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DOES THE STANDARD QUARK MODEL OF D-MESON NONLEPTONIC DECAYS SURVIVE ?

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DOES THE STANDARD QUARK MODEL OF D-MESON NONLEPTONIC DECAYS SURVIVE ?

The nonleptonic D-meson decays are considered in the c-quark decay diagram model. The recent experimental data are used to estimate the widths of two- and quasi-two-body nonleptonic D-decays. Our conclusion is that these decays give the main contribution to the D^0- meson total width, while the analogous D^+-decays are strongly suppressed due to the quark diagram cancellations. This mechanism naturally explains the substantial difference between D^+ and D^0 mean lifetimes.

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ВЕРНА ЛИ СТАНДАРТНАЯ КВАРКОВАЯ МОДЕЛЬ НЕЛЕПТОННЫХ РАСПАДОВ D -МЕЗОНОВ ?

Нелептонные распады D -мезонов рассмотрены в модели кварковых диаграмм ,отвечающих распаду с-кварка. Используя последние экспериментальные данные по D -мезонам, получены оценки для ширин двух- и квазидвухчастичных нелептонных распадов, позволяющие сделать заключение о том, что они дают основной вклад в полную ширину D^0 -мезона, в то время как аналогичный вклад в полную ширину D^+ -мезона подавлен из-за сокращения кварковых диаграмм. Этот механизм приводит к естественному объяснению существенного различия средних времён жизни D^+ и D^0 .

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The purpose of this note is to discuss the recent experimental results [1-2] on the charmed D-mesons from the point of view of "standard" model based on the c-quark decay diagrams [3-6] (see Fig.1) .

We shall demonstrate here that this standard model , considered purely phenomenologically (with a few necessary inputs), is in general agreement with the present experimental situation. At the same time such a consideration will lead us to the following conclusion, to which we would like to call attention: the substantial if not the main contribution to the total widths of D-mesons seems to come from the quasi-two-body decays $D \to VP$, VV , where P (V) is a usual pseudoscalar (vector) meson. Note, however, that this conclusion, as well as the detailed predictions given below, are rather qualitative because the uncertainties of the experimental inputs are still too large.

The most interesting experimental result is the sharp difference between D^+ and D^0 mean lifetimes:

$$\tau_{D^+}/\tau_{D^0} \sim 3 \div 5 \qquad (1)$$

observed recently in a few independent measurements.

In e^+e^- - experiments [1] this result follows from the measured values of semileptonic (SL) branching ratios :

$$BR(D^+ \to e^+ + \cdots) = 15 \div 20 \;\%$$
$$BR(D^0 \to e^+ + \cdots) = 4 \div 5 \;\% \qquad (2)$$

if one takes into account the equality of the absolute SL widths :

$$\Gamma(D^+ \to e^+ + \cdots) = \Gamma(D^0 \to e^+ + \cdots)$$

which obviously follows from the isospin symmetry of the $(\bar{c}s)(\bar{\nu}e)$ SL interaction.

In emulsions and bubble chambers the lifetime difference has been indicated [2] by direct observation of D-meson traces.

Evidently this result means that the well known prediction [3-6] :

$$\tau(D^+) = \tau(D^0) \simeq \frac{1}{5 \div 8}\left(\frac{m_\mu}{m_D}\right)^5 \tau(\mu \to e\nu\bar{\nu}) \qquad (3)$$

based on the parton-like approximation of the c-quark decay width (with appropriate short-distance corrections in the weak vertex) , can be taken only as a very crude, order of value estimate.

Recall, however, that this estimate is not an unavoidable consequence of the standard model. Indeed, this model in its general formulation (see e.g. Ref. [6]) says nothing about the inclusive or total widths. It merely provides us with relations between the amplitudes of various exclusive nonleptonic (NL) modes of the same type (with the same multiplicity and the same set of J^{PC} quantum numbers of the final particles)

Therefore the violation of (3) simply means that the parton model of the c-quark decay is unreliable (The relevant reasons are easily found: the c-quark mass is not large enough and (or) the quark interaction at large distances is essential)

Returning to the recent experimental results, we note that the branching ratios of the two-body NL D - decays [1]:

$$
\begin{aligned}
&BR\ (D^0 \to K^-\pi^+) = 2{,}8 \pm 0{,}5\ \% \\
&BR\ (D^0 \to \bar{K}^0\pi^0) = 2{,}1 \pm 0{,}9\ \% \\
&BR\ (D^+ \to \bar{K}^0\pi^+) = 2{,}1 \pm 0{,}5\ \%
\end{aligned}
\qquad (4)
$$

also disagree with the earlier expectations.

