RADIATIVE DECAYS OF LIGHT VECTOR MESONS IN POINCARE-COVARIANT QUANTUME MECHANICS

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We research pseudoscalar and vector mesons in a relativistic constituent-quark model in the u-, d- and s-quark sector. Using experimental data for masses of mesons we determinate basic parameters of our model and analyzing radiative decay of light vector mesons, using this parameters.

Keywords: Poincare-invariant quantum mechanics, quark, bounded systems, meson, electroweak decays, radiative decays, magnetic moment.

Introduction

Electroweak decays of pseudoscalar and vector mesons have always been useful tool for understanding and researching mechanism of interaction of quarks inside the hadrons. We present one of the possible ways for describing electroweak properties of hadrons.

Generally, there are a lot of different models and approaches for describing basic parameters of pseudoscalar and vector mesons: lattice QCD [1], mock-meson models [2,3], various approaches, based on parton assumptions [4], models, uses Bethe-Salpeter equation [5,6] and different phenomenological models [7,8]. In any approach the question of behavior strong coupling constant is opened: [9] was shown all different way for parametrization of strong coupling constant. However, "freezing" procedure is widely used in all approaches; we follow [3], where were used the convenient way for parametrization of strong coupling behavior, which based on data for first moments of spin functions of nucleons [10].

In our work we consider mesons as compounded two-body quark-antiquark system in a Relativistic Hamiltonian dynamics (further **RHD**) with potential, offered in [3]. For describing of electroweak decays we use point form of **RHD**: this form of dynamics with certain modifications is widely used for these purposes (see [11,12]). We briefly describe features of our model with following process of calculation basic parameters and quark magnetic moments using experimental data for $V \to P\gamma$ transition.

Modelling the strong coupling constant α_{QCD}

In complete 4-loop approximation the running coupling of QCD, obtained it the $\overline{MS}$-scheme, is given by [13]

$$\alpha_{QCD}(Q^2) = \pi\left[\frac{1}{\beta_0 L_Q} - \frac{b_1 \ln L_Q}{(\beta_0 L_Q)^2} + \frac{1}{(\beta_0 L_Q)^3}\left[b_1^2(\ln^2 L_Q - \ln L_Q - 1) + b_2\right] + \frac{1}{(\beta_0 L_Q)^4}\times\right.$$
$$\left.\times\left[b_1^3\left(-\ln^3 L_Q + \frac{5}{2}\ln^2 L_Q + 2\ln L_Q - \frac{1}{2}\right) - 3b_1 b_2 \ln L_Q + \frac{b_3}{2}\right]\right], \qquad (1)$$

where

$$L_Q = \ln z_Q = \ln(Q^2/\Lambda^2)$$

(details see in [13]).

As was said before, the behavior of strong coupling constant has different ways of parametrization. Since the main requirement for QCD running strong coupling constant dictated by the condition of matching the theoretical predictions with experimental data we, follow [3], chose the QCD coupling constant in form

$$\alpha_{QCD}(Q) = \sum_{i=1}^{7} \alpha_i \exp\left[-Q^2/4\gamma_i^2\right] \quad , \qquad (2)$$

where α_i and γ_i – some parameters, which determine the behavior of strong coupling constant.

In our work we use "freezing" mode with $\alpha_{QCD}^{crit.}$, fixed by the requirement of the correspondence the experimental data for the difference in the first moments $\Gamma_1^{p-n}(x,Q^2)$ proton and neutron spin structure functions $g_1^{p,n}(x,Q^2)$ (so-called QCD-modified Bjorken sum rule [10]): as a result, we obtained

$$\alpha_{QCD}^{crit.} = \sum_{i=1}^{7} \alpha_i = 0.660 \pm 0.007. \qquad (3)$$

Poincare-covariant quark model of mesons

For describing bound states of quarks we use Poincare-invariant quantum mechanics or **RHD**, which is simple generalization of the quantum mechanics. Let us discuss the basic features of this model.

