TO THE QUESTION ON THE THEORY OF MAGNETIC CHARGES AND QUANTUM CHROMODYNAMICS AT LARGE DISTANCES

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It is known [1] that the presence of monopoles in the Universe would has allowed the most simply to explain the quantization of electric charges. The monopole theory, constructed by Dirac in 30th of last century [2], did not suffered substantial changes in all past times, therefore the rather long time interval, devoted to the monopole search, gives cause to seriously treat the negative result of experimental works.

In the first place we shall consider (as N.A. Chernikov [3] who applied the hypothesis to the gravitational interaction) that fundamental physical interactions have finite ranges. Therefore it is necessary to re-write the monopole potential

$$\vec{B}(r) = \pm \frac{g}{r} \frac{[\vec{s}\vec{r}]}{r - \vec{s}\vec{r}} \qquad (1)$$

(it is used the system of units h/2π = c = 1, where h is the Planck constant and c is the light speed) taking into account the results of Chernikov works in the form:

$$\vec{B}(r) = \pm \frac{g}{L}\left(1 - \coth\frac{r}{L}\right)\frac{[\vec{s}\vec{r}]}{r - \vec{s}\vec{r}} = \mp \frac{g}{L}\frac{e^{-2r/L}}{1 - e^{-2r/L}}\frac{[\vec{s}\vec{r}]}{r - \vec{s}\vec{r}}\ , \qquad (2)$$

where g is the magnetic charge of the particle; r is the distance from the magnetic charge to an observer; L is the Lobachevsky constant; and $\vec{s}$ is the unit vector, whose direction defines the direction of the singular Dirac line; $\vec{s}\vec{r}$ - scalar and $[\vec{s}\vec{r}]$ - $\vec{s}$ and $\vec{r}$ vector product. (We connect the direction of $\vec{s}$ with the spin direction of elementary particles. The offered interpretation takes account of the absence in experiments fundamental scalar particles for their detection [4].) Note, that the constant L (which makes available the shielding of the magnetic charge g) will depend on the degree of the vacuum polarization (we consider that the vacuum is not a sterile one as in the previous work [4]).

In the case, if the elementary particle is composite, singular lines must be several that gives rise to the generalization of the potential (2).

$$\vec{B}(r) = \pm \frac{g}{nL}\left(1 - \coth\frac{r}{L}\right)\sum_{i=1}^{n}\frac{[\vec{s}_i\vec{r}]}{r - \vec{s}_i\vec{r}} = \mp \frac{g}{nL}\frac{e^{-2r/L}}{1 - e^{-2r/L}}\sum_{i=1}^{n}\frac{[\vec{s}_i\vec{r}]}{r - \vec{s}_i\vec{r}} \ . \quad (3)$$

Such generalization procedure on two lines could be found in the Schwinger paper [5] and on an arbitrary number of lines in the Usachev work [1]. As a result, from observable particles only neutron can pretend to the role of the conditionally stable “composite” monopole with the minimum (3) number of singular lines and with zero electric charge. Hence a quark can pretend to the role of a fundamental monopole with a singular line but with a nonzero electric charge. In consequence of this we can interpret the baryonic charge as a magnetic one.

For the description of a physical system which is characterized by a finite shielding radius it is convenient to take advantage of a symmetry, a group structure of which become precise only in asymptotical limits and in the general case it depends on space coordinates [4]. That's precisely the problem on the development of the extended gauge formalism [6] became actual. It is the sense to use the given formalism for the description of strong interactions considering the dynamic symmetry breaking [7].

The status of the particular (different from electric one) magnetic charge must be verified by the presence of special virtual particles, which characterize it. The gluons can be regarded as such particles for hadron matter.

Considering the hadron as the nonlocal physical system it can be used the extended gauge formalism [6], within the scope of which it was received the propagator of a vector boson with a nonzero rest mass [8]. The formalism application will not be limited by the central hadron region where it is taken the gluon rest mass equal to zero. In the neighborhood of a hadron boundary the application of the precise *SU(3)* symmetry it is becoming inexpediently and quantum chromodynamics must be constructed on the base of a more general formalism [4], which is characterized by a quasi-group symmetry. Here it can be needed approximate methods of a description. For example it can be use spaces with nontrivial geometrical structure such as Riemannian one.