In fact, the absolute widths of these decays in the standard model (i.e. in the SU_3-limit of the relevant c-quark decay diagrams of Fig.1) are related as follows [3-5] :

$$
\begin{aligned}
&\Gamma(D^0 \to \bar{K}^0\pi^0) = \frac{\delta^2}{2}\Gamma(D^0 \to K^-\pi^+) \\
&\Gamma(D^+ \to \bar{K}^0\pi^+) = (1+\delta)^2\,\Gamma(D^0 \to K^-\pi^+)
\end{aligned}
\qquad (5)
$$

Here δ is the ratio $\{1b\}/\{1a\}$ where $\{1a\}(\{1b\})$ denotes the contribution of diagram in Fig. 1a (1b) to the amplitudes of these decays. Recall that

$$\delta = (2c_+/c_- - 1)/(2c_+/c_- + 1)\ ,$$

where c_- (c_+) is the coefficient in front of the sextet (15-plet) part of the quark NL Hamiltonian [4 - 6] :

$$H(\Delta C = 1; \Delta S = -1) = \frac{G}{\sqrt{2}} \cos^2\theta_c \frac{1}{2} \left\{ c_+[(\bar{s}c)(\bar{u}d) + (\bar{u}c)(\bar{s}d)] + \right.$$

$$\left. + c_-[(\bar{s}c)(\bar{u}d) - (\bar{u}c)(\bar{s}d)] \right\} \qquad (6)$$

(G is the Fermi constant, θ_c is the Cabibbo angle , $(\bar{s}c) \equiv \bar{s}_i \gamma_\mu (1+\gamma_5) c_i$ etc. (sum over color)) .

The QCD calculation of c_+ and c_- (the gluon exchanges at small distances in the weak four-quark vertex), performed in Ref.[4] , gives $c_+/c_- \simeq +0{,}36$ i.e. $\delta = -0{,}15$ which leads to a large discrepancy between relations (5) and the experimental data (4) , (1) .

To restore a numerical agreement within experimental errors we need $\delta = -(1{,}3 \div 1{,}6)$ i.e. $c_+/c_- = -(0{,}06 \div 0{,}12)$. The last value as compared with the QCD prediction corresponds to much more sextet enhancement in (6) and have an opposite sign.

The discussion of such a drastical variation of the c_+/c_- ratio , connected , as it seems at first sight, with certain large distance effects, is out of scope of this paper. The only thing which is important for us here, is the obvious fact , that there is one numerical parameter δ , which determines in standard model all relations between the amplitudes of NL D-decays of the same type.

For the simplest NL decays, where the number of independent quark amplitudes corresponding to the "standard" diagrams is small (i.e. the number of relations is large), the value of δ may be crucial. For example, the pattern of the $D \to 2P$ decays (their quark amplitudes are given in Table 1) looks quite different, depending on this value. At $|\delta| \ll 1$ the total widths of 2P decays are

$$\Gamma(D^0 \to 2P) \simeq \Gamma(D^0 \to K^-\pi^+) \simeq \Gamma(D^+ \to 2P) \equiv \Gamma(D^+ \to \bar{K}^0\pi^+)$$

whereas at $\delta \to -1$ the suppression of $D^+ \to \bar{K}^0\pi^+$ amplitude takes place, accompanied with the enhancement of all $D^0 \to 2P$ amplitudes proportional to δ. In particular, $\Gamma(D^0 \to \bar{K}^0\pi^0) \sim \Gamma(D^0 \to K^-\pi^+)$ so that at $\delta \simeq -1$

$$\Gamma(D^0 \to 2P) \gg \Gamma(D^+ \to 2P)$$

It is easy to notice that the above-mentioned suppression of $D^+ \to \bar{K}^0\pi^+$ decay is caused by the cancellation of Fig.1a and Fig.1b diagrams in the limit $\delta \to -1$.
In terms of the SU_3 - symmetry, this cancellation corresponds to the familiar $\Delta V = 0$ selection rule [7] which is true in the sextet enhancement limit $c_+/c_- \to 0$.