For the construction of the state vectors of the free particles in Poincare-invariant quantum mechanics use a set of ten generators of Poincare group $\hat{P}^{\mu}$ and $\hat{M}^{\mu\nu}$, which have a simple physical meaning: operators $\hat{\vec{P}}$ are three-dimensional momentum, while a mass operator $\hat{M}$ (or Hamiltonian) represented by $\hat{P}^0$. Components of tensor $\hat{M}^{23}$, $\hat{M}^{31}$ and $\hat{M}^{12}$ are three-dimensional momentum of a system and $\hat{M}^{01}$, $\hat{M}^{02}$ and $\hat{M}^{03}$ are boosts components:

$$\hat{\vec{N}} = (\hat{M}^{01}, \hat{M}^{02}, \hat{M}^{03}) \cdot$$

In [14] was shown, that there is no definite division of operators on the kinematic and dynamic set. Since there are three ways of introduction of interaction in **RHD**: instant, point and front forms of **RHD** (for details, see [15]). However, in any form of dynamic, interaction contains mass operator $\hat{M} \equiv M_0 + \hat{V}$, where M_0 is an effective mass of a system of noninteracting particles with masses m_q and $m_{\bar{Q}}$:

$$M_0 = \sqrt{\vec{k}^2 + m_q^2} + \sqrt{\vec{k}^2 + m_{\bar{Q}}^2}. \tag{4}$$

In (4) $\vec{k}$ – the relative momentum

$$\vec{k} = \frac{1}{2}(\vec{p}_1 - \vec{p}_2) + \frac{\vec{P}}{\widetilde{M}_0(\omega_{\widetilde{M}_0}(\mathrm{P}) + \widetilde{M}_0)}\left(m_{\bar{Q}}^2 - m_q^2 - \widetilde{M}_0\left[\omega_{m_{\bar{Q}}}(\mathrm{p}_2) - \omega_{m_q}(\mathrm{p}_1)\right]\right) \tag{5}$$

and $\vec{P}$ is the total momentum of free system:

$$\vec{P} = \vec{p}_1 + \vec{p}_2, \tag{6}$$

$$\widetilde{M}_0 = \sqrt{\left(\omega_{m_q}(\mathrm{p}_1) + \omega_{m_{\bar{Q}}}(\mathrm{p}_2)\right)^2 - \vec{P}^2}. \tag{7}$$

In all paper we assume, that $\omega_m(\mathrm{k}) = \sqrt{\vec{k}^2 + m^2}$ and $\mathrm{k} = \sqrt{\vec{k}^2}$.

Using state vectors of free particles one can easily build a state vector of bound system [15]:

$$\left|\vec{P}, J\mu, M\right\rangle = \sum_{\lambda_1,\lambda_2}\sum_{\nu_1,\nu_2}\int d\vec{k}\sqrt{\frac{\omega_{m_q}(\mathrm{p}_1)\omega_{m_{\bar{Q}}}(\mathrm{p}_2)M_0}{\omega_{m_q}(\mathrm{k})\omega_{m_{\bar{Q}}}(\mathrm{k})\omega_{M_0}(\mathrm{P})}}\Phi_{LS}^J(\mathrm{k})Y_{Lm}(\theta_k, \phi_k)\times$$
$$\times \tilde{N}_{\nu_1,\nu_2,\lambda}^{s_1,s_2,S}\ \tilde{N}_{m,\lambda,\mu}^{L,S,J}\ D_{\lambda_1,\nu_1}^{1/2}(\vec{n}_{W_1})D_{\lambda_2,\nu_2}^{1/2}(\vec{n}_{W_2})\left|\vec{p}_1, \lambda_1; \vec{p}_2, \lambda_2\right\rangle, \tag{8}$$

where $\Phi_{LS}^J(\mathrm{k})$ – wave function of the bound system, which satisfies the equation [16]:

$$\sum_{\lambda_1,\lambda_2}\int\left\langle\vec{k}, \sigma_1, \sigma_2\right\|\hat{V}\left\|\vec{k}, \lambda_1, \lambda_2\right\rangle\Phi_{\bar{Q},\lambda_1,\lambda_2}^J(\mathrm{k}')d\vec{k}' = (M - M_0)\Phi_{\bar{Q},\sigma_1,\sigma_2}^J(\mathrm{k}). \tag{9}$$

