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ЕРЕВАНСКИЙ ФИЗИЧЕСКИЙ ИНСТИТУТ

Yu.G. SHAKHNAZARYAN

$e^+e^- \to q\bar{q}g$ PROCESS CROSS SECTION TRANSVERSE MOMENTUM DISTRIBUTION FOR HEAVY QUARKS

ЦНИИатоминформ

ЕРЕВАН-1986

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ՇԱՀՆԱԶԱՐՅԱՆ Յու.Գ.

$e^+e^- \to q\bar{q}g$ ՊՐՈՑԵՍԻ ԿՏՐՎԱԾՔԻ ԲԱՇԽՈՒՄԸ ԸՍՏ ԼԱՅՆԱԿԻ ԻՄՊՈՒԼՍԻ՝ ԾԱՆՐ ՔՎԱՐԿՆԵՐԻ ՀԱՄԱՐ

Քվանտային քրոմոդինամիկայի շրջանակներում հետազոտված է ծանր քվարկների զանգվածի հաշվառման ազդեցությունը $e^+e^- \to q\bar{q}g$ եռափունջ պրոցեսի կտրվածքի՝ ըստ T /առավել մեծ էներգիա ունեցող պարտոնի իմպուլս/ և $x_\perp$ /մյուս երկու պարտոնների $\vec{T}$ առանցքի նկատմամբ լայնակի իմպուլս/ փոփոխականների բաշխման վրա: Ցույց է տրված, որ ստացվող արդյունքները էապես կախված են քվարկի զանգվածից: Զանգվածի հաշվառումը բերում է ոչ միայն $x_\perp$-ի փոփոխման տիրույթի զգալի ընդլայնմանը՝ զանգվածը հաշվի չառնելու դեպքի համեմատ, և այդ տիրույթի տեղաշարժմանը դեպի $x_\perp$-ի փոքր արժեքները, այլև $d^2\sigma/dTdx_\perp$ կտրվածքի $x_\perp$-կախվածությունը նկարագրող կորերի վրա կառուցվածքների առաջացմանը:

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Yu.G. SHAKHNAZARYAN

$e^+e^- \to q\bar{q}g$ PROCESS CROSS SECTION TRANSVERSE MOMENTUM DISTRIBUTION FOR HEAVY QUARKS

In QCD framework the influence of taking the mass of heavy quarks into account on the distribution over the value T (thrust, the momentum of the most energetic parton) and on transverse to $\vec{T}$ axis momentum $x_\perp$ of each of two other partons in the process $e^+e^- \to q\bar{q}g$, responsible for three-jet events in e^+e^- annihilation, is investigated. It is shown that the account of quark mass has a considerable effect on theory predictions. This leads to significant widening of vari tion range of $x_\perp$ as compared with the massless case, to the shift of this range towards small values of $x_\perp$ and also to structures in curves describing the dependence of the cross sectior $d^2\sigma/dTdx_\perp$ on $x_\perp$.

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Ю.Г.ШАХНАЗАРЯН

РАСПРЕДЕЛЕНИЕ ПО ПОПЕРЕЧНОМУ ИМПУЛЬСУ СЕЧЕНИЯ ПРОЦЕССА $e^+e^- \to q\bar{q}g$ ДЛЯ ТЯЖЕЛЫХ КВАРКОВ

В рамках КХД исследовано влияние учета массы тяжелых кварков на распределение по величине T (импульсу наиболее энергичного партона) и поперечному относительно оси $\vec{T}$ импульсу $x_\perp$ каждого из двух других партонов в процессе $e^+e^- \to q\bar{q}g$, ответственном за трехструйные события в e^+e^--аннигиляции. Показано, что масса кварка оказывает заметное влияние на предсказания теории. Учет массы приводит не только к значительному расширению области изменения $x_\perp$ по сравнению с безмассовым случаем и смещению этой области в сторону меньших значений $x_\perp$, но и к появлению структур у кривых, описывающих зависимость $d^2\sigma / dTdx_\perp$ от $x_\perp$.