The analogous suppression will also take place for the $D^+ \to VV$ quasi-two-body decays as compared with the $D^0 \to VV$ decays.

Finally, the $D^+ \to VP$ decays will be suppressed relative to the $D^0 \to VP$ decays for the same reason, if the A_1 and A_2 quark amplitudes corresponding to the Fig. 1a diagram

(where V is formed by the upper and lower quark pair respectively) are equal and have the same sign.

Turn now to the many-body NL D-decays . The corresponding "standard" quark diagrams are easily obtained from those in Fig. 1 by adding a necessary number of planar $\bar{q}q$-insertions (q=u,d,s)between the final quark pairs. The resulting diagrams lead to the situation , different from the above-discussed one for the two- and quasi-two-body decays in two aspects.

First, it turns out that the cancellations at $\delta \rightarrow -1$ take place for both D^+ and D^0 nearly to the same extent. Second, the number of independent quark amplitudes becomes large, so that the interplay between these amplitudes, rather than the value of δ , determines the contributions of many-body decays into the total widths of D^0 and D^+ . At the same time, it is difficult to imagine that there exists some special interplay between many-body quark amplitudes, that makes these contributions essentially different.

We have checked these general conjectures for the simplest (and probably dominant among the others) many-body NL decays $D \rightarrow (3P)_s$; $(2P)_s V$, (s denotes the totally symmetrical states) exploiting the relevant quark diagram relations which have been obtained in Ref. [6] .

Our final conclusion is that the above-discussed cancellation mechanism is peculiar to the two- and quasi-two-body NL decays only.

Therefore, the following simple explanation of the observed D^0 and D^+ lifetime difference arises : if the main contribution into the total width of D^0 comes from the

$D^0 \to 2P, VP, VV$ modes and simultaneously δ is close to -1, then the analogous D^+-decays are strongly suppressed and

$\tau_{D^+} \gg \tau_{D^0}$.

In the rest of this paper we shall present two independent arguments in support of this hypothesis. In particular, we shall demonstrate that the contribution of vector mesons into the final states of NL D-decdys is really substantial.

1. The general $\Delta T = 1$ selection rule, which holds for the Hamiltonian (6) regardless of the sextet enhancement rate and (or) the quark diagram relations, leads to the following relations [6] between $D \to (3P)_S$ widths :

$$\Gamma(D^0 \to (K^-\pi^+\pi^0)_S) = \Gamma(D^+ \to (\bar{K}^0\pi^+\pi^0)_S) = \frac{1}{4}\Gamma(D^+ \to K^-\pi^+\pi^+) \quad (7)$$

The experimentally measured branching ratios are [1] :

$$\begin{aligned} BR(\, D^0 &\to K^-\pi^+\pi^0 \,) = 6{,}3 \pm 2{,}2\ \% \\ BR(\, D^+ &\to \bar{K}^0\pi^+\pi^0 \,) = 16{,}4 \pm 9{,}5\ \% \\ BR(\, D^+ &\to K^-\pi^+\pi^+ \,) = 5{,}2 \pm 1{,}0\ \% \end{aligned} \quad (8)$$

The obvious discrepancy between Eq.(7) and Eq.(8) immediately leads to the conclusion that the antisymmetrical 2P-states are essential in these decays. The most probable sources of such states are the vector mesons due to $D^0 \to K^-\rho^+, \bar{K}^{*0}\pi^0, K^{*-}\pi^+$; $D^+ \to \bar{K}^{*0}\pi^+, \bar{K}^{*0}\rho^+$ decays. The absence of any structure in the Dalitz-plots of the final states (8) will lead to a serious contradiction with the general isospin structure of the charm changing NL interaction (6).

2. In the standard model considered here we are able to relate $D \to 2P, VP, VV$ NL decays with $D \to Ke\nu$, $K^{*}e\nu$ SL decays. These relations follow from the factorization of quark NL(SL) amplitudes corresponding to the Fig.1 (Fig.2) diagrams in the limit of point-like four-quark(quark-lepton) interaction (see also Ref. [5]).

