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"INTERNAL" B–MESON DECAYS: DIS AND HQET APPROACH

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Inclusive B-meson decays, in particular of "internal" types (into heavy mesons and baryon pairs), are considered using DIS and HQET type approaches. Quite large $\sim 12\%$ contribution of these internal nonleptonic decays ($\sim 7\%$ only of baryon pairs resulting from diquark production) has been found. This lead to a considerable reduction of the semileptonic decay ratio–down to its experimental value $\sim 9\%$. It explains simultaneously experimental data on the large fraction $\sim 7\%$ of B-decays into baryon–antibaryon pairs.

The general picture of distributions of B-decays branchings of all main types is presented. It looks resonable even in the considered zero order both in $1/N_c$ and in QCD.

Fig. - 11, ref - 17.

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1 Introduction: role of quark–spectator in B–meson decays; Γ_B^{tot} and decay branchings $B^i(j') = \Gamma^i(j')/\Gamma_B^{tot}$

$\bar{B}$–meson consists of b–quark ($m_b \simeq 4.8GeV$) and of light antiquark–spectator ($m_{sp} = m_u \sim m_d \sim 0.3GeV$); both of them are virtual and effective mass of b–quark

$$p_b^2 = (P_B - p_{sp})^2 = M_B^2 + m_{sp}^2 - 2M_B m_{sp} v_B v_{sp}$$

depends on 4–momentum $p_{sp} = m_{sp} v_{sp}$ of quark–spectator. In $\bar{B}$–meson decays (resulting mainly from $b \to cW^-$ weak transition (see Fig.1)) the role of spectator is very important: only due to it the resonance peaks (which correspond e.g. to production of D, D^* e.t.c. resonances, see Fig.2) appear in the distribution over the effective mass $M' = (p_c + p_{sp})^2$ of produced hadrons.

In a number of papers [1–3] the decay of a "free" b–quark, which is practically at rest inside of B–meson, is considered instead of B–meson decay.

This: a) violates the energy conservation law, especially at the hard part on the spectra of produced particles (e.g. deformes the most interesting–hard part of electron spectrum) — as m_b is smaller that $M_B \simeq 5.28GeV$,

b) leads to the wrong–flat distribution in M',

c) instead of the Γ_B^{tot} value of the form

$$\Gamma_0 = \frac{G^2 M_B^2}{(4\pi)^3} |V_{cb}|^2 = \left|\frac{V_{cb}}{0.039}\right|^2 \Gamma_{exp}^B ,$$

where $\Gamma_B^{exp} = 1/\tau_B^{exp}$, $\tau_B^{exp} = (1.50 \pm 0.04) \cdot 10^{12}\, sec$, provides Γ_B^{tot} in the form $\Gamma_B^{tot} \simeq \Gamma_b = \frac{G^2 m_b^5}{(4\pi)^3} |V_{cb}|^2 (1 + O(m_c^2/m_b^2))$ where correction of the order of m_c^2/m_b^2 turn to be not small as $m_b^5 \simeq M_B^5/2$.

Therefore contributions to electron and to other spectra from transitions to multihadron continuum $\bar{B}^0 \to X_c'$ (which begins from $M' > M_1'$, $M_1' = M_{D^*} + \Delta$, where $\Delta \simeq 0.15GeV$ is small, see ref.[4]) and to a single hadron states $\bar{B}^0 \to D^+ = P'$ (pseudoscalar) or $\bar{B}^0 \to D^{*+} = V'$ (vector) have to be considered separately. In the sum the decay widths $\Gamma^i(j') = Br^i(j')\Gamma_0$ of all of these transitions have to yield $\Gamma_B^{tot} \simeq \Gamma_0$ value, i.e. one must have: $\Sigma_{i,j'} Br^i(j') = 1$, where

$$B^i(j') = \Gamma^i(j')/\Gamma_0, \qquad j' = P', V', X'$$

and i–labels all possible states in the upper block in Fig.1 (and also in decay of other types, see below) $i = X_{l\nu_l}$, $l = e, \mu, \tau$ for semileptonic decays, or for nonleptinic decays $i = \pi, \rho, X_{\bar{u}d}$, or $i = D_s, D_s^*, X_{\bar{c}s}$ e.t.c.

2 Decay branchings and distributions; theory

1) <u>Distribution of b–quark inside of B–meson</u> will be most useful below. It has the nonperturbative nature and will be used below in the following simplest form:

$$\chi^2(p_b^2) = A_0 \exp\left(p_b^2/p_0^2\right) = A_1 \exp(-2\lambda_0(v_B v_{sp})) = |\qquad\qquad|^2 ,$$

where parameter $p_0^2 = M_B m_{sp}/\lambda_0$, (or $\lambda_0 = M_B m_{sp}/p_0^2 \sim 1$) determines the slope of decreasing of $\chi^2(\eta')$ with rising of the value of

$$\eta' = (v_B v_{sp}) = \frac{M_B^2 + m_{sp}^2 - p_b^2}{2 M_B m_{sp}} = \frac{1}{2}\left(\frac{1-x}{\zeta_0} + \frac{\zeta_0}{1-x} + \frac{p_\perp^2}{(1-x)M_B m_{sp}}\right) ,$$

$\zeta_0 = m_{sp}/M_B = 0.06 - 0.07$, $m_{sp} = 0.30 - 0.35 GeV$ — is the constituent $\bar{d}$ (or $\bar{u}$) quark–spectator mass. The light cone frame was used [1] where $p_b = P_B - p_{sp} = xP_B + p_\perp$, $P = |\vec{P}_B| \to \infty$, $\vec{P}_B \| \vec{q}$; $q = (q_0, \vec{q})$ is the 4–momentum of W–boson emitted in $b \to c$ transition (see Fig.1). Thus, with the normalization $\int \chi^2 \frac{d^3 p_{sp}}{\pi \varepsilon_{sp}} = \int_0^\infty dp_\perp^2 \int_0^1 f(x, p_\perp) \frac{dx}{x} = 1$ (see Fig.3a) one has the following b–quark distribution in B–meson in its momentum $p_b = (xP + \frac{p_b^2}{2xP}, \vec{p}_\perp, xP)$ (compare with $f(x)$ in ref.[3]):

$$\frac{1}{x} f(x, p_\perp) = \frac{\chi^2(p_b^2)}{1-x} = \exp\left[-\lambda_0\left(\frac{1-x}{\zeta_0} + \frac{\zeta_0}{1-x}\right)\right] \frac{e^{-p_\perp^2/p_0^2(1-x)}}{2\zeta_0 K_1(2\lambda_0) p_0^2 (1-x)} \tag{1}$$

as $d^3 p_{sp}/\pi\varepsilon_{sp} = \frac{dx}{1-x} dp_\perp^2$ and $\int_0^{\zeta_0^{-1} \to \infty} \exp\left[-\lambda_0 (z + 1/z)\right] dz/z^{1-n} = 2K_n(2\lambda_0)$. The distribution (1) has a sharp maximum at $x = 1 - \zeta_0 \sim m_b/M_B$, i.e. $p_0^2(1-x) \simeq m_{sp}^2/\lambda_0$.