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It is known that the hadron production in e^+e^- annihilation at high energies is of a jet nature. According to modern views primarily a quark-antiquark pair is formed which then decays into hadrons flying in opposite directions in the form of two jets. Hadrons in jets are experimentally found to have a limitted transverse momentum of ~ 300 MeV/c relative to jet axis independent of energy. That is why the jets will be narrowed and become more distinct with increasing reaction energy as the multiplicity of the produced hadrons grows only logarithmically here.

However, at rather high energies, in e^+e^- annihilation events with large transverse momenta are observed, though, not so frequently. They are due to bremsstrahlung of hard gluon in the process $e^+e^- \to q\bar{q}g$. Gluon also fragments into hadrons, and a planar three-jet event is experimentally observed as a result. To describe the mentioned process in QCD and compare theory with experiment, usually the so-called infrared-stable variables are used. Among them is, in particular, the thrust T [1,2] and transverse to $\vec{T}$ axis momentum $x_\perp$ [3] of each of two other jets.

In Ref.[4] the differential over variables T and $x_\perp$ cross section of the three-jet process $e^+e^- \to q\bar{q}g$ has

been calculated in the first order of QCD, the mass of quark being ignored. As at energies achieveable on modern storage rings the mass of c and b quarks and all the more, that of t quark can appreciably change the results, in the present work an analogous consideration with heavy quarks is made. Such a generalization is not trivial but a complicated one.

The differential cross section of the process $e^+e^- \to q\bar{q}g$ with heavy quarks and non-polarized primary particles, after summation over colours and integration over angles has the form (see, e.g., Refs[5-8]):

$$\frac{d^2\sigma}{dx_1' dx_2'} = \frac{8\alpha^2\alpha_s Q^2}{3S}\rho(x_1', x_2', x_3),$$

$$\rho(x_1', x_2', x_3) \equiv \frac{1}{(1-x_1')(1-x_2')}\left\{x_1'^2 + x_2'^2 + \eta\left[1 - x_3 - \frac{1}{2}\left(1+\frac{1}{2}\eta\right)\frac{x_3^2}{(1-x_1')(1-x_2')}\right]\right\}. \quad (1)$$

Here S is the squared total energy of reaction, $\eta = 4m^2/S$, m and Q are the mass and the charge of quark (in the units of e). Variables $\vec{x}_n = 2\vec{P}_n/\sqrt{s}$ and $x_n' = 2E_n/\sqrt{s}$ determine the dimensionless momentum and dimensionless energy of n parton, respectively ($n = 1,2,3$, accordingly for $q, \bar{q}, g$), and relate as

$$x_{1,2}' = (\vec{x}_{1,2}^{\,2} + \eta)^{1/2}, \quad x_3' = x_3.$$

Taking $x_i \geqslant x_j \geqslant x_k$, let us determine variables, through which the original cross section (1) must be expressed

$$T = max(x_1, x_2, x_3) = max(x_i, x_j, x_k) = x_i, \quad (2)$$

$$x_\perp = x_j \sin\theta_{ij} = x_k \sin\theta_{ik} = \frac{1}{x_i}\left[4(1-x_i')(1-x_j')(1-x_k') - \eta x_3^2\right]^{1/2}.$$

To pass on to these variables in the cross section (1), let us devide the phase space into the regions [8]

$$\text{I}.\ x_1 \geqslant x_2 \geqslant x_3, \quad \text{II}.\ x_1 \geqslant x_3 \geqslant x_2, \quad \text{III}.\ x_3 \geqslant x_1 \geqslant x_2. \quad (3)$$

In the region I at $T_0 \leq T \leq T_B$, x_3 varies in the range of $2(1-T') \leq x_3 \leq [(2-T')^2-\eta]/2(2-T')$ and, for other values of $T_B \leq T \leq T_A$ - in the range of $2(1-T') \leq x_3 \leq 2(1-T')/(2-T-T')$, where $T_0 = -2/3+4(1-3\eta/4)^{1/2}/3$ is the minimal value of T for all the regions (3), $T_A = (1-\eta)^{1/2}$, $T_B \simeq 1-(3\eta/4)(1+\eta^2/4)$.