At the present time one of the three forms of relativistic dynamics for describing composite systems most widely used the light front dynamic (see [17,18]). This is explained by the fact that in this form of the dynamic missing diagram of the pairs creation from a vacuum. However, as well as in any form of dynamics, there are certain difficulties.

We believe, that point form of **RHD** the most convenient for describing compounded systems of two quarks (mesons), since in this form of dynamics 4-velocities with and without interaction are the same; this caused the Lorentz-invariance of the wave functions of coupled systems. We use this advantage in all paper for calculation leptonic and hadronic decay constants.

The quark-antiquark potential, based on QCD and its parameters.

For describing two-body bound system, it's necessary to determinate interaction between particles. It should be noticed, that different potentials can be used for describing bound system of the same composition. Such freedom gives the opportunity to construct new models, based on the Poincare-covariant model.

We use the quark-antiquark potential in coordinate representation, which was offered in [3]. That potential considered a sum of Coulomb, linear confinement and spin-spin parts of pseudoscalar and vector mesons:

$$\hat{V}(\mathrm{r}) = \hat{V}_{Coul}(\mathrm{r}) + \hat{V}_{conf}(\mathrm{r}) + \hat{V}_{SS}(\mathrm{r}), \tag{10}$$

where

$$\hat{V}_{Coul}(\mathrm{r}) = -\frac{4}{3}\frac{\alpha_{QCD}(\mathrm{r})}{\mathrm{r}} = -\frac{4}{3\mathrm{r}}\sum_{k=1}^{7}\alpha_k erf(\tau_k \mathrm{r}), \tag{11}$$

$$\hat{V}_{conf}(\mathrm{r}) = w_0 + \sigma\,\mathrm{r}\left(\frac{\exp(-b^2 r^2)}{\sqrt{\pi}b\mathrm{r}} + \left(1 + \frac{1}{2b^2\mathrm{r}^2}\right) erf(b\mathrm{r})\right), \tag{12}$$

and

$$\hat{V}_{SS}(\mathrm{r}) = -\frac{32(\vec{S}_q \vec{S}_{\bar{Q}})}{9\sqrt{\pi}m_q m_{\bar{Q}}}\sum_{k=1}^{7}\alpha_k \tau_k^4 \exp(-\tau_k^2 \mathrm{r}^2). \tag{13}$$

In (11) $\alpha_{QCD}(\mathrm{r})$ – strong coupling constant in coordinate representation, which we discussed earlier.

Parameter of linear confinement part in large number of models lies in the range $\sigma = 0.18 \div 0.20$ GeV^2, that's why we assume, that

$$\sigma = (\sigma \pm \Delta\sigma) = (0.19 \pm 0.01)\ \mathrm{GeV}^2. \tag{14}$$

Parameter of spin-spin part τ_k is deduced from the relation $\tau_k^2 = \gamma_k^2 b^2/(\gamma^2 + b^2)$, where b – "smearing" parameter, which was used in [3] by the following rule:

$$\tilde{f}(\mathrm{r}) = \int d\vec{r}'\rho(\vec{r} - \vec{r}')f(\mathrm{r}'). \tag{15}$$

Using (15) "smearing" function with parameter b is chosen in the form

$$\rho(\vec{r} - \vec{r}') = \frac{b^3}{\pi^{3/2}}\exp\left[-b(\vec{r} - \vec{r}')^2\right]. \tag{16}$$