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[1] Choosing $OZ \| \vec{P}_B$ one will have: $P_B = M_B v_B = (P + M_B^2/2P, \vec{O}, P)$, $p_b = (xP + p_b^2/2Px, \vec{p}_\perp, xP)$, $p_{sp} = \left((1-x)P + \frac{m_{sp}^2 + p_\perp^2}{2P(1-x)}, -\vec{p}_\perp, (1-x)P\right)$. In principle, the distribution $\chi^2(p_b^2, p_{sp}^2) dp_{sp}^2$ over p_{sp}^2 has sharp maximum at $p_{sp}^2 = m_{sp}^2$. Because of that we have put, for simplicity, here and in Eq.(1) $p_{sp}^2 \equiv m_{sp}^2$, i.e. will use $\chi_B^2(p_b^2, p_{sp}^2) \simeq \chi_B^2(p_b^2)\delta(p_{sp}^2 - m_{sp}^2)$.

Note also that choosing $\vec{P} = \vec{P}_B \| \vec{q}$ one has for $P_D = P_B - q$: $P_D = (\gamma\xi_D P + M_D^2/2P\gamma\xi_D, \vec{0}, \gamma\xi_D P)$ where $\xi_d = M_D/M_B$ and $\eta = (v_B v_d) = (\gamma + 1/\gamma)/2$ will be used below.

In general, b–quark distribution in B–meson is determined by nonperturbative QCD. Some information about its form at $x \to 0$ and $1-x \to 0$ follows [17] from Regge role approach which gives $\chi_B^2(x,p_\perp^3) \sim (1-x)^a x^b$ with small $a = 1-\alpha_R(0) \simeq 1/2$ and large $b = -\alpha_{b\bar{b}}(0) \simeq \alpha_R(0) - 2\alpha_B(0) \simeq 8-10$.

Therefore, the power form of $\chi^2 = \chi_B^2$

$$\frac{1}{x} f_1(x,p_\perp^2) = \frac{\chi^2(x,p_\perp^2)}{1-x} =$$

$$= B_0^{-1}(1-x)^a x^b \left[\exp\left(-p_\perp^2/p_0^2(1-x)\right)\right]/p_0^2(1-x) \qquad (1a)$$

with $p_0^2 \simeq m_{sp}^2/\lambda_0, B_0 = \beta(a+1,b+1)$ seems to be more natural than the exponential one given in Eq.(1). However, with given above values of a,b, its maximum (at $x \simeq b/(a+b)$) is much more flat that the sharp peak of distribution $f(x,p_\perp^2)$ in Eq.(1) at $x = 1-\zeta_0$.

In Eq.(1a) the same $p_\perp^2$ normalized distribution

$$\sim [exp(-p_\perp^2/p_0^2(1-x))]/p_0^2(1-x)$$

was used as in Eq.(1). Having no theoretical information on it one can substitute here simply p_0^2 or $p_0^2 x(1-x)$ for $p_0^2(1-x)$.

One can also reproduce the sharp maximum of Eq.(1) by introducing in Eq.(1a) the denominator of the resonance form [10]

$$\frac{1}{x} f_2(x,p_\perp^2) = \frac{\chi^2(x,p_\perp^2)}{1-x} =$$

$$= \frac{C_0(1-x)^a x^b}{[(1-x)^2+\varepsilon_0 x]^2}\left[exp\left(-p_\perp^2/p_0^2(1-x)\right)\right]/p_0^2(1-x) \qquad (1b)$$

containing small parameter $\varepsilon_0 \sim 10^{-2} - 10^{-3}$; this function has power law asymptotics only at extreme small $1-x < \sqrt{\varepsilon_0} \sim 1/30$. Both distributions (1a) and (1b), at proper choise of parameters ($a = 2.2, b = 28$ in Eq.(1a), or $\varepsilon_0 \sim 2 \cdot 10^{-3}$ in Eq.(1b) with $a = 1/2, b \simeq 8$) coinside closely with that given in Eq.(1) in the region $1-x \simeq m_{sp}/M_B$ of their maximum. Therefore, throughout this paper the simplest form (1) will be used (while it is not the best one for the $b \to c$ quark density matrix $\zeta(\eta) = \int \chi_B \chi_D^* \frac{d^3 p_{sp}}{\pi \epsilon_{sp}}$, $\eta = (v_B v_D)$, see below).

<u>All B–meson decays modes</u> are considered below; **a)** with unique b–quark distrib. function (1), at fixed values of parameters $\lambda_0 = M_B m_{sp}/p_0^2$ and ζ_0 in different decay channels, **b)** in the zero order in $1/N_c$, **c)** without

QCD corrections specific for each channel. Only ZVS corrections [5–7,1] forming L^{eff}_{Weak} will be taken into account.

In this zero order approach all decay amplitudes are factorized and differ from the semileptonic case: i) by substitution the produced quark masses μ_1, μ_2 (in the upper block in Fig.1b,c) for masses of e, ν_e, ii) by the nonleptonic enhancement and colour factors like $(3C^2_{e\nu})C^2$, where $3C^2_{e\nu} = 1$ and the constant C — depends on the channel under consideration [5–7,1].

We shall consider below all main channels of B-decay to both hadron continuum and to a single i, j' hadron resonanse states (at least states $i, j' = P, V$ must be included).

For nonleptonic decays the production of heavy $i = P, V$ states at $W^- \to \bar{c}s$ transition are enhanced due to a large values of constants f_P, f_V of coupling of heavy hadron resonances to W-boson. This makes appreciable the value of $W^- \to \bar{c}s$ transition rate, as compared with $W^- \to \bar{u}s$ transition - for both usual and internal decays. Account for the last–internal decays, in particular for production of barion pairs leads, together with $W^- \to \bar{c}s$ transition enhancement to total 15—20% of enhancement of the total nonleptonic decay rate compared with the case of a free b-quark decay. The corresponding violation of "detailed duality" results in decreasing of the semileptonic decay rate down to its experimental value 9—10%.

2) <u>Decay $B \to X'_c$ to multihadrons</u> will be considered similar to Bjorken's approach (see refs. [8,9] and paper by Jin, Palmer and Paschos [10]) to deep inelastic scattering (DIS). The inclusive probability of this decay $d\Gamma^X(X'_c) = \left(\sum_n \frac{<|T^X_n(X'_c)|^2>}{2M_B} d\tau_n\right) \frac{d^3p_e}{(2\pi)^3 2\epsilon_e} \frac{d^3p_\nu}{(2\pi)^3 2\epsilon_\nu}$ (e.g. for $X = X_{e\nu}$) can be put in the usual DIS form [10]:

$$d\Gamma^X(X'_c) = \Gamma_0 \cdot \Phi_{12}(y) \frac{2\,|\,\vec{q}\,|}{M_B} \left\langle \frac{L^{(e\nu)}_{\alpha\beta}}{M_B^2} \right\rangle W_{\alpha\beta} \frac{dq^2}{M_B^2} \frac{dM'^2}{M_B^2}\ , \qquad (2)$$

where Γ_0 was determined above, $\Phi_{12}(y) = \frac{2|\vec{p}_e{}^0|}{\sqrt{q^2}} = (1 - 2\lambda_+ + \lambda_-^2)^{1/2}$, $\frac{2|\vec{q}\,|}{M_B} = \left[1 - 2(y + z') + (y - z')^2\right]^{1/2}$, $\lambda_\pm = (\mu_1^2 \pm \mu_2^2)/q^2$, $y = q^2/M_B^2$, $z' = M'^2/M_B^2$, are two particles phase space factors, μ_1, μ_2 — masses of e, ν (or of other pairs of fermions in the upper block in Fig.1a,b,c), while