Let M_n is the Riemannian space-time [9], $\Gamma^k_{ij}(x)$ are the components of the internal connection (here and further Latin indices *i, j, k, l,…* will run the values of integers from 1 to *n*) , ∇_i is the symbol of the covariant derivative in regard to the connection $\Gamma^k_{ij}(x)$. We regard the following gauge-invariant Lagrangian

$$\Lambda_t = \Lambda\left(\Psi, D_{(k)}\Psi\right) + \frac{1}{4}\eta^{(j)(m)}\Big[\kappa_\circ \eta_{\underline{a}\underline{b}}\eta^{(i)(k)} E^{\underline{a}}_{(i)(j)} E^{\underline{b}}_{(k)(m)} + + \kappa_1 \Big(\eta_{(k)(n)}\eta^{(i)(l)} F^{(k)}_{(i)(j)} F^{(n)}_{(l)(m)} + 2F^{(k)}_{(i)(j)} F^{(i)}_{(k)(m)} - 4F^{(i)}_{(i)(j)} F^{(k)}_{(k)(m)}\Big)\Big], \tag{4}$$

where

$$D_{(k)}\Psi = \Phi^i_{(k)}\nabla_i\Psi - \Phi^i_{(k)} L_i\Psi - A^{\underline{c}}_{(k)} L_{\underline{c}}\Psi \ . \tag{5}$$

$$F^{(k)}_{(i)(j)} = \Phi^{(k)}_{m}\left(\Phi^{l}_{(i)}\nabla_{l}\Phi^{m}_{(j)} - \Phi^{l}_{(j)}\nabla_{l}\Phi^{m}_{(i)}\right) + \Phi^{l}_{(i)}L_{l}{}^{(k)}_{(j)} - \\ - \Phi^{l}_{(j)}L_{l}{}^{(k)}_{(i)} + A^{\underline{c}}_{(i)}L_{\underline{c}}{}^{(k)}_{(j)} - A^{\underline{c}}_{(j)}L_{\underline{c}}{}^{(k)}_{(i)} = \Phi^{(k)}_{l}F^{l}_{mn}\Phi^{m}_{(i)}\Phi^{n}_{(j)}, \tag{6}$$

$$E^{\underline{a}}_{ij} = E^{\underline{a}}_{(k)(l)}\Phi^{(k)}_{i}\Phi^{(l)}_{j} = \\ = \nabla_{i}A^{\underline{a}}_{j} - \nabla_{j}A^{\underline{a}}_{i} + C^{\underline{a}}_{\underline{b}\underline{c}}A^{\underline{b}}_{i}A^{\underline{c}}_{j} + C^{\underline{a}}_{i\underline{b}}A^{\underline{b}}_{j} - C^{\underline{a}}_{j\underline{b}}A^{\underline{b}}_{i} + C^{\underline{a}}_{ij}\ , \tag{7}$$

$$\Phi^{(k)}_{i}\Phi^{i}_{(j)} = \delta^{(k)}_{(j)}\ , \qquad A^{\underline{b}}_{i} = A^{\underline{b}}_{(j)}\Phi^{(j)}_{i}, \tag{8}$$

(hereinafter $(i),(j),(k),(l),... = 1,2,...,n; \underline{a},\underline{b},\underline{c},\underline{d},\underline{e} = n+1, n+2,...,n+\underline{r}$; $\eta_{(i)(j)}$ are metric tensor components of a tangent space to M_n and $\eta_{(a)(b)}$ are metric tensor components of a tangent space to $M_{\underline{r}}$; $\eta^{(i)(k)}$ are determined as the solution of equations: $\eta^{(i)(j)}\eta_{(i)(k)} = \delta^{(j)}_{(k)}$ and $\eta^{(a)(c)}$ are determined as the solution of equations: $\eta^{(a)(c)}\eta_{(a)(b)} = \delta^{(c)}_{(b)}$; $\delta^{(k)}_{(j)}$ and $\delta^{(c)}_{(b)}$ are Kronecker deltas).