The others parameters of of model (masses of quarks etc.) must be calculated. For calculation we use variational method [19] with oscillator wave functions

$$\Phi_{LS}^J(\mathrm{k},\beta) = \frac{2}{\pi^{1/4}\beta^{3/2}}\exp\left[-\frac{\mathrm{k}^2}{2\beta^2}\right], \tag{17}$$

which is reduced to the calculation of the functional minimum:

$$M(m_q, m_{\bar{Q}}, w_0, \beta) = \left\langle \Phi(\mathrm{k},\beta) \middle| \hat{M}_0 \middle| \Phi(\mathrm{k},\beta) \right\rangle + \left\langle \Phi(\mathrm{k},\beta) \middle| \hat{V} \middle| \Phi(\mathrm{k},\beta) \right\rangle. \qquad (18)$$

Minimum of functional requirements leads to the equation

$$\left. \frac{\partial M(m_q, m_{\bar{Q}}, w_0, \beta)}{\partial \beta} \right|_{\beta_{\min}} = 0. \qquad (19)$$

Another equations can be obtained from the leptonic decays of pseudoscalar $P(q\bar{Q})$ and vector $V(q\bar{Q})$ mesons. For decay $P(q\bar{Q}) \to \ell + \tilde{\nu}_\ell$ constant is defined by the relation:

$$_{out}\left\langle 0 \middle| \hat{J}_A^\mu \middle| \vec{P}, M_P \right\rangle_{in} = i \frac{1}{(2\pi)^{3/2}} \frac{P^\mu}{\sqrt{2\omega_{M_P}(\mathrm{P})}} f_P, \qquad (20)$$

where $\hat{J}_A^\mu$ – the electroweak axial current, which is taken in the Heisenberg representation.

For the case of leptonic decays of vector mesons $V(q\bar{Q}) \to \ell + \bar{\ell}$ decay constant is defined by

$$_{out}\left\langle 0 \middle| \hat{J}_V^\mu \middle| \vec{P}, M_P \right\rangle_{in} = i \frac{1}{(2\pi)^{3/2}} \frac{\varepsilon_\lambda^\mu M_V}{\sqrt{2\omega_{M_V}(\mathrm{P})}} f_V, \qquad (21)$$

where ε_λ^μ – polarization vector of a vector meson with mass M_V. In [20] was calculated integral representations for the constants of leptonic pseudoscalar f_p and vector f_V mesons within the point the framework of Poincare-covariant models:

$$f_P(m_q, m_{\bar{Q}}, \beta) = \sqrt{\frac{3}{2}} \frac{1}{\pi} \int d\mathrm{k}\, \Phi(\mathrm{k},\beta)\, \mathrm{k}^2 \times$$
$$\times \frac{\sqrt{(\omega_{m_q}(\mathrm{k}) + \mathrm{k})(\omega_{m_{\bar{Q}}}(\mathrm{k}) - \mathrm{k})} + \sqrt{(\omega_{m_{\bar{Q}}}(\mathrm{k}) + \mathrm{k})(\omega_{m_q}(\mathrm{k}) - \mathrm{k})}}{\sqrt{\omega_{m_q}(\mathrm{k}) + \omega_{m_{\bar{Q}}}(\mathrm{k})}\sqrt{\omega_{m_q}(\mathrm{k})\omega_{m_{\bar{Q}}}(\mathrm{k})}} \qquad (22)$$

and

$$f_V(m_q, m_{\bar{Q}}, \beta) = \sqrt{\frac{3}{2}} \frac{1}{\pi} \int d\mathrm{k}\, \Phi(\mathrm{k},\beta)\, \mathrm{k}^2 \times$$
$$\times \frac{\sqrt{(\omega_{m_q}(\mathrm{k}) + \mathrm{k})(\omega_{m_{\bar{Q}}}(\mathrm{k}) - \mathrm{k})} + \sqrt{(\omega_{m_{\bar{Q}}}(\mathrm{k}) + \mathrm{k})(\omega_{m_q}(\mathrm{k}) - \mathrm{k})}}{3\sqrt{\omega_{m_q}(\mathrm{k}) + \omega_{m_{\bar{Q}}}(\mathrm{k})}\sqrt{\omega_{m_q}(\mathrm{k})\omega_{m_{\bar{Q}}}(\mathrm{k})}}. \qquad (23)$$