$$\left\langle L^{e\nu}_{\alpha\beta} \right\rangle = \frac{2}{3}\left\{(1 + \lambda)\left(q_\alpha q_\beta - g_{\alpha\beta} q^2\right) + \frac{3}{2}\lambda'_- q^2 g_{\alpha\beta}\right\}$$

is lepton tensor $L^{e\nu}_{\alpha\beta} = \frac{1}{4}\sum_{\sigma_e,\sigma_\nu=\pm 1/2}(\bar{e}O_\alpha\nu)(\bar{\nu}O_\beta e)$ averaged over $\vec{p}_e{}^0 = -\vec{p}_\nu{}^0$

direction (in $e\nu$ rest frame) and $\lambda = \lambda_+ - 2\lambda_-^2$, $\lambda'_- = \lambda_+ - \lambda_-^2$. The corresponding hadron tensor

$$2W_{\alpha\beta} = \Sigma_n \int V_\alpha^{(n)} V_\beta^{(n)*} d\tau_n/2\pi = (-g_{\alpha\beta})W_1 + (P_\alpha P_\beta/M_B^2)W_2 -$$

$$-i\varepsilon_{\alpha\beta\gamma\delta}(P_\gamma q_\delta/M_B^2)W_3 + \left[(P_\alpha q_\beta + q_\alpha P_\beta)/(M_B^2)\right] W_4 + (q_\alpha q_\beta/M_B^2)W_5, \qquad P = P_B \tag{3}$$

can be expressed in terms of quarks $b \to c$ transition tensor $L_{\alpha\beta}^{(cb)}$ determined similar to $L_{\alpha\beta}^{(e\nu)}$:

$$W_{\alpha\beta} = \int L_{\alpha\beta}^{(cb)} \delta\left[(p_b - q)^2 - m_c^2\right] f(x, p_\perp) \frac{dx}{x} dp_\perp^2 \ , \tag{4}$$

where $p_b - q = p_c$ and $\delta(p_c^2 - m_c^2)$ results from c–quark phase space

$$(2\pi)^4 \delta^4(p_c + p_d - P) \frac{d^3 p_c}{(2\pi)^3 2\varepsilon_c} \equiv 2\pi\delta(p_c^2 - m_c^2) \ .$$

For $p_b = xP + p_\perp$, $p_b^2 = x^2 M_B^2 - p_\perp^2$ one has

$$\delta((p_b - q)^2 - m_c^2) = (|x_+ - x_-| M_B^2)^{-1} [\delta(x - x_+) + \delta(x - x_-)] \ ,$$

$$x_\pm = \left(q_0 \pm \sqrt{\vec{q}^{\,2} + m_c^2 + \vec{p}_\perp^{\,2}}\right) / M_B \ .$$

This results in (see Jin, Palmer, Paschos [10]):

$$W_1 = f(x_+) - f(x_-), \qquad W_2 = \frac{4[x_+ f(x_+) + x_- f(x_-)]}{|x_+ - x_-|},$$

$$W_3 = W_4 = -\frac{2[f(x_+) - f(x_-)]}{|x_+ - x_-|}, \qquad W_5 = 0 \ .$$

Here, to simplify notation, $f(x_\pm)$ was written instead of $f(x_\pm, p_\perp)$ and consequent integration over $p_\perp^2$ will be assumed below everywhere.

With these values of $W_i = W_i(q_0, |\vec{q}|)$, $q_0 = (M_B^2 + q^2 - M'^2)/2M_B$, $|\vec{q}| = \sqrt{q_0^2 - q^2}$, Eqs.(2), (3), (4) give for $\Gamma^X(X'_c)/\Gamma_0 = B^X(X')$:

$$B^X(X') = C^2 \int\limits_{y > y_1} \int\limits_{z' > z'_1} dz' dy \Phi_{12}(y) \frac{2|\vec{q}|}{M_B} \left\{ (1 + \lambda) \left(6yW_1 + \frac{2\vec{q}^2}{M_B^2} W_2 \right) \right.$$

$$\left. -3\lambda'_- \left(4W_1 - W_2 - \frac{2q_0}{M_B} W_4 \right) y \right\} \ , \tag{5}$$

or

$$B^X(X') = 2C^2 \int\limits_{y>y_1} \int\limits_{z'>z'_1} dydz'|\vec{a}|\times$$

$$\times \left\{ \left[(1+\lambda)\frac{x_+\vec{a}^2}{x_+ - x_-} + 3y(1-\lambda_-^2) \right] f(x_+) - (x_+ \leftrightarrow x_-) \right\} \Phi_{12}(y)$$

with $|\vec{a}| = 2|\vec{q}|/M_B$ (see above Eq.(2)), $y_1 = M_1^2/M_B^2$, $z'_1 = M_1'^2/M_B^2$ (and M_1 — is the beginning of continuum in the upper block in Figs.1a,b,c, $M_1 \simeq 0$ for $e\nu_e$ cases). Integration in $p_\perp^2$ is assumed here and one has to put $f(x_\pm) = 0$ for $x_+ > 1$ or $x_- < 0$; the main contrib. gives x_+ term.

Note that electron spectrum from $B \to e\nu X'_c$ decay is determined similar to that obtained in ref.[10] with, however, the lower integration limits the same as in Eq.(5):

$$d\Gamma^{e\nu}/\Gamma_0 = \int\limits_{y>y_1} \int\limits_{z'>z'_1} dydz' \frac{8\varepsilon_\nu/M_B}{|x_+ - x_-|/2} \left\{ \left[\frac{2\varepsilon_e}{M_B} - (y/x_+)(1+\lambda_-) \right] x_+ f(x_+) + \right.$$

$$\left. +(x_+ \leftrightarrow x_-) \right\} \frac{d\varepsilon_e}{M_B} \tag{6}$$

$\varepsilon_\nu = q_0 - \varepsilon_e$. It must be clear that $B \to e\nu X'_c$ decay branching $Br^{e\nu}(X'_c)$ is given by (5) with $C^2 = C_{e\nu}^2 = 1/3$ and that (5), (6) determine also q^2 and M'^2 distrib. in different $B \to X'_c$ transitions (compare with refs.[2, 3]).

Note also that branchings $Br^i(X'_c) = \Gamma^i(X'_c)/\Gamma_0$ for producing in B-decays of a single $i = P$ or $i = V$ states in the <u>upper</u> block in Fig.1b,c (i.e. of π, ρ, or of D_s, D_s^*) at $B \to X'_c$ transition can be obtained directly from Eq.(2) substituting in it $(j_\alpha^i j_\beta^i)/4$ for $< L_{\alpha\beta}^{(e\nu)} >$. Here the currents $j_\alpha^P = f_P q_\alpha$, $j_\alpha^V = f_V M_V e_\alpha$ includes the constants f_P, f_V of coupling of P, V states to W-boson, and e_α — is 4-vector of polarization of the produced vector V-state. The results for $Br^i(X'_c)$ are given (together with Eq.(5)) in the Table 1 — see Appendix I.