In the variables (T, $x_\perp$) the boundary $x_3 = 2(1-T')$ is determined by expression

$$x_\perp = \frac{2(1-T')}{T}(2T'-1-\eta)^{1/2} \equiv x_\perp^{(1)} \qquad (4)$$

(curve 1 in Fig.1), the boundary $x_3 = [(2-T')^2-\eta]/2(2-T')$ is determined by

$$x_\perp = \left[1-T'-\frac{\eta}{4}+\frac{\eta^2}{4(2-T')^2}\right]^{1/2} \equiv x_\perp^{(2)} \qquad (5)$$

(curve 2 in Fig.1), and on the boundary $x_3 = 2(1-T')/(2-T-T')$ $x_\perp = 0$. The solid lines in Fig.1 correspond to the value η = = 0.1 which this parameter obtains, for instance, for b quark at $\sqrt{s} \simeq 30$ GeV.

In contrast to the massless case when the transverse momentum obtains its maximum and minimum values on the boundaries of admissible phase space [4], at taking the mass of quark into account, $x_\perp$ obtains its maximum value

$$x_\perp^{max} = \frac{2(1-T')}{[4(1-T')+\eta]^{1/2}} \equiv x_\perp^{(3)} \qquad (6)$$

(curve 3 in Fig.1) at $x_3 = 2(1-T')(2-T')/[4(1-T')+\eta]$.

It is not difficult to check that at the fixed T the transverse momentum obtains the maximum value (6) not for all T but when

$$3T'-2-\eta \geq 0, \quad T' \geq \frac{2+\eta}{3}, \quad T \geq \frac{1}{3}[(4-\eta)(1-\eta)]^{1/2} \equiv T_K. \qquad (7)$$

So, the phase space of region I in variables (T, $x_\perp$) is determined by

$$\begin{aligned} &T_0 \leqslant T \leqslant T_K , && x_\perp^{(2)} \leqslant x_\perp \leqslant x_\perp^{(1)} , \\ &T_K \leqslant T \leqslant T_B , && x_\perp^{(1)} \leqslant x_\perp \leqslant x_\perp^{(3)} , \quad x_\perp^{(2)} \leqslant x_\perp \leqslant x_\perp^{(3)} , \\ &T_B \leqslant T \leqslant T_A , && x_\perp^{(1)} \leqslant x_\perp \leqslant x_\perp^{(3)} , \quad 0 \leqslant x_\perp \leqslant x_\perp^{(3)} . \end{aligned} \tag{8}$$

The phase space shape strongly depends on the quark mass. In the massless case for all three regions (3) it has the form shown by dashed lines in Fig.1.

In the region II the variation range of T is $T_0 \leqslant T \leqslant T_B$. In the interval $T_0 \leqslant T \leqslant T_C$ the range of permissible values of x_3 is $[(2-T')^2-\eta]/2(2-T') \leqslant x_3 \leqslant T$, while in the interval $T_C \leqslant T \leqslant T_B$ it is $[(2-T')^2-\eta]/2(2-T') \leqslant x_3 \leqslant 2(1-T')/(2-T')$, $T_C = 2(1-\sqrt{\eta})/(2-\sqrt{\eta})$. The lower boundary of the x_3 variation range in the variables (T, $x_\perp$) is determined by (5) (curve 2 in Fig.1), the boundary $x_3 = T$ - by

$$x_\perp = \frac{1}{T}\left[4(1-T')(1-T)(T+T'-1)-\eta T^2\right]^{1/2} \equiv x_\perp^{(4)} \tag{9}$$

(curve 4). At the other upper boundary $x_\perp = 0$ as before. The maximum (6) in the region II is not achieved and the transverse momentum obtains its maximum and minimum values at the boundaries of the region.

So, the phase space in the region II is determined by

$$\begin{aligned} &T_0 \leqslant T \leqslant T_C , && x_\perp^{(4)} \leqslant x_\perp \leqslant x_\perp^{(2)} , \\ &T_C \leqslant T \leqslant T_B , && 0 \leqslant x_\perp \leqslant x_\perp^{(2)} \end{aligned} \tag{10}$$

and is limitted by the curves 2 and 4 and the abscissa between the points B and C (see Fig.1).