Thus, for example, the factorization of the Fig.1a and Fig.2 diagrams leads to the following expressions

$$\langle D|(\bar{c}s)(\bar{u}d)|K\pi\rangle = \langle D|(\bar{c}s)|K\rangle\langle 0|(\bar{u}d)|\pi\rangle$$

$$\langle D|(\bar{c}s)(\bar{\nu}e)|Ke\nu\rangle = \langle D|(\bar{c}s)|K\rangle\langle 0|(\bar{\nu}e)|e\nu\rangle$$

etc. (We suppose that the strong interaction effects at large distances don't influence the factorization properties and manifest themselves only in the variation of c_+ and c_- coefficients relative to their small distance values).

The relevant quark matrix elements in terms of an invariant amplitudes are:

$$\langle D|\bar{c}\gamma_\mu(1+\gamma_5)s|K\rangle \equiv F_p^+(q^2)(\mathcal{P}+k)_\mu + F_p^-(q^2)(\mathcal{P}-k)_\mu \qquad (9)$$

$$\langle D|\bar{c}\gamma_\mu(1+\gamma_5)s|K^*\rangle \equiv F_v(q^2)K^*_\mu m_{K^*} \qquad (10)$$

$$\langle 0|\bar{u}\gamma_\mu(1+\gamma_5)d|\pi^+\rangle = f_\pi q_\mu \qquad (11)$$

$$\langle 0|\bar{u}\gamma_\mu(1+\gamma_5)d|\rho^+\rangle = g_\rho \rho_\mu \qquad (12)$$

where $\mathcal{P}$ (k) is the four-momentum of D (K) meson ; $q = \mathcal{P} - k$; K^*_μ and ρ_μ are the K^* and ρ polarisation vectors; $g_\rho = \sqrt{2}\, m_\rho / f_{\gamma\rho}$; f_π and $1/f_{\gamma\rho}$ are the $\pi \to \mu\nu$ and $\rho^0 \to \gamma$ constants (wave functions at the origin). $\sqrt{2}$ in the definition of g_ρ stays since we deal with ρ^+ instead of ρ^0 . In Eq.(10) we have leaved the simplest s-wave kinematical structure. In our opinion, neglecting the two other possible structures, we shall not influence the correct order of value of the further estimates.

From the factorization properties, using the Eqs.(9)-(12), we obtain the following expressions for the NL and SL decay amplitudes :

$$
\begin{aligned}
A(D^0 \to K^- \pi^+) &= \frac{G}{\sqrt{2}} \cos^2\theta_c \, \alpha F_p^+ \left(1 + \frac{F_p^-}{F_p^+} \frac{m_\pi^2}{m_D^2 - m_K^2}\right) f_\pi (m_D^2 - m_K^2) \\
A(D^0 \to K^- \rho^+) &= \frac{G}{\sqrt{2}} \cos^2\theta_c \, \alpha F_p^+ g_\rho \, 2 \mathcal{P}_\mu \rho_\mu \\
A(D^0 \to K^{*-} \rho^+) &= \frac{G}{\sqrt{2}} \cos^2\theta_c \, \alpha F_V g_\rho m_{K^*} K^*_\mu \rho_\mu \\
A(D^0 \to K^{*-} \pi^+) &= \frac{G}{\sqrt{2}} \cos^2\theta_c \, \alpha F_V f_\pi \mathcal{P}_\mu K^*_\mu \qquad (13) \\
A(D^+ \to \bar{K}^0 \rho^+) &= \frac{G}{\sqrt{2}} \cos^2\theta_c \, \alpha (2 F_p^+ g_\rho + \delta F_V m_{K^*} f_\pi) K^*_\mu \mathcal{P}_\mu \\
A(D^+ \to \bar{K}^{*0} \pi^+) &= \frac{G}{\sqrt{2}} \cos^2\theta_c \, \alpha (2 \delta F_p^+ g_\rho + F_V m_{K^*} f_\pi) K^*_\mu \mathcal{P}_\mu
\end{aligned}
$$

$$
\begin{aligned}
A(D^0 \to K^- e^+ \nu) &= A(D^+ \to \bar{K}^0 e^+ \nu) = \frac{G}{\sqrt{2}} \cos\theta_c \, F_p^+ 2 \mathcal{P}_\mu \, \bar{\nu} \gamma_\mu (1 + \gamma_5) e \\
A(D^0 \to K^{*-} e^+ \nu) &= A(D^+ \to \bar{K}^{*0} e^+ \nu) = \frac{G}{\sqrt{2}} \cos\theta_c \, m_{K^*} F_V K^*_\mu \, \bar{\nu} \gamma_\mu (1 + \gamma_5) e \qquad (14)
\end{aligned}
$$