3) <u>Transitions $B \to P', V'$ to a single hadron state</u> in the <u>lower</u> block (in Figs.1) are determined in HQET [7,11,12] by b-quark density matrix (Fig.3b), called the Isgur–Wise function:

$$\xi(\eta) = \int \chi(v_B v_{sp})\chi^*(v_{j'} v_{sp}) \frac{d^3 p_{sp}}{\pi \varepsilon_{sp}} = \int \frac{dx_{sp}}{x_{sp}} \int\limits_0^\infty dp_\perp^2 \chi(x_{sp}, p_\perp^2)\chi^*(\gamma x_{sp}, p_\perp^2) \ ,$$

$\eta = (v_B v_{j'}) = (M_B^2 + M_{j'}^2 - q^2)/2M_B M_{j'}$, where $j' = P'$ or $j' = V'$ and where the right hand part is written in the light cone frame where

$\vec{P}_B \parallel p_{j'}$, $p_B = P \to \infty$ is the produced $j' = P'$, or V'–meson state momentum and $\zeta_{j'} = M_{j'}/M_B < 1$. In expression for $\xi(\eta)$ the value $\gamma = 1$ of the parameter γ (see above footnote 1) corresponds to j'–meson being at rest relative to B–meson. Relativistic invariance demands that $\xi(\eta)$ will be the function of $\eta = \frac{1}{2}(\gamma + 1/\gamma)$ and not of $\gamma = \eta \pm \sqrt{\eta^2 - 1}$. E.g. the form (1a) of b–quark distribution function yields

$$\zeta_{1a}(\eta) = \left(\frac{2}{\eta+1}\right)^{\frac{a}{2}+1} \frac{F\left(\frac{a+1}{2}, \frac{a}{2}+1, a+b/2+1; 2(\eta+1)^{-1}\right)}{F\left(\frac{a+1}{2}, \frac{a}{2}+1, a+b/2+1; 1\right)}$$

where F–is hypergeometric function $[\zeta(\eta)]_{\eta=1} = 1$ and $[-\zeta'(\eta)]_{\eta=1} = \frac{1}{2}\left(\frac{a}{2}+1\right)\left(1+\frac{a+1}{b-1}\right) \simeq \frac{1}{2}\left(\frac{a}{2}+1\right)$ as $b \gg a$.

The form (1) for b–quark distribution function gives

$$\xi_0(\eta) = \frac{2}{r}\frac{K_1(\lambda_0 r)}{K_1(2\lambda_0)}, \qquad r = \sqrt{2(1+\eta)},$$

while an account of quark spin dynamics (see [13]) changes slightly this result leading to $\xi(\eta) = \frac{2}{r}\frac{K_1(r\lambda_0)+(2/r)K_2(r\lambda_0)}{K_1(2\lambda_0)+K_2(2\lambda_0)}$, where $K_n(z)$ are the Bessel-Mc Donald functions. Both forms for $\xi_0(\eta)$ and for $\xi(\eta)$ satisfy Bjorken's and Voloshin's sum rules ruquirements $1/4 \le [-\xi'(\eta)]_{\eta=1} \le 1$ at $a/2 < 1$, and at $\lambda_0 \sim 1$. The last form of $\xi(\eta)$ will be used below with $\lambda_0 \simeq 1.3 \pm 0.5$ what reproduces (in frames of experim. errors) existing experimental data of ARGUS and CLEO [4, 7, 14, 15] on $\xi(\eta)$ dependence on η.

The amplitudes of $B \to i, j'$ decays (see Fig.3a,b,c, where $i = P, V, X$ or $i = X_{l\nu_e}$) are given, according to HQET, by:

$$\begin{cases} T^i(P') = C\sqrt{M_B M_{P'}}(G/\sqrt{2})\xi(v_B v_{P'})(v_B + v_{P'})_\alpha j^i_\alpha \\ T^i(V') = C\sqrt{M_B M_{V'}}(G/\sqrt{2})\xi(v_B v_{V'})\left[(1 + v_B v_{V'})e'_\alpha - \right. \\ \qquad\qquad \left. -(v_B e')v_{V'_\alpha} + i\varepsilon_{\alpha\beta\gamma\delta} e'_\beta v_{B_\gamma} v_{V'_\delta}\right] j^i_\alpha \end{cases} \tag{7}$$

where e'_α is the vector V' state polarization 4–vector and j^i_α are given above for the single states $i = P, V$ in the upper block in Fig.3b,c, while for multihadron continuum one has: $j^{X_{sd}}_\alpha = (\bar{u}O_\alpha d)$, $j^{X_{cs}}_\alpha = (\bar{c}O_\alpha s)$, or $j^{X_{e\nu}}_\alpha = (\bar{e}O_\alpha \nu)$ for the semileptonic decay case Fig.3a. Branchings $Br^i(P')$ and $Br^i(V')$ corresponding to these amplitudes are easily calculated and are given in the Table 1 (see Appendix I, $\Gamma^i(j') = \frac{<|T^i(j')|^2>}{2M_B} \cdot \frac{1}{8\pi} \cdot \frac{2|\vec{q}|}{M_B}$).

3 "Internal" decays and numerical results

1) "Internal" decays:

a) At $C = C_{e\nu} = 1/\sqrt{3}$ or $C = C_1 = 1.13$ (see ref.[5–7]) Table 1 determines branchings of different channels of semileptonic or, corresponding, usual "external" nonleptonic decays of B–meson (see Figs.1a,b,c). However, at $C \simeq C_2 = -0.29$ [5–7] they determines also the branchings of "internal" B–decays, the amplitudes of which are represented by graphs in Fig.4a,b for $W^- \to \bar{u}d$ transition (and corresponds to two terms in ZVS Lagrangian L^{eff}_{weak} [5,7], see Appendix II). In the similar $W^- \to \bar{c}s$ transition case Fig.5a,b implies the production of white $c\bar{c}$ meson states (η^c — pseudoscalar, J/ψ — vector, or $X_{c\bar{c}}$ continuum) and of kaon type ($s\bar{d}$) states K^0, K^{*0}, $X^0_{s\bar{d}}$. One has to disregard, in the considered zero order in $1/N_c$, the contributions of graphs in Fig.4a,5a while graphs in Figs.4b,5b without QCD corrections give the factorized result — the same as we had in Fig.1 and in the Table 1, with, $C \to C_2$.

b) Graph shown in Fig.6a, (and in Fig.7a — for $W^- \to \bar{c}s$ decay) correspond to production of colour diquark (cd) and antidiquark ($\bar{u}\bar{d}$). They can be produced in the colour states $\bar{3}$ and 3 correspondingly (as $\bar{q}$ and q). Then the corresponding amplitude will be factorized (as was remarked by B.Stech [7], see Fig.6b and corresponding form of L^{eff}_{weak} is given in Appendix II) and diquark $(cd)_{\bar{3}}$–antidiquark $(\bar{u}\bar{d})_{\bar{3}}$ pair will convert into the white baryon $\Lambda_c = (cd)_{\bar{3}}q_{\bar{3}}$–antibaryon $\bar{N} = (\bar{u}\bar{d})_{\bar{3}}\bar{q}_{\bar{3}}$ pair as one more $\bar{q}q$ quark pair will be produced obviously due to confinement. The factor $C_-/3 = 0.47$ ($C_- = C_1 - C_2 = 1.42$) appears [7] in front of $G/\sqrt{2}$ in the contribution of graph in Fig.6b. The similar graphs 7a,b correspond to transition $W^- \to \bar{c}s$ and to decay $\bar{B}^0 \to \Xi_{cs} + \bar{\Lambda}_c$.