In the region III at the fixed T the function $x_\perp(x_1')$ obtains its maximum value

$$x_\perp^{max} = (1-T-\eta)^{1/2} \equiv x_\perp^{(5)} \tag{11}$$

(curve 5 in Fig.1) at the point $x_1' = 1 - T/2$. As x_1' now varies in the range of $1 - T/2 \leqslant x_1' \leqslant T'$ when $T_0 \leqslant T \leqslant T_C$ and in the range of $1 - T/2 \leqslant x_1' \leqslant 1 - T/2 + [1 - \eta/(1-T)]^{1/2} T/2$, when $T_C \leqslant T \leqslant T_D$, where $T_D = 1 - \eta$, then the maximum value (11) is achieved at the lower boundary and the minimum value (9) or $x_\perp = 0$, depending on T , is achieved at the upper boundaries $x_1' = T'$ and $x_1' = 1 - T/2 + [1 - \eta/(1-T)]^{1/2} T/2$, respectively:

$$\begin{aligned} &T_0 \leqslant T \leqslant T_C , \qquad x_\perp^{(4)} \leqslant x_\perp \leqslant x_\perp^{(5)}, \\ &T_C \leqslant T \leqslant T_D , \qquad 0 \leqslant x_\perp \leqslant x_\perp^{(5)}. \end{aligned} \tag{12}$$

So, the phase space in the region III is limitted by the curves 4 and 5 and by the axis $x_\perp = 0$ between the points C and D (see Fig.1).

Let us now come to variables T and $x_\perp$ in the cross section (1). In the regions I and II one has

$$\begin{aligned} &x_2'^{\pm} = 2 - T' - x_3^{\mp} , \quad x_3^{\pm} = \frac{2(1-T')}{4(1-T')+\eta}(2 - T' \pm T y_1), \\ &y_1 \equiv \left[1 - \frac{4(1-T')+\eta}{4(1-T')^2} x_\perp^2\right]^{1/2}, \\ &dx_1' dx_2' = \frac{T^2 x_\perp}{2T'(1-T')y_1} dT dx_\perp , \end{aligned} \tag{13}$$

and in the region III -

$$\begin{aligned} &x_1'^{\pm} = x_2'^{\pm} = 1 - \frac{T}{2}(1 \mp y_2), \quad y_2 \equiv \left(1 - \frac{x_\perp^2 + \eta}{1-T}\right)^{1/2}, \\ &dx_1' dx_2' = dx_1' dx_3 = \frac{T x_\perp}{2(1-T)y_2} dT dx_\perp . \end{aligned} \tag{14}$$

In virtue of the conservation laws, to the values $x_2'^{\pm}$ correspond $x_3^{\mp}$ for the first two regions. It is not difficult to see that always $x_2^+ > x_3^-$, regardless of T and $x_\perp$, while the condition $x_3^+ > x_2^-$ is satisfied only when $x_\perp < x_\perp^{(2)}$. That is why in the region I where according to (3) $x_2 \geqslant x_3$,

It is necessary to consider together with the distribution $\rho(T', x_2'^+, x_3^-)$ also $\rho(T', x_2'^-, x_3^+)$ for the values of $x_\perp \geqslant x_\perp^{(2)}$. As these are two branches of the same function, they intersect at the point $x_2'^+ = x_2'^-$ ($x_3^- = x_3^+$) where $y_1 = 0$, which is realized at the value of $x_\perp = x_\perp^{(3)}$. At $\eta = 0$ this is the transition point between the regions I and II. With regard to the quark mass such transition, which should take place at $x_2 = x_3$, is realized at $x_\perp = x_\perp^{(2)}$.

Normalizing the cross section (1) to the total cross section $\sigma_{\mu\mu} = 4\pi\alpha^2/3s$ of the process $e^+e^- \to \mu^+\mu^-$, and taking into account the regions obtained from (3) by substitutions $x_1 \rightleftarrows x_2$, the differential cross section for the regions I and II will have the form

$$\frac{1}{\sigma_{\mu\mu}} \frac{d^2\sigma_{I,II}}{dT\,dx_\perp} = 2\frac{\alpha_s}{\pi} Q^2 \frac{T^2 x_\perp}{T'(1-T')y_1} \rho_{I,II} . \qquad (15)$$