The other NL amplitudes are easily obtained from Eq.(13) by means of the relations given in Table 1 . In Eq.(13) we have used the following notation $\alpha = 2c_+ + c_-/3$ and the SU_3 - approximation:

$$\langle D|(\bar{c}s)|K\rangle = \langle D|(\bar{c}u)|\pi\rangle$$

$$\langle 0|(\bar{u}d)|{}^{\pi}_{\rho}\rangle = \langle 0|(\bar{s}d)|{}^{K}_{K^*}\rangle$$

We also suppose that the relative sign of the two terms in the $A(D^+\to VP)$ expression is determined by the sign of δ .

The Eqs. (13) lead to the relations between NL and SL widths if one neglects the q^2- dependence of the F formfactors. In fact, the expected behaviour of these formfactors is $(q^2 - m^2_{F^*})^{-1}$ where $m_{F^*} \sim 2$ GeV is the F^*-meson mass.

Here are these relations :

$$0{,}5\,\Gamma(D^0\to K^-\rho^+) \simeq 0{,}55\,\Gamma(D^0\to K^-\pi^+) \simeq \alpha^2\Gamma(D^0\to K^-e^+\nu)$$

$$0{,}16\,\Gamma(D^0\to K^{*-}\rho^+) \simeq 0{,}26\,\Gamma(D^0\to K^{*-}\pi^+) \simeq \alpha^2\Gamma(D^0\to K^{*-}e^+\nu) \qquad (15)$$

$$\frac{1{,}34\,\Gamma(D^+\to \bar{K}^0\rho^+)}{(1+\delta\frac{F_v}{F_\rho}0{,}32)^2} \simeq \frac{1{,}12\,\Gamma(D^+\to \bar{K}^{*0}\pi^+)}{(\delta+\frac{F_v}{F_\rho}0{,}32)^2} \simeq \alpha^2\Gamma(D^0\to K^-e^+\nu)$$

Besides that, from Eq.(14) we have

$$\frac{|F_v|}{|F^+_\rho|} \simeq 4{,}3\sqrt{\frac{\Gamma(D^0\to K^{*-}e^+\nu)}{\Gamma(D^0\to K^-e^+\nu)}} \qquad (16)$$

To obtain Eqs.(15) and (16) we have used the following values of parameters entering Eqs.(13),(14): $f_\pi \simeq m_\pi$, $4\pi/f^2_{\gamma\rho} = 0{,}44$ ($g^2_\rho = 0{,}16\ GeV^2$) . We have also neglected the $\bar{F}_\rho^-$ contribution into the first of Eqs. (13) since the coefficient in front of it is numerically small.

According to the available experimental data [1] , the $Ke\nu$ ($K^*e\nu$) final states represent $\simeq$ 55% (39 %) of the SL decays and the fraction of the many-body SL decays ($D \to K\pi\pi e\nu$) is negligible.Note that this last circumstance itself supports the idea of two- and quasi-two-body dominance in the NL decays,if one believes in the factorization links between SL and NL decays.

By means of the above-mentioned data, from Eq. (15) we are able to estimate

$$\alpha^2 \simeq \frac{1}{2}\,\frac{BR(D^0 \to K^-\pi^+)}{BR(D^0 \to K^-e\nu)} \simeq 0.5 \div 0.8$$

and then (using $\delta = -(1{,}3 - 1{,}6)$, Eqs. (15),(16) and the secc column of Table 1) to calculate all $D \to 2P, VP, VV$ widths in the units of the total SL width $\Gamma(D^0 \to e^+ + \cdots) \simeq 2\Gamma(D^0 \to Ke\nu)$. The obtained values are presented in the third column of Table 1. For completeness we also present there the analogous estimates for the F^+-meson.

In the fourth column of Table 1 the corresponding QCD predictions are given (calculated in the same way at $c_+ = 0{,}7$, $c_- = 1{,}9$ i.e. $\delta = -0{,}15$, $\alpha^2 = 1{,}2$).