2) Values of parameters and numerical results

2.1) Values of parameters. The following values of constituent quark masses and of meson decay constants are used (in GeV) below: $m_u = m_d = m_{sp} = 0.35$ ($\zeta_0 = m_d/M_B = 0.07$), $m_c = 1.4$, $m_s = m_d + 0.2 = 0.55$. Also from ARGUS and CLEO data [14,15] one can extract:

$$\begin{cases} f_\pi = 0.13,\ f_D = 0.17,\ f_{DS} = 0.26,\ f_{\eta_c} = 0.38 \\ f_\rho = 0.20,\ f_{D^*} = 0.22,\ f_{D^*_s} = 0.29,\ f_{J/\psi} = 0.39 \end{cases}$$

while the lower boundaries of hadron continuum will be taken (in correspondance to experim. data) as follows: $(M_1')_{cd} = M_{D^*} + 0.15 = 2.15$, $(M_1')_{cs} = 2.26$, $(M_1')_{c\bar{c}} \simeq 3.25$, $(M_1)_{\bar{u}d} \simeq 1$, $(M_1)_{sd} = 1.06$. Among there parameters the most important are the values of m_{sp} (or of ζ_0) and of m_c.

2.2) <u>Numerical results</u> (they are given below in percents)

a) The following values of lepton branchings $Br^{l\nu_l}(D^+)$, $Br^{l\nu_l}(D^{*+})$, $Br^{l\nu_l}(X_c')$, $l = e, \mu, \tau$ are calculated from formulae of Table 1:

$Br^{e\nu_e}(j')$	$Br^{\mu\nu_\mu}(j')$	$Br^{\tau\nu_\tau}$	j'
1.67	1.67	0.94	D
5.21	5.20	2.23	D^*
2.71	2.60	0.28	$X_{cd}'^{+}$
$Br_{tot}^{e\nu_e} = 9.60$	9.50	3.45	$Br_{tot}^{lept} = 22.6$

b) For nonleptonic "external" decays branchings $Br^i(j')$ Table 1 lead to:

a) $W \to \bar{u}d$

π^-	p^-	$X_{\bar{u}d}^-$	$j' \downarrow$
0.34	0.79	5.77	D^+
0.37	0.93	18.60	D^{*+}
0.55	1.20	8.10	X_{cd}^+
$(Br_{tot}^{\bar{u}d})_{ext} =$	1.31+3.10+32.47 = 36.9		

b) $W^- \to \bar{c}s$

D_s^-	D_s^{*-}	$X_{\bar{c}s}^-$	$j' \downarrow$
2.06	2.63	3.32	D^+
1.49	3.06	8.52	D^{*+}
0.93	1.51	1.21	X_{cd}^+
$(Br_{tot}^{\bar{c}s})_{ext} =$	$4.48 + 7.20 + 13.05 = 24.7$		

As one see the branching $(Br_{tot}^{\bar{c}s})_{ext} \simeq 25\%$ turns to be quite appreciable as compared with $(Br_{tot}^{\bar{u}d})_{ext} \simeq 37\%$.

c) The values of "internal" decay branchings are smaller but still appreciable; B-decays in meson give:

a) $W \to \bar{u}d$

D^0	D^{*0}	$X_{\bar{u}c}^0$	$j' \downarrow$
$> 10^{-4}$	$> 10^{-4}$	0.01	π^0
0.03	0.05	0.58	p^0
0.11	0.18	1.86	X_{dd}^0
$(Br_{tot}^{\bar{u}d})_{int} =$	$0.11 + 0.23 + 2.45 = 2.8$		

b) $W \to \bar{c}s$

η_c^0	J/ψ	$X_{c\bar{c}}^0$	
0.01	~ 0.01	0.13	K^0
0.04	0.03	0.44	K^{*0}
0.17	0.31	0.32	X_{sd}^0
$(Br_{tot}^{\bar{c}s})_{int} =$	$0.23 + 0.35 + 0.89 = 1.97$		

$$Br_{int}^{meson} = 4.27$$

d) Branchings of B–meson decay into baryon pairs $Br^X(X')$ (really — into diquark–antidiquark pairs in states $\bar{3}$ and 3 with effective mass $M = \sqrt{q^2}$, M' larger that the sum of corresponding constituent quark mass) turn to be not small:

$$Br_{incl}(\Lambda_c, \bar{N}) = 5.73\% \qquad for \qquad W^- \to \bar{u}d\ ,$$

$$Br_{incl}(\Xi_{cs}, \bar{\Lambda}_c) = 1.25\% \qquad for \qquad W^- \to \bar{c}s \ ;$$

$Br^{tot}_{baryon} \simeq 7\%$.

2.3) Summing the contribution of all channels one has

$$B_0 = \sum_{i,j'} Br^i(j') = 22.6 + 61.6 + 4.27 + 7.0 + \Delta B_0 = 95.5\% + \Delta B_0$$

where $\Delta B_0 = 4\%$ comes from $b \to u$ (1%) and from $b \to s$ (3%) "penguin" transition. In the result one has $B_0 \simeq 99.4\% = 0.995$, i.e.

$$(\Gamma^{tot}_B)_{theor} = 0.995 \left| \frac{V_{cb}}{0.037} \right|^2 \Gamma^{exp}_B \simeq \Gamma^{exp}_B$$

at reasonable values of $|V_{cb}| \simeq 0.037 - 0.038$. Note that QCD corrections would change about in $10 - 15\%$ the values of these branchings but the above picture of destribution of branchings in different channels can be later restored partly by fitting parameters m_c and ζ_0.

The spectrum of electrons produced in $b \to c$ transition is given in Fig.8; it fits very well experimental data. Distributions in M'^2 in usual (and semileptonic) "external" decay and in q^2 are represented in Fig.9a,b. The same distributions are represent in Figs.10a,b for "internal" decays, while Fig.11 shows the distribution of vector hadrons J/ψ and D^{*0} produced in these "internal" decays in their momenta.

4 Conclusions

- The important role of quark–spectator ($\bar{u}$ or $\bar{d}$) in $\bar{B}$–meson decays in emphasized: its presence deforms crucially the final spectra of produced hadrons leading to resonance peaks.

- Bjorken's DIS approach is applied to B–meson decay to multihadrons. It leads to simple results for different distribution of produced particles giving them in terms of b–quark distribution function $\chi^2(x, p_\perp)$ in B–meson.

- The same b–quark destribution function $\chi(x, p^2_\perp)$ determines in HQET [5–7] all branchings and distributions for B–meson transitions to a single final P' or V' hadron states.

- The simplest form $\chi = A_0 \exp[p_b^2/p_0^2] = A_1 \exp[-2\lambda_0(v_B v_{sp})]$ of b–quark distrib. in B–meson leads to reasonable values of all main decay branchings and of the forms of different distributions of particles produced in B–decays.

- The sum $B_0 = \Sigma_{i,j'} Br^i(j')$ of decay branchings in all channels turn to be close to unity only if contrib. of "internal" nonleptonic decays $\sim 12\%$ are taken into account. This contribution encreases the nonleptonic decay branching and reduces the electron decay ratio down to its experimental value — $9 - 10\%$, Branching of decay to baryon pairs turns to be $\sim 7\%$ — in correspondence with experiment.

- QCD corrections have to be introduced by a standard methods in the considered DIS form of theory. Their $10 - 15\%$ effect is expected to be partly compensated by a small change of two parameters ζ_0 and m_c important for the results.

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Appendix I. Table 1 of branchings.