Thus, we have following system of equations

$$M_P(m_q, m_{\bar{Q}}, w_0, \beta) = M_P^{\exp} \pm \Delta M_P, \qquad (24)$$

$$\left. \frac{\partial M_P(m_q, m_{\bar{Q}}, w_0, \beta)}{\partial \beta} \right|_{\beta_{\min}} = 0, \qquad (25)$$

$$M_V(m_q, m_{\bar{Q}}, w_0, \beta) = M_V^{\exp} \pm \Delta M_V, \qquad (26)$$

$$M_V(m_q, m_{\bar{Q}}, w_0, \beta) - M_P(m_q, m_{\bar{Q}}, w_0, \beta) = M_V^{\exp} - M_P^{\exp} + \delta M_{V,P}^{\exp}, \qquad (27)$$

$$f_P(m_q, m_{\bar{Q}}, \beta) = f_P^{\exp} + \Delta f_P^{\exp}, \tag{28}$$

$$f_V(m_q, m_{\bar{Q}}, \beta) = f_V^{\exp} + \Delta f_V^{\exp}, \tag{29}$$

where $\delta M_{V,P}^{\exp} = \sqrt{\Delta M_V^2 + \Delta M_P^2}$.

Assuming, that [3]

$$m_d - m_u = 4 \pm 1\,\text{MeV}, \tag{30}$$

we get following parameters of Poincare-covariant quark model [9]:

$$m_u = (239.9 \pm 2.3)\,\text{MeV},\ m_d = (243.8 \pm 2.3)\,\text{MeV},\ m_s = (466.6 \pm 28)\,\text{MeV},$$
$$\beta_{\text{uu}} \cong \beta_{\text{dd}} \cong \beta_{\text{ud}} = (328.78 \pm 2.1)\,\text{MeV},\ \ \beta_{\text{us}} \cong (360.3 \pm 12.1)\,\text{MeV}. \tag{31}$$

Radiative decay of vector mesons in Poincare-covariant quark model

Matrix element of the radiative decay process $V \to P\gamma$ could be parameterized using 4-velocity of the vector and pseudoscalar mesons by expression [17]

$$\left\langle Q', M' \middle| \hat{J}^\mu \middle| Q, M \right\rangle = e\, g_{VP\gamma} \frac{1}{(2\pi)^3} \frac{\varepsilon^{\mu\nu\rho\sigma} \varepsilon_\nu(\lambda_V) Q_\rho Q_\sigma}{\sqrt{2\omega_M(Q)}\sqrt{2\omega_{M'}(Q')}} \tag{32}$$

or, using 4-velocities of mesons

$$V_Q = \frac{Q}{M},\ V_{Q'} = \frac{Q'}{M'} \tag{33}$$

we obtain

$$\left\langle Q', M' \middle| \hat{J}^\mu \middle| Q, M \right\rangle = e\, g_{VP\gamma} \frac{1}{(2\pi)^3} \frac{K^\mu}{\sqrt{2V_0}\sqrt{2V_0'}} \sqrt{MM'}, \tag{34}$$

where $K^\mu = \varepsilon^{\mu\nu\rho\sigma} \varepsilon_\nu(\lambda_V) V_\rho V'_\sigma$.