For the region I

$$\rho_I = \rho(T', x_2'^+, x_3^-) + \rho(T', x_2'^-, x_3^+),$$

$\rho(T', x_2'^+, x_3^-)$ describing the distribution for the values

$$T_K \leqslant T \leqslant T_A , \quad x_\perp^{(1)} \leqslant x_\perp \leqslant x_\perp^{(3)}, \qquad (16)$$

and $\rho(T', x_2'^-, x_3^+)$ - for the values

$$\begin{aligned} T_0 \leqslant T \leqslant T_K , &\quad x_\perp^{(2)} \leqslant x_\perp \leqslant x_\perp^{(1)}, \\ T_K \leqslant T \leqslant T_B , &\quad x_\perp^{(2)} \leqslant x_\perp \leqslant x_\perp^{(3)}, \qquad (17) \\ T_B \leqslant T \leqslant T_A , &\quad 0 \leqslant x_\perp \leqslant x_\perp^{(3)}. \end{aligned}$$

In the region II, where according to (3) $x_3 \geqslant x_2$, in virtue of the above said one has

$$\rho_{II} = \rho(T', x_2'^-, x_3^+)$$

for all admissible values (10).

Thus, some events with $x_\perp \geqslant x_\perp^{(2)}$ being described by the function $\rho(T', x_2'^-, x_3^+)$ as well as all the events described by the function $\rho(T', x_2'^+, x_3^-)$ refer to the region I . In consequence, the cross section in the region II breaks at $x_\perp = x_\perp^{(2)}$ and the cross section in the region I makes a jump, shown by a dashed line in Fig.2. If at $\eta \neq 0$ the function $\rho(T', x_2'^-, x_3^+)$ describes only events in the region II , then the curves I and II in Fig.2 would intersect at the point $x_\perp = x_\perp^{(3)}(\eta)$ as it is in the case of $\eta = 0$.

The differential cross section in the region III has the form

$$\frac{1}{\sigma_{\mu\mu}} \frac{d^2\sigma_{III}}{dT dx_\perp} = 2 \frac{\alpha_s}{\pi} Q^2 \frac{T x_\perp}{(1-T) y_2} \rho_{III} , \qquad (18)$$

where

$$\rho_{III} = \rho(x_1'^+, x_2'^-, T)$$

for all the values of (12).

On the boundary $x_1 = x_3 = T$ of the regions II and III , corresponding to $x_\perp = x_\perp^{(4)}$, $\rho(T', x_2'^-, x_3^+) = \rho(x_1'^+, x_2'^-, T)$ takes place. However, due to the difference between the phase volumes of the regions II and III , the corresponding curves in Fig.2 at $\eta = 0.1$ do not intersect.

In Fig.2 at some admissible values of η the curves of $(4\frac{\alpha_s}{\pi} Q^2 \sigma_{\mu\mu})^{-1} d^2\sigma/dx_\perp dy$ as a function of $x_\perp$ in the regions I - III for the certain value $T = 0.8$ are given to illustrate to what quantitative changes leads the taking of the quark mass into account. Events with such T can be initiated by both, light and heavy quarks, that is why on this example one can clearly see how much the taking of the quark mass into account affects

the theory predictions.

As it is seen in Fig.2, all the curves for the regions I-III shift to the left, to the smaller values of $x_\perp$ with the increasing η. At $\eta = 0$ in all regions the transverse momentum varies in the same range, while it is not so at $\eta \neq 0$, the regions II and III noticeably expanding over $x_\perp$ at the same time (also see Fig.1). Discontinuities on the curves in the region I at $\eta \neq 0$ are due to the fact, that beginning from a certain value of the transverse momentum at a given η ($x_\perp \geqslant x_\perp^{(2)} \simeq 0.342$ at $\eta = 0.1$ and $x_\perp \geqslant x_\perp^{(2)} \simeq 0.205$ at $\eta = 0.2$) some events, which at small values of $x_\perp$ contributed to the region II, now do to the region I. It follows from the curves shown in Fig.2 that there is a rather wide range of the values of $x_\perp$ at $\eta = 0.1$ ($0.124 \simeq x_\perp^{(4)} \leqslant x_\perp \leqslant x_\perp^{(1)} \simeq 0.275$) where the gluon jet can be either of intermediate energy as compared with q and $\bar{q}$ jets, or the most energetic one. Drawing nearer to the upper boundary of η first of all disappear the events in the region III, and then in the region II too. So, in the considered case of $T = 0.8$ at $\eta = 0.2$ there are no events in the region III and at $\eta \simeq 0.26$ - in the region II as well.