1) $B \to X'$–transitions to multihadrons in the lower block.

$$\begin{cases} Br^P(X') = (CF_P)^2 \int\limits_{x_1'}^{(1-\zeta_P)^2} dz' \frac{a^P(z')}{|x_+ - x_-|} \{[x_+(x_+ + x_-)^2 - (x_- + 3x_+)y] f(x, p_\perp) + (x_+ \leftrightarrow x_-)\} , \\ Br^V(X') = (CF_V)^2 \int\limits_{x_1'}^{(1-\zeta_V)^2} dz' \frac{a^V(z')}{|x_+ - x_-|} \{[x_+(x_+ + x_-)^2 - (x_- + 3x_+)y - 2\zeta_V^2(x_+ - x_-)] \times \\ \qquad \times f(x, p_\perp) + (x_+ \leftrightarrow x_-)\} , \\ Br^X(X') = \int\limits_{x_1'}^{(1-\sqrt{y_1})^2} dz' \int\limits_{y_1}^{(1-\sqrt{z'})^2} \Phi_{12}(y) I(y, z') dy = \int\limits_{y_1}^{(1-\sqrt{x_1'})^2} \Phi_{12}(y) \int\limits_{x_1'}^{(1-\sqrt{y})^2} I(y, z') dz' , \end{cases}$$

$$I(y, z') = 2C^2|\vec{a}| \left\{ \left[(1+\lambda) \frac{x_+ \cdot \vec{a}^2}{x_+ - x_-} + 3y \left(1 - \lambda_-^2\right) \right] f(x, p_\perp) - (x_+ \leftrightarrow x_-) \right\}$$

$$\begin{cases} \Phi_{12} = (1 - 2\lambda_+ + \lambda^2)^{1/2}, \ \lambda_\pm = (\mu_1^2 \pm \mu_2^2)/q^2, \ \zeta_i = M_i/M_B, \ y = q^2/M_B^2, \ z' = M'^2/M_B^2 \\ |\vec{a}| = \frac{2|\vec{q}|}{M_B} = [1 - 2(y + z') + (y - z')^2]^{1/2}, \ a^i(z') = |\vec{a}|_{y=\zeta_i^2}, \ y_1 = M_1^2/M_B^2, \ z_1' = M_1'^2/M_B^2 \\ i = P, V, \ \zeta_c = m_c/M_B, \ \lambda = \lambda_+ - 2\lambda_-^2, \ x_\pm = \frac{1}{2}\left[(1 + y - z') \pm \sqrt{\vec{a}^2 + 4\zeta_c^2 + 4p_\perp^2/M_B^2}\right] \end{cases}$$

Everywhere the integraton $\int\limits_0^\infty dp_\perp^2$ over $p_\perp$ is assumed in experssions for $Br^i(X')$.

2) $B \to P', V'$–transitions to a single P' or V' hadron.

$$\begin{cases} Br^P(P') = \frac{1}{8}(CF_P)^2 \left[(1 + \zeta_{P'})^2 - \zeta_P^2\right]^2 \left(\zeta_{P'}^{-1/2} - \zeta_{P'}^{1/2}\right)^2 a_{P'}^P \xi^2(\eta_{P'}^P), \ F_P = \frac{2\pi f_P}{M_B}, \\ Br^V(P') = \frac{1}{8}(CF_V)^2 \left(\zeta_{P'}^{-1/2} + \zeta_{P'}^{1/2}\right)^2 \left[a_{P'}^V\right]^3 \xi^2(\eta_{P'}^V), \ F_V = \frac{2\pi f_V}{M_B} \\ Br^X(P') = 4C^2\zeta_{P'}^3 \int\limits_1^{\eta_{P'}^0} d\eta_{P'} \left[(1 + \zeta_{P'})^2(\eta_{P'} - 1) + \lambda(1 - \zeta_{P'})^2(\eta_{P'} + 1) + \lambda_+' y\right] \Phi_{12}(y)(\eta_{P'} + 1) \times \\ \times \sqrt{\eta_{P'}^2 - 1}\, \xi^2(\eta_{P'}), \qquad \lambda_+' = \lambda_+ + \lambda_-^2 \end{cases}$$

$$\begin{cases} Br^P(V') = \frac{1}{8}(CF_P)^2 \left(\zeta_{V'}^{-1/2} + \zeta_{V'}^{1/2}\right)^2 \left(a_{V'}^P\right)^3 \xi^2(\eta_{V'}^P) \\ Br^V(V') = \frac{1}{8}(CF_V)^2 \left[(1 + \zeta_{V'})^2 - \zeta_V^2\right] \left(R_{V'}^V/\zeta_{V'}\right) a_{V'}^V \xi^2(\eta_{V'}^V) \\ Br^X(V') = 4C^2\zeta_{V'}^3 \int\limits_1^{\eta_{V'}^0} d\eta_{V'} \left[(1 - \zeta_{V'})^2 (5\eta_{V'} + 1) - 8\zeta_{V'}\eta_{V'}(\eta_{V'} - 1) + \lambda(1 + \zeta_{V'})^2(\eta_{V'} - 1) - \right. \\ \qquad \left. - \lambda_+' y(2\eta_{V'} + 1)\right] \Phi_{12}(y)(\eta_{V'} + 1)\sqrt{\eta_{V'}^2 - 1}\, \xi^2(\eta_{V'}) \end{cases}$$

$$\begin{cases} R_{V'}^V = (1 - \zeta_{V'}^2)^2 - \zeta_V^2 \left[(1 - \zeta_{V'})^2 - 8\zeta_{V'}\right], \quad a_{j'}^i = |\vec{a}|_{y=\zeta_i^2, z'=\zeta_{j'}^2}, \begin{cases} i = P, V \\ j' = P', V' \end{cases} \\ \eta_{j'} = (1 + \zeta_{j'}^2 - y)/2\zeta_{j'}, \quad j' = P', V', \quad \zeta_{j'} = M_{j'}/M_B \end{cases}$$

$$\eta_{j'}^0 = (\eta_{j'})_{y=y_1=M_1^2/M_B^2} \begin{cases} M_1 \text{— is the beginning of hadr. continuum in the upper block} \\ M_2' \simeq M_V + \Delta \text{— is the same for the lower block} \end{cases}$$

Appendix II. ZSW Lagrangian L_W^{eff}.

Hard gluon corrections convert [5–7] the usual weak interaction c.c. Lagrangian in:

$$L_W^{eff} = (G/\sqrt{2})V_{cb}\left[C_1\cdot(\bar{c}b)_\alpha(\bar{d}u)_\alpha + C_2\cdot(\bar{d}b)_\alpha(\bar{c}u)_\alpha + C_1'\cdot(\bar{c}t_a b)_\alpha(\bar{d}t_a u)_\alpha + \ldots + \right.$$
$$\left. + \left[(\bar{d}u)\to(\bar{s}c)\right] \equiv (G/\sqrt{2})\left[C_-(\bar{c}^c d)^\dagger_{\bar{3}}(\bar{u}^c b)_3 + C_+(\bar{c}^c d)^\dagger_{\bar{6}}(\bar{u}^c b)_6 + \ldots\right] \qquad (a)$$

with $(\bar{c}b)_\alpha = (\bar{c}^i\gamma_\alpha(1-\gamma_5)b_i)$, $(\bar{c}^c_i d)^i_{\bar{3}} = \varepsilon^{ijk}(\bar{c}^c_j(1-\gamma_5)d_k)$ e.t.c. and with

$$\left.\begin{array}{l} C_- = C_1 - C_2 = Q^{17/22} \simeq 1.42 \\ C_+ = C_1 + C_2 = Q^{-6/22} = 0.84 \end{array}\right\} Q = \frac{\ln(M_W/\Lambda_{QCD})}{\ln(m_b/\Lambda_{QCD})} \approx 1.53, \quad \begin{array}{l} C_1 = 1.13,\ C_2 \simeq -0.29, \\ C_-/3 = 0.47\ . \end{array}$$