In framework of Poincare-invariant quantum mechanics we consider mesons V and P as relativistic constituent quark-antiquark system: using (8) one can easily construct state vectors of pseudoscalar and vector mesons:

$$\left|Q, M\right\rangle = \sum_{\lambda_1,\lambda_2}\sum_{\nu_1,\nu_2} \int d\vec{k} \sqrt{\frac{\omega_{m_q}(\text{p}_1)\omega_{m_{\bar{Q}}}(\text{p}_2)}{\omega_{m_q}(\text{k})\omega_{m_{\bar{Q}}}(\text{k}) V_0}} \Phi_{LS}(\text{k}) Y_{Lm}(\theta_k, \phi_k) \times$$
$$\times \sqrt{\frac{3 + 4\nu_1\nu_2}{4}} \delta_{\nu_2, \lambda_V - \nu_1} D^{1/2}_{\lambda_1,\nu_1}(\vec{n}_{W_1}) D^{1/2}_{\lambda_2,\nu_2}(\vec{n}_{W_2}) \left|\vec{p}_1, \lambda_1; \vec{p}_2, \lambda_2\right\rangle, \tag{35}$$

$$\left|Q', M'\right\rangle = \sum_{\lambda_1,\lambda_2}\sum_{\nu_1,\nu_2} \int d\vec{k}' \sqrt{\frac{\omega_{m_q}(\text{p}_1')\omega_{m_{\bar{Q}}}(\text{p}_2')}{\omega_{m_q}(\text{k}')\omega_{m_{\bar{Q}}}(\text{k}') V_0'}} \Phi_{LS}(\text{k}) Y_{Lm}(\theta_k, \phi_k) \times \tag{36}$$
$$\times \sqrt{2}\nu_1' \delta_{\nu_2', -\nu_1'} D^{1/2}_{\lambda_1',\nu_1'}(\vec{n}'_{W_1}) D^{1/2}_{\lambda_2',\nu_2'}(\vec{n}'_{W_2}) \left|\vec{p}_1', \lambda_1'; \vec{p}_2', \lambda_2'\right\rangle.$$

Using the current operator $\hat{J}^\mu$ in the quark basis

$$\hat{J}^\mu = \overline{\psi}_{q',\bar{Q}'} \Gamma^\mu \psi_{q,\bar{Q}} \tag{37}$$

after some calculation in generalized Breit system, we get

$$g_{VP\gamma^*} = \frac{1}{4\pi\sqrt{MM'}}\int d\vec{k}\,\Phi_{L,S}(\mathrm{k})\Phi_{L,S}(\mathrm{k}_2)\sqrt{\frac{\omega_{m_{\bar{Q}}}(\mathrm{k}_2)}{\omega_{m_q}(\mathrm{k})\omega_{m_q}(\mathrm{k}_2)\omega_{m_{\bar{Q}}}(\mathrm{k})}}\times$$

$$\times\sum_{\nu_1,\nu_1'}\sqrt{\frac{3+4\nu_1(\lambda_V-\nu_1)}{2}}\nu_1'\frac{e_q}{e}\bar{u}_{\nu_1'}(\vec{k}_2',m_q)\frac{(\Gamma\cdot K^*)}{(K\cdot K^*)}B(\vec{\upsilon}_Q)u_{\nu_1}(\vec{k},m_q)D^{1/2}_{-\nu_1',\lambda_V-\nu_1}+$$

$$\frac{1}{4\pi\sqrt{MM'}}\int d\vec{k}\,\Phi_{L,S}(\mathrm{k})\Phi_{L,S}(\mathrm{k}_2)\sqrt{\frac{\omega_{m_q}(\mathrm{k}_2)}{\omega_{m_{\bar{Q}}}(\mathrm{k})\omega_{m_{\bar{Q}}}(\mathrm{k}_2)\omega_{m_q}(\mathrm{k})}}\times$$

$$\times\sum_{\nu_1,\nu_1'}\sqrt{\frac{3+4\nu_1(\lambda_V-\nu_1)}{2}}\nu_1'\frac{e_{\bar{Q}}}{e}\bar{\upsilon}_{\lambda_V-\nu_1}(\vec{k},m_{\bar{Q}})B^{-1}(\vec{\upsilon}_Q)\frac{(\Gamma\cdot K^*)}{(K\cdot K^*)}\upsilon_{\nu_1}(\vec{k}_2,m_{\bar{Q}})D^{1/2}_{\nu_1',\nu_1}, \quad (38)$$

where

$$\Gamma^\mu = F_1(t)\gamma^\mu + iF_2(t)\frac{\sigma^{\mu\nu}(k_2-k)_\nu}{2m_{q,\bar{Q}}}. \quad (39)$$