Using the expressions (15)-(18) it is easy to obtain the summary distribution in variables T and $x_\perp$ for the process we are interested in:

$$\frac{1}{\sigma_{\mu\mu}} \frac{d^2\sigma}{dT dx_\perp} = 2\frac{\alpha_s}{\pi} Q^2 T x_\perp \left\{ \frac{T}{T'(1-T')y_1} \left[\rho(T', x_2'^{+}, x_3^{-}) + \right.\right.$$
$$\left.\left. + \rho(T', x_2'^{-}, x_3^{+}) \right] + \frac{1}{(1-T)y_2} \rho(x_1'^{+}, x_2'^{-}, T) \right\}, \qquad (19)$$

where the function $\rho(T', x_2'^{-}, x_3^{+})$ contributes to the summary distribution for the valu =

$$
\begin{aligned}
&T_0 \leqslant T \leqslant T_K , \qquad x_\perp^{(4)} \leqslant x_\perp \leqslant x_\perp^{(1)} , \\
&T_K \leqslant T \leqslant T_C , \qquad x_\perp^{(4)} \leqslant x_\perp \leqslant x_\perp^{(3)} , \\
&T_C \leqslant T \leqslant T_A , \qquad 0 \leqslant x_\perp \leqslant x_\perp^{(3)} ,
\end{aligned} \tag{20}
$$

while $\rho(T', x_2'^{+}, x_3^{-})$ and $\rho(x_1'^{+}, x_2'^{-}, T)$ contribute to the summary distribution for the values (16) and (12), respectively.

In Fig.3 dependence of the differential cross section (19) on the transverse momentum at some values of η is presented for the considered case of T = 0.8. The form of curves implies, that taking the mass of quarks into account noticeably changes the picture. Apart from the considerable expansion of the variation ranges of $x_\perp$ at $\eta \neq 0$ as compared with the massless case and the shift of these ranges towards small values of $x_\perp$, it is remarkable that there appear structures in the curves.

At $\eta = 0.1$ in the range $0.124 \simeq x_\perp^{(4)} \leqslant x_\perp \leqslant x_\perp^{(1)} \simeq 0.275$, as it is seen in Fig.2, the summary distribution is due to events from the regions II and III only. Beginning from $x_\perp \simeq 0.275$ events in the region I become possible which results in a sharp increase of the cross section (almost an order of magnitude). Structure at $x_\perp = x_\perp^{(3)} \simeq 0.316$ has a kinematic nature and is due to the fact that at drawing nearer to the upper boundary of the region III ($x_\perp \to x_\perp^{(5)}$) in the denominator of the expression (19) $y_2 \to 0$ (integrable square root singularity, connected with the phase volume in the region III). Beginning from this value the summary distribution is due to the regions I and II and beginning from $x_\perp = x_\perp^{(2)} \simeq 0.342$ - the region I only. At the boundary of the region I ($x_\perp \to x_\perp^{(3)}$), there is again the square root singularity connected with the phase volume ($y_1 \to 0$) which leads to unlimitted increase of the cross section.

At $\eta = 0.2$, in contrast to the case with $\eta = 0.1$, there are no events in the region $\overline{\text{III}}$, therefore the corresponding structure ($y_2 \to 0$) does not appear. At $\eta = 0$, as it has already been mentioned, the variation range of $x_\perp$ is the same for all the regions and besides, $y_1 = y_2$, i.e. there is only one square root singularity at the common boundary of the regions. This is the reason why the distribution curve is continuous in this case.

As the masses of heavy quarks are noticeably different, the corresponding values of η at a given energy of reaction, being in a square-law dependence with them, will be quite different too. Taking into account, that at a given T the region of the admissible values of $x_\perp$ significantly depends on η, one might suppose that the measuring of T and $x_\perp$ would allow to judge about the flavour of the quark or antiquark, responsible for the given event.

The results obtained in this paper can be used in the corresponding Monte-Carlo calculations with the use of various models for fragmentation process of quarks and gluons into hadrons.