If we neglect all many-body NL modes and sum over calculated two- and quasi-two-body widths, (the resulting sums denoted as $\Gamma(D \to PP, VP, VV)$ are given in Table 1) then the following estimates of the lifetime ratios are easily obtained:

$$\frac{\tau_{D^+}}{\tau_{D^0}} = \frac{\Gamma(D^0 \to PP, VP, VV)+2}{\Gamma(D^+ \to PP, VP, VV)+2} = 6 \div 4.6 \quad (1.6)$$

and, similarly, τ_{F^+}/τ_{D^0} = 1,5 - 1,6 (1,5) at $\delta =$ $= -$ (1,3 - 1,6) ; α^2 = 0,5 - 0,8 ($\delta = -0{,}15$; $\alpha^2 = 1{,}2$) . These estimates allow to clarify the origin of the lifetime differences.

Thus, we have demonstrated that the "standard " quark model of c-quark decay diagrams is really in qualitative agreement with the present experimental situation. No annihilation diagrams (e.g. as in Ref. [8]) are needed to be invoked. (Recall that the $F^+ \to 3\pi, \rho\pi, \omega\pi$ and $D^0 \to \Phi\bar{K}^0, K^0\bar{K}^0\bar{K}^0$ modes still remain [5,6] an easy and model-independent "indicators" of the annihilation diagrams) .

At the same time, various perturbation theory calculations (parton model, one-gluon exchanges in QCD) in the framework of standard model seems to be unreliable.

We predict a substantial contribution of vector mesons into the final NL states. Their absence will be crucial not only for the standard model but also for the general isospin structure of the NL interaction.

In Ref. [6] it was noticed that at small values of δ an enhancement of Cabibbo suppressed decays with $\Delta S = 0$ is possible relative to the main decays with $\Delta S = -1$, which have proportional to δ amplitudes. However, at $\delta \simeq -1$ the original Cabibbo hierarchy is generally restored .Apart from that, due to the same cancellation mechanism, the majority of the two- and quasi-two-body D^{+}-decays with $\Delta S=0$ will be suppressed relative to the analogous D^{0}-decays. The only exceptions are the $D^{+}\to\rho^{+}\eta$, $\rho^{+}\eta'$ decays. Their amplitudes do not cancel in the $\delta\to -1$ limit. Thus, the detection of $D^{+}\to\rho^{+}\eta$ decay at the level of Cabibbo favoured D^{+} decays (the $D^{+}\to\rho^{+}\eta'$ decay has too small phase space) might be a serious argument in favour of the cancellation mechanism.

In conclusion we note that the diagram cancellation mechanism was assumed to be in Ref. [9], but there this mechanism was assumed to be applied to all many-body (inclusive) decays.

One of us (A.Yu.Khodjamirian) is grateful to V.A.Novikov, L.B.Okun', and M.A.Shifman for useful discussions and comments.

Table 1 . The amplitudes and widths of two- and quasi-two-body NL decays of charmed mesons. $A;A_{1,2};B$ (δA; $\delta A_{1,2}$; δB) denote the contributions of Fig.1a (Fig.1b) diagrams into the $D,F \to PP,VP,VV$ decay amplitudes respectively . (The other notations see in the text).

Mode a	Amplitude b	$\Gamma/\Gamma(D^0 \to e^+ \dots)$ $\delta = -(1,3 \div 1,6)$ $\alpha^2 = 0,8 \div 0,5$ c	 $\delta = -0,15$ $\alpha^2 = 1,2$ d
$D^0 \to K^-\pi^+$	A	0,8 ÷ 0,5	1,2
$\bar{K}^0\pi^0$	$\frac{\delta}{\sqrt{2}} A$	0,7 ÷ 0,6	0,01
$\bar{K}^0\eta$	$\frac{\delta}{\sqrt{6}} A$	0,20 ÷ 0,18	0,002
$\bar{K}^0\eta'$	$\frac{\delta}{\sqrt{3}} A$	0,30 ÷ 0,27	0,003
ρ^+K^-	A_1	0,90 ÷ 0,55	1,3
$\rho^0\bar{K}^0$	$\frac{\delta}{\sqrt{2}} A_2$	1,25 ÷ 1,20	0,02
$\omega\bar{K}^0$	$\frac{\delta}{\sqrt{2}} A_2$	1,25 ÷ 1,20	0,02
$K^{*0}\pi^0$	$\frac{\delta}{\sqrt{2}} A_1$	0,60 ÷ 0,55	0,01
$K^{*-}\pi^+$	A_2	1,2 ÷ 0,75	1,8
$\bar{K}^{*0}\eta$	$\frac{\delta}{\sqrt{6}} A_1$	0,10 ÷ 0,11	0,002
ϕK^0	0	0	0
ρ^+K^{*-}	B	1,95 ÷ 1,2	2,9
$\rho^0\bar{K}^{*0}$	$\frac{\delta}{\sqrt{2}} B$	1,65 ÷ 1,55	0,03
$\omega\bar{K}^{*0}$	$\frac{\delta}{\sqrt{2}} B$	1,65 ÷ 1,55	0,03
$\Gamma(D^0 \to PP, PV, VV)$		12,5 ÷ 11,0	7,3