In relation (39) form-factors $F_1(t)$ and $F_2(t)$ normalized in the natural units magnetic μ and anomalous magnetic moments κ of quarks :

$$F_1(t=0)+F_1(t=0)=\mu_{q,\bar{Q}},\quad F_2(t=0)=\kappa_{q,\bar{Q}}, \quad (40)$$

and in (38) $\vec{k}_2$ and $\omega_{m_{q,\bar{Q}}}(\mathrm{k}_2)$ given by:

$$\vec{k}_2 = \vec{k} + \vec{\upsilon}_{\bar{Q}}\left((\varpi+1)\omega_{m_{q,\bar{Q}}}(\mathrm{k}) + \sqrt{\varpi^2-1}\,\mathrm{k}\cos\theta_k\right)$$
$$\omega_{m_{q,\bar{Q}}}(\mathrm{k}_2) = \omega_{m_{q,\bar{Q}}}(\mathrm{k})\varpi - \sqrt{\varpi^2-1}\mathrm{k}\cos\theta_\mathrm{k}, \quad (41)$$

where

$$\varpi = \frac{M_0^2+M_0'^2-t}{2M_0^2M_0'^2}. \quad (42)$$

Radiative constant decay $g_{VP\gamma}$ obtained by limiting $g_{VP\gamma}\to g_{VP\gamma^*}(t\to 0)$. Using the experimental data for the light $\rho^\pm, K^{*\pm}$ and K^{*0} mesons [21] after numerical calculation we obtain the values of the magnetic moments of the quarks μ, in natural units($\mu_N = \frac{e}{2m_p}$), in relativistic quark model based on point form Poincare-invariant quantum mechanics:

Table 1

The magnetic moments of quarks

Quark	Our work, μ_N	[22]	[23]
u	2.080 ± 0.082	2.066	2.08 ± 0.07
d	-1.261 ± 0.015	-1.110	-1.31 ± 0.06
s	-0.621 ± 0.011	-0.633	-0.77 ± 0.06

The comparative analysis shows the values obtained in the framework of relativistic quark model based on point form Poincare-invariant quantum mechanics correspond to the results, obtained from the analysis of the magnetic moments of the baryon.

Conclusion

This work dedicated calculation of integral representation for the form-factor transition $V \to P\gamma$ within the framework of the relativistic quark model based on point form of the Poincare-invariant quantum mechanics is obtained. From the condition of matching the width of the model calculations with the experimental values found values of the magnetic moments of quarks, which are correlated with the data, obtained from using the experimental values of the magnetic moments of baryons.

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STATUS OF THE TIME PROJECTION CHAMBER FOR THE MPD/NICA PROJECT

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Abstract: The Time-Projection Chamber (TPC) is the main detector for tracking and identification of charged particles in the Multi-Purpose Detector (MPD) at new accelerator complex the Nuclotron-based Ion Collider Facility (NICA). The status of the TPC construction is presented.

1 Introduction

Within the framework of the JINR scientific program on study of hot and dense baryonic matter a new accelerator complex the Nuclotron-based Ion Collider Facility (NICA) **[1, 2]** is under realization. It will operate at luminosity up to 10^{27} cm^{-2} s^{-1} for Au^{79+} ions. Two interaction points are foreseen at the NICA for two detectors which will operate simultaneously. One of these detectors, the Multi-Purpose Detector (MPD), is optimized for investigations of heavy- ion collisions **[3, 4]**. The MPD cross-section is shown in **Fig. 1**.