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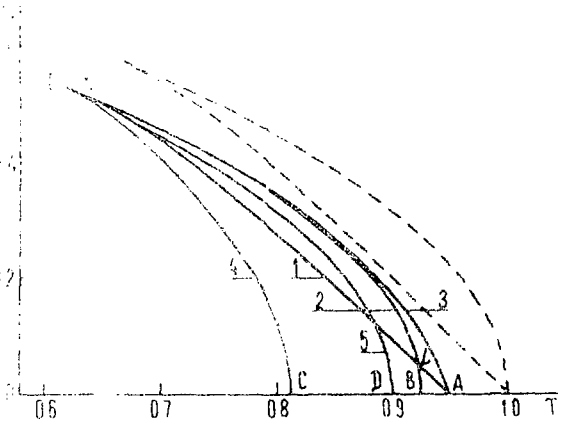
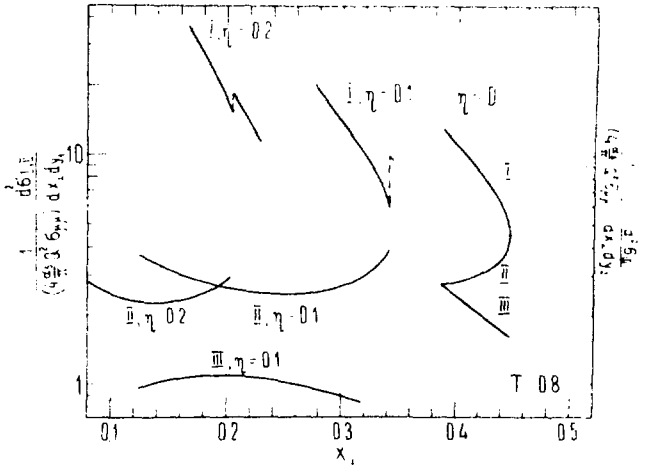
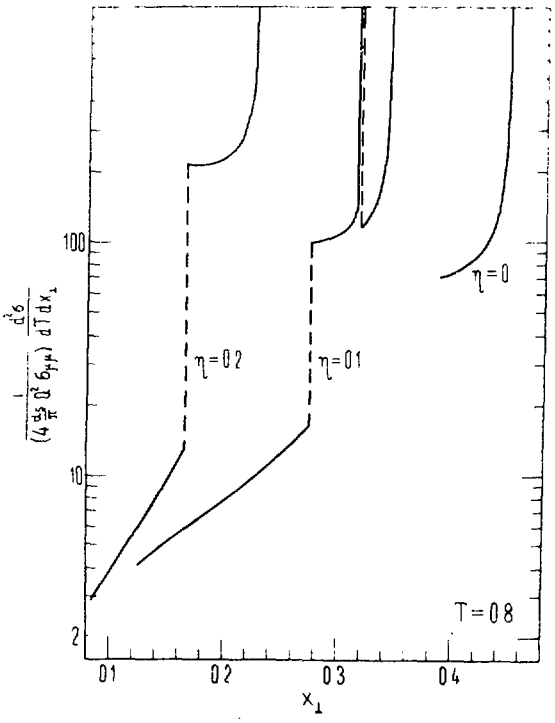


1. The phase space of the considered process in variables $(T, x_\perp)$ at $\eta = 0.1$. The dashed line indicates the phase space at $\eta = 0$, which is the same for all three regions I - III.



2. The dependence of the cross section $d^2\sigma/dx_\perp dy$, normalized to the value $4\frac{\alpha_s}{\pi}Q^2\sigma_{\mu\mu}$, on the transverse momentum in three different regions I-III in case of $T = 0.8$, at some values of the mass parameter η.



3. The dependence of the cross section $d^2\sigma/dTdx_\perp$ of the considered process on the transverse momentum at the same parameters as in Fig.2.

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РАСПРЕДЕЛЕНИЕ ПО ПОПЕРЕЧНОМУ ИМПУЛЬСУ СЕЧЕНИЯ ПРОЦЕССА $e^+e^- \to q\bar{q}g$ ДЛЯ ТЯЖЕЛЫХ КВАРКОВ

(на английском языке, перевод Г.А.Папяна)

Редактор Л.П.Мукаян

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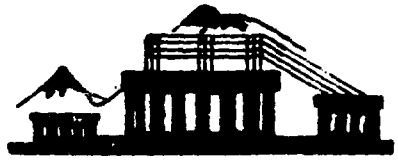

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