Table 1 (continued)

a	b	c	d
$D^+ \to \bar{K}^0\pi^+$	$(1+\delta)A$	0,1 ÷ 0,2	0,87
$\rho^+\bar{K}^0$	$A_1+\delta A_2$	0,1 ÷ 0,15	0,34
$\bar{K}^{*0}\pi^+$	$\delta A_1 + A_2$	0,01 ÷ 0,05	0,60
$\bar{K}^{*0}\rho^+$	$(1+\delta)B$	0,2 ÷ 0,4	2,1
$\Gamma(D^+ \to PP, PV, VV)$		0,4 ÷ 0,8	3,9
$F^+ \to \eta\pi^+$	$-\sqrt{\frac{2}{3}}A$	0,49 ÷ 0,31	0,73
$\pi^+\pi^0$	0	0	0
$\eta'\pi^+$	$\frac{1}{\sqrt{3}}A$	0,2 ÷ 0,1	0,3
$K^+\bar{K}^0$	δA	1,18 ÷ 1,1	0,02
$\rho^+\eta$	$-\sqrt{\frac{2}{3}}A_1$	0,9 ÷ 0,5	1,2
$\rho\pi$, $\omega\pi^+$	0	0	0
$\phi\pi^+$	A_2	1,0 + 0,7	1,6
$\rho^+\eta'$	$\frac{1}{\sqrt{3}}A_1$	0,14 + 0,09	0,2
$K^{*+}\bar{K}^0$	δA_2	2,1 + 2,0	0,04
$\bar{K}^{*0}K^+$	δA_1	1,4 ÷ 1,3	0,03
$\Gamma(F^+ \to PP, PV, VV)$		7,5 ÷ 6,1	4,15

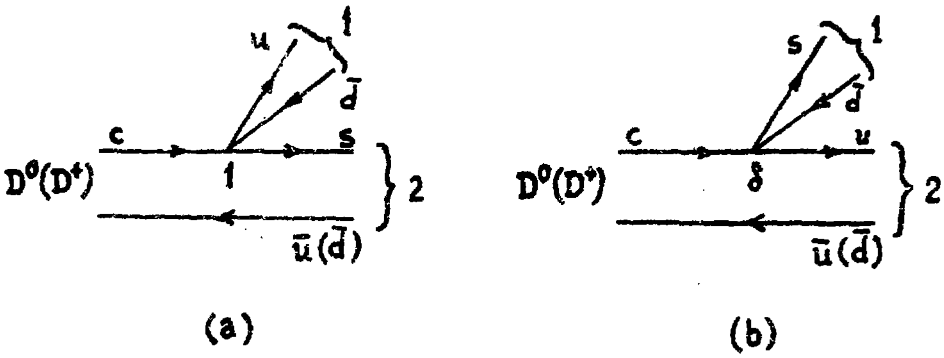

Fig.1 The quark diagrams corresponding to the two- and quasi-two-body decays of D^0(D^+)-meson.

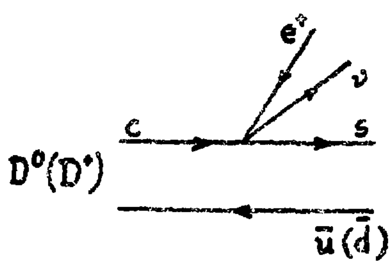

Fig.2 The quark diagram corresponding to the SL decays of D^0(D^+) -meson.

R E F E R E N C E S

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ВЕРНА ЛИ СТАНДАРТНАЯ КВАРКОВАЯ МОДЕЛЬ НЕЛЕПТОННЫХ РАСПАДОВ D -МЕЗОНОВ?

(на английском языке)

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