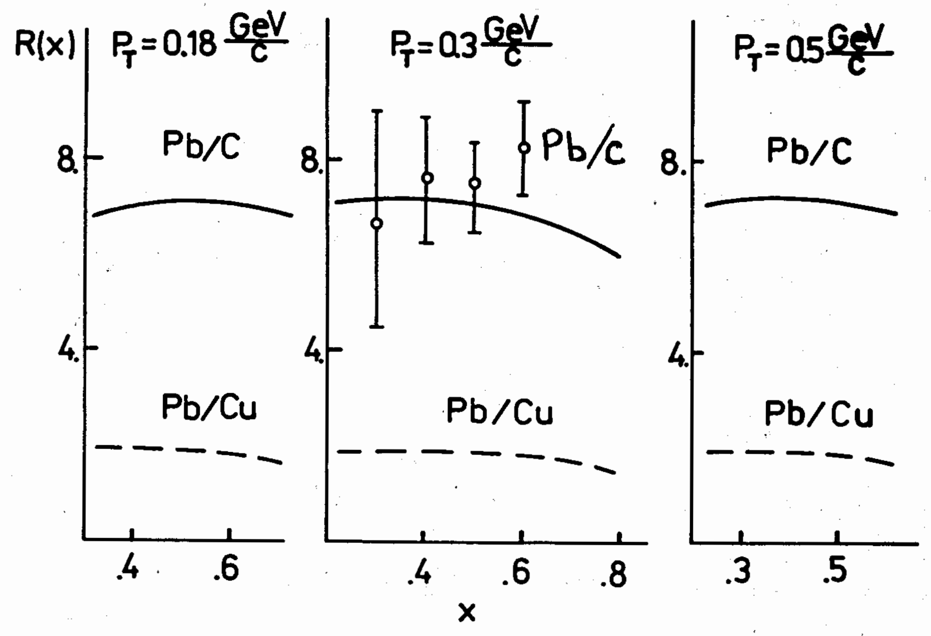


Fig.5. The spectra ratios of secondary K^--mesons R as a function of x in K^+-A collisions, A = ^{207}Pb, ^{64}Cu, ^{12}C at different p_t at P_0 = 100 (GeV/c), g_r, $g_{r\to h}$ are chosen in form (11) at above-mentioned B_r and $\tilde{B}_r$, the experimental data are taken from ref./27/

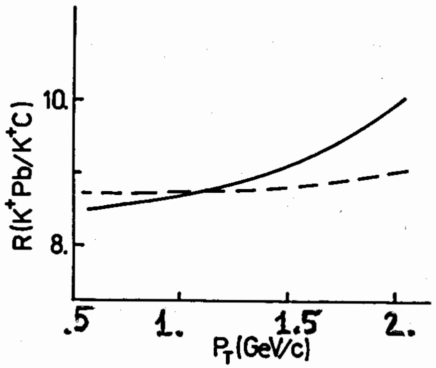


Fig.6. The spectra ratios of the process $K^+Pb \to K^-X$ and $K^{+12}C \to K^-X$ as a function of p_t at P_0 = 100 (GeV/c). The dashed curve is the model/14/; the solid curve is our method; g_r, $\tilde{g}_{r\to h}$ are chosen in form (11) at the above-mentioned values of B_r and $\tilde{B}_r$.

CONCLUSION

The possible modification of the MQGS is developed in the present paper, which allows one to describe the invariant spectra of hadrons produced in h-P and h-A interactions as a function of both x and p_t rather satisfactorily.

The suggested method of consequent division of the internal transverse momentum between quark-antiquark chains gives the sharper dependence of the average transverse momentum $\langle p_t \rangle$ of particles produced in hadron, e.g. P-P, interactions on the number n of Pomeron showers or 2n q-$\bar{q}$ chains and therefore on x. The suggested mechanism manifests itself in h-A collision where the contribution of the multipomeron chains is a significant /15/ event in the fragmentation region of initial hadrons. It is seen from the sharper (as compared with the model /14/) dependence of the relation $R(p_t)$ of the emission of K^--mesons in the collisions of K^+ with different nuclei in the dependence of p_t in particular at $p_t > 0.5$ (GeV/c). Therefore, obtaining the experimental information about $R(p_t)$ at $p_t > 0.5$ (GeV/c) is very interesting for verification of our method or the model /14/.

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APPENDIX

We shall present the expressions for the quark distribution functions over x in the proton and K^+-meson respectively, which are taken from/5,6,15,16,28/.

$$\tilde{f}_{u,p}(x) = C_u x^{-\alpha_R(0)} (1-x)^{\alpha_R(0)-2\alpha_N(0)}$$

$$\tilde{f}_{d,p}(x) = C_d x^{-\alpha_R(0)} (1-x)^{\alpha_R(0)-2\alpha_N(0)+1}$$

$$\tilde{f}_{uu,p}(x) = x\tilde{f}_{ud,p}(x)(1-x); \quad \tilde{f}_{ud,p} = C_{ud}\, x^{\alpha_R(0)-2\alpha_N(0)} (1-x)^{-\alpha_R(0)}$$

$$\tilde{f}_{u,k^+}(x) = \tilde{C}_u x^{-\alpha_R(0)} (1-x)^{-\alpha_\phi(0)}$$

$$\tilde{f}_{\bar{s},K^+}(x) = \tilde{C}_{\bar{s}} x^{-\alpha_\phi(0)} (1-x)^{-\alpha_R(0)}$$

$$f_r^{(n)}(x) = \tilde{f}_r(x)(1-x)^{n-1}$$

for the proton: r = u, d; uu, ud
for the K^+-meson: $r = u, \bar{s}$
The distributions of sea quarks, antiquarks are taken equal to the above mentioned valence quarks. The coefficients C_r, $\tilde{C}_r$ are determined from the normalization conditions:

$$\int_0^1 f_r(x)\,dx = 1; \quad \alpha_R(0) = 0.5, \quad \alpha_\phi(0) = 0, \alpha_N(0) = -0.5$$

are the well known Regge trajectories.

All fragmentation functions of quarks from the proton are taken from ref. /15/ and for the K^+-meson from ref. /23/ .

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Учет поперечных импульсов кварков
в модели кварк-глюонных струн

В рамках модели кварк-глюонных струн предлагается механизм учета зависимости функций распределения кварков, антикварков, дикварков и их функций фрагментации в адроны от поперечного импульса k_t. Предполагается последовательное деление k_t между 2n кварк-антикварковыми цепочками или n-померонными ливнями. Анализируются адронные и адрон-ядерные процессы P-P, P-A, K^+-P, K^+-A. В таком методе получается сильная зависимость наблюдаемых величин от числа n, что особенно важно при анализе адрон-ядерных столкновений. Предлагаемый метод сравнивается с методом равномерного деления k_t .

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Inclusion of Transverse Quark Momenta
in the Model of Quark-Gluon Strings

The mechanism of the inclusion of the dependence of distribution functions of quarks, antiquarks, diquarks and their fragmentation into hadrons on the transverse momentum k_t is proposed in the frame of the quark-gluon string model. The consequent division of k_t between 2n-quark-antiquark chains, or n-Pomeron showers is suggested. The hadron and hadron-nuclear processes, P-P, P-A, K^+-P, K^+-A, are analyzed. A strong dependence of the observed values on the number n is derived in this method, it is of special importance for the analysis of hadron-nucleus collisions. The suggested method is compared with the regular k_t division method.

The investigation has been performed at the Laboratory of Nuclear Problems, JINR.

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