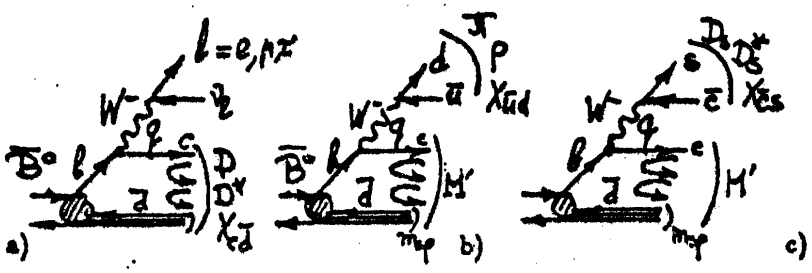


Fig.1

a) semileptonic, b,c) nonleptonic "external" types decay amplitudes.

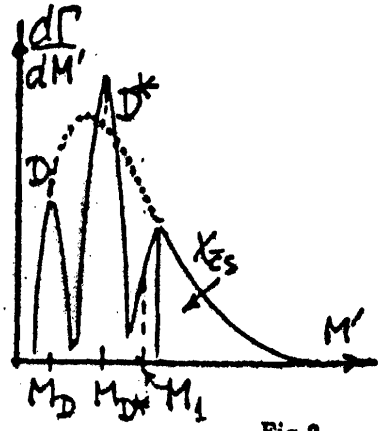


Fig.2

Distribution in M' in decays shown in Fig.1a,b,c.

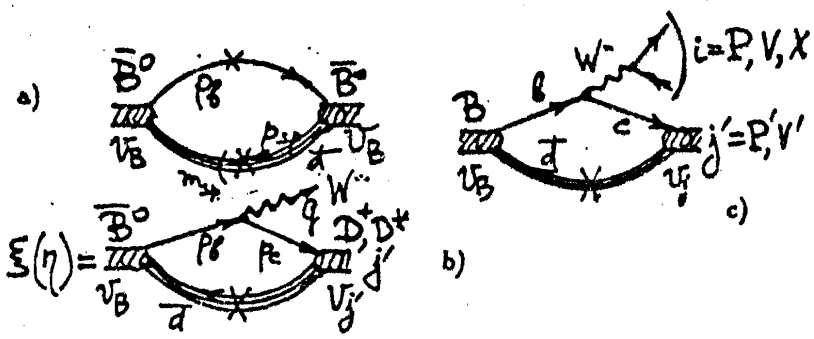


Fig.3 a) the normalis. condition of b-quark distrib. function (1),
b) b-quark density matrix for $B \to D$, or $B \to D^*$ transition,
c) the amplitudes of $B \to j'$ decays to a single hadron states $j' = D^+$ or D^{*+}.

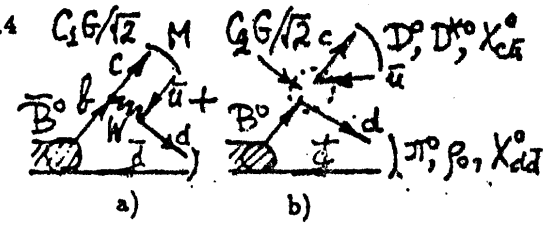


Fig.4

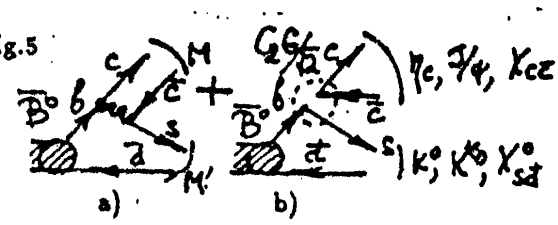


Fig.5

Fig.4 Graphs of "internal" nonleptonic B-meson decays into heavy mesons for $W^- \to \bar{u}d$ transition: a) graph of the contrib. of the first and of third terms in the first line in L_W^{ell} (see (a) in Appendix II) which cancel about totally together,
b) graph from the second term in L_W^{ell} giving the main contribution (proportional to $C_2 \simeq -0.29$) in zero order in $1/N_c$.

Fig.5 The same as in Fig.4, but for $W^- \to \bar{c}s$ transition.

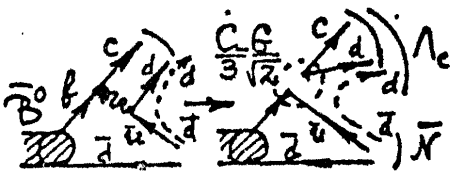


Fig.6

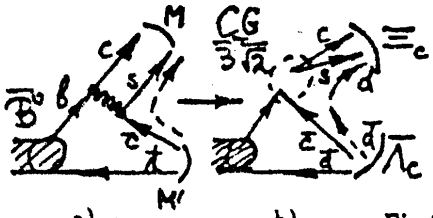


Fig.7

Fig.6 a) Graph of "internal" B-meson decay (for $W^- \to \bar{u}d$ transition) into diquark (cd) and antidiquark $(\bar{u}\bar{d})$,
b) graph of B-meson decays to the same (cd) and $(\bar{u}\bar{d})$ diquarks in the states $\bar{3}$ and $\bar{3}$ which convert to $\Lambda_c = (cd)_3 q_3$, $\bar{N} = (\bar{u}\bar{d})_3 \bar{q}_3$ due to creation of one more $q\bar{q}$ light quark pair.

Fig.7 The same, but for $W^- \to \bar{c}s$ transition.

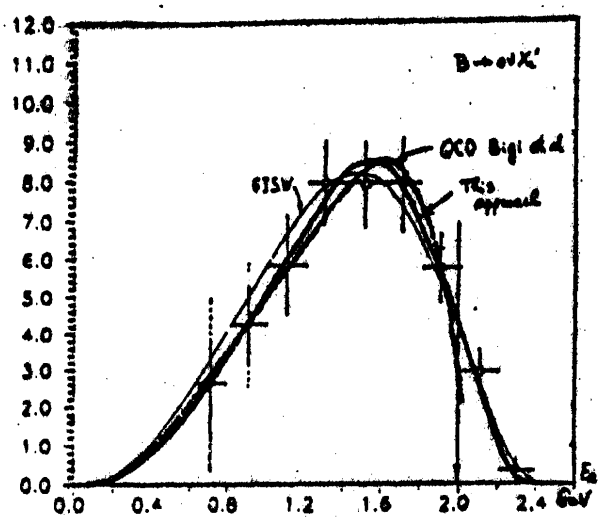
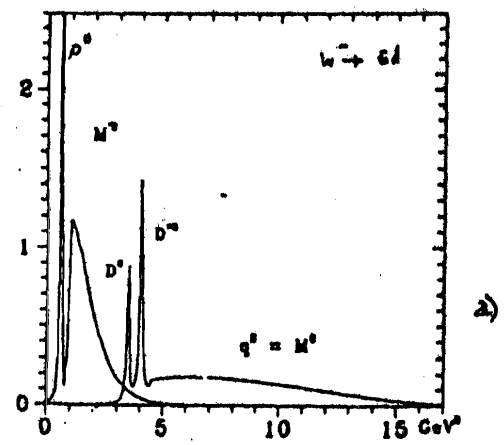


Fig.8 Electron spectrum in $B \to e\nu_e X$ decay: solid thick line — this approach; solid thin line — from ref.[16] — contrib. from only resonance states D, D^*, D^{**}; dotted line — free b-quark decay contrib. (see ref.[2]).



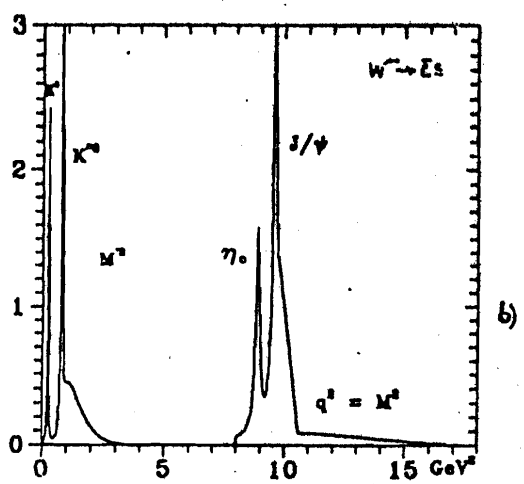


Fig.10 a,b) The same distributions (in M'^2 and in q^2) as in Fig.9 a,b for the "internal" decay to heavy mesons (see Figs.4,5) at $W^- \to \bar{c}s$ transition.

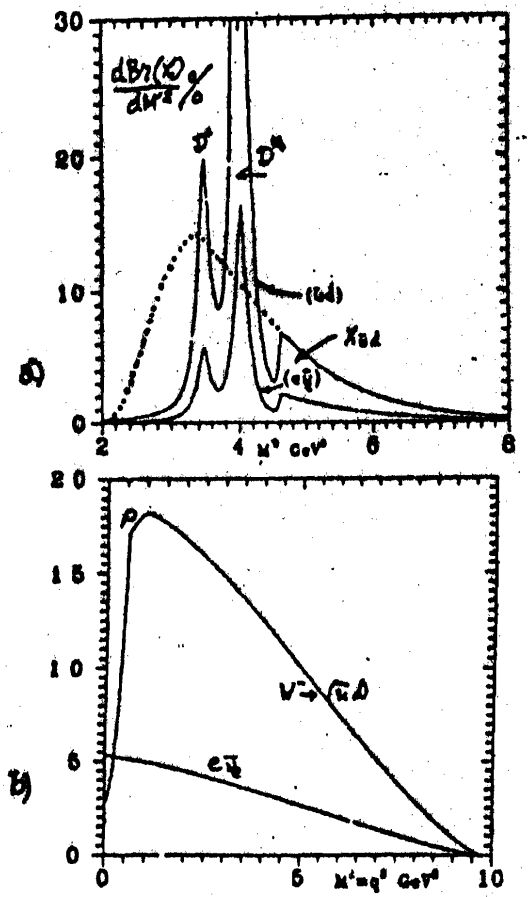


Fig.9 a) M'^2 — distribution in $\bar{B}^0 \to e\nu_e X'_c$ and the "external" nonleptonic $\bar{B}^0 \to \bar{u}dX'_c$ decays; dashed line — the last case for small $M'_i \leq 1.4GeV$. b) $q^2 = M^2$ distributions for the same decays.

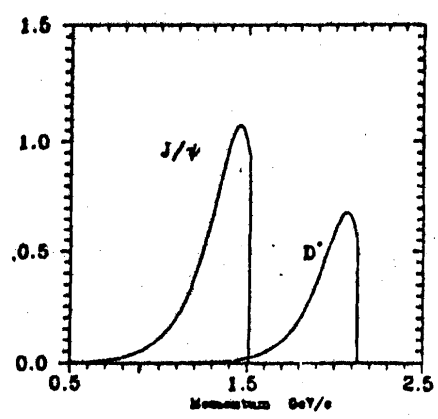


Fig.11 Distribution of vector mesons D^{*0} and J/ψ produced in the "internal" decay (Figs.4,5) in their momenta.

References

[1] G.Altarelli, N.Cabbibo, G.Corbo, L.Maiani, G.Martinelli, Nucl. Phys. **B208** (1982) 365–380, G.Altarelli, S.Petrarca Phys. Lett. 261B (1991) 303

[2] I.I.Bigi, N.G.Uraltsev Phys. Lett. **B280** (1992) 271–280; I.I.Bigi, N.G.Uraltsev, A.I.Vainstein Phys. Lett. **B283** (1992) 430–436; I.I.Bigi, M.Shifman, N.G.Uraltsev, A.Vainstein preprint TPI–MINN 93/12–T; I.I.Bigi, N.G.Uraltsev preprint CERN–TH 7020/93

[3] I.I.Bigi, M.A.Shifman, N.G.Uraltsev preprint CERN–TH 7129/93

[4] ARGUS Collab. preprint DESY 92–146 (1992)

[5] A.I.Vainstein, V.I.Zakharov, M.A.Shifman JEPT (Sov. J. Nucl. Phys.) **72**, 1 **72** (1977), 1275.

[6] F.G.Gilman, M.V.Wise Phys. Lett. **D20** (1979) 2392; B.Grinstein, M.J.Savage, M.B.Wise Nucl. Phys. **B319**, (1989) 271

[7] M.Neumbert, V.Rieckert, B.Stech, Q.P.Xu Heidelberg preprint D–THEP–91–28, (1991)

[8] J.D.Bjorken Phys. Rev. **179** (1969), 1574

[9] A.Bareiss, E.A.Paschos Nucl. Phys. **B327** (1989) 353; A.Bareiss, C.Peterson, N.Sakai Phys. Rev **D23** (1981) 2745

[10] C.H.Jin, M.F.Palmer, E.A.Paschos preprint DO–TH 93/21 (1993)

[11] M.B.Voloshin, M.A.Shifman Yad. Fiz. **45** (1987), 463 (Sov. J. Nucl. Phys. **45** (1987), 292)
Yad. Fiz. **47**, (1988), 801 (Sov. J. Nucl. Phys. **47** (1988), 512)

[12] N.Isgur, M.B.Wise Phys. Lett. **232B** (1989) 113, Phys. Lett. **237B** (1990), 527; M.B.Wise preprint CALT–68–1654 (1990); H.Georgy Phys. Lett. **240B** (1990), 447

[13] A.Yu.Dubin, A.B.Kaidalov preprint ITEP–71–92 (1992)

[14] M.V.Danilov Proc. if 26-th Conf. at Dallas (1992); A.I.Golutvin Rep. on Surveys in HEP **6** (1992), 223

[15] CLEO Rep. on 26-th HEP Conf. at Dallas (1992); A.Roussarie, R.Patterson Rep. at La-Thuile Conf. of 1994; S.Henderson Rep. at QCD Moriond Conf. of 1994

[16] B.Grinstein, M.Isgur, M.B.Wise Phys. Rev. Lett. **56** (1980), 258; B.Grinstein et al. Phys. Rv. **D39** (1989)

[17] A.B.Kaidalov. Elementary particles, Moscow, Energoatomizdat, 1983, N 2, p.3.

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