Let $n=4$. As a result the equations of fields $\Phi^{i}_{(j)}(x)$ may be received in a standard manner [10] as the Einstein gravitational equations

$$R_{jik}{}^{j}-\frac{1}{2}g_{ik}g^{lm}R_{jlm}{}^{j}=\frac{1}{2\kappa_1}\left[g_{kj}\frac{\partial\Lambda}{\partial D_j\Psi}D_i\Psi-g_{ik}\Lambda\right.$$
$$\left.+\kappa_{\circ}\eta_{\underline{ab}}g^{jl}\left(E^{\underline{a}}_{ij}E^{\underline{b}}_{kl}-\frac{1}{4}g_{ik}g^{mn}E^{\underline{a}}_{mj}E^{\underline{b}}_{nl}\right)\right]. \qquad (9)$$

($R_{ijk}{}^{l}$ is the curvature tensor of the connection Γ^{k}_{ij} of Riemannian space-time M_n). Naturally, that the Einstein equations only show a physical state of a matter. All this confirm a capability for interpretations of fields $\Phi^{i}_{(j)}(x)$ or fields $\Phi^{(j)}_{i}(x)$ as gravity potentials, but taking into account their dependence on properties of medium (vacuum), it is meaningful to call $\Phi^{i}_{(j)}(x)$ and $\Phi^{(j)}_{i}(x)$ by polarization fields. Precisely these fields describing the slow subsystem it can hide introducing the Riemannian structure of space-time, thereby we receive a possibility to apply the methods of differential geometry by the condensed description of physical systems not only in the cosmology, but and in the elementary particle physics [8].

Let's study an approaching, in which the space-time is possible to consider as a Minkowski space, the fields $\Phi_i^{(k)}$, $\Phi_{(k)}^i$ are constants and let $\underline{r}=1$, that assumes $C_{\underline{ab}}^{\underline{c}}=0$. For obtaining equations of fields $A_i^{\underline{b}}(x)$ in Feynman perturbation theory the calibration should be fixed. For this we shall add the following addend:

$$\Lambda_q = \frac{\kappa_\circ}{2} q_{\underline{bb}} g^{ij} g^{kl} \left(\partial_i A_j^{\underline{b}} - q_\circ C_i A_j^{\underline{b}}\right)\left(\partial_k A_l^{\underline{b}} - q_\circ C_k A_l^{\underline{b}}\right), \qquad (10)$$

to the Lagrangian (4), where $q_\circ = \eta_{\underline{bb}} / q_{\underline{bb}}$, $C_i = C_{i\underline{b}}^{\underline{b}}$. Besides let

$$L_{\underline{b}(k)}^{(i)} \eta^{(j)(k)} + L_{\underline{b}(k)}^{(j)} \eta^{(i)(k)} = t_{\underline{b}} \eta^{(i)(j)} \ . \qquad (11)$$

As a result of this equations of a vector field $A_i^{\underline{b}}(x)$ will be written as:

$$\begin{aligned} & g^{jk}\left[\partial_j \partial_k A_i^{\underline{a}} - (1 - 1/q_\circ)\partial_i \partial_j A_k^{\underline{a}} + (1 - q_\circ) C_i C_j A_k^{\underline{a}}\right] \\ & + m^2 A_i^{\underline{a}} = I_i^{\underline{a}} / \kappa_\circ , \end{aligned} \qquad (12)$$

where $I_i^{\underline{a}} = \dfrac{g_{ij}}{\eta_{\underline{aa}}} \dfrac{\partial \Lambda(\Psi)}{\partial A_j^{\underline{a}}}$ and

$$m^2 = (n-1)(n-2)\kappa_1 t_{\underline{a}}^2 / (2\kappa_\circ \eta_{\underline{aa}}) - g^{jk} C_j C_k \ . \qquad (13)$$

Notice that owing to the vacuum polarization ($C_i \neq 0$) the propagator of a vector boson has the rather cumbersome view [8]

$$D_{ij}(p) = \left(p^m p_m - m^2\right)^{-1}\Big[-g_{ij} +$$
$$(1-q_\circ)\frac{\left(p_i p_j - C_i C_j\right)\left(p^k p_k - q_\circ m^2\right) + (1-q_\circ)p^k C_k\left(p_i C_j + C_i p_j\right)}{\left(p^l p_l - q_\circ m^2\right)^2 + (1-q_\circ)^2\left(p^l C_l\right)^2}\Bigg],$$

(14)

which is simplified and receives the familiar form ($-g_{ij}\big/\left(p^k p_k - m^2\right)$, p^k is the 4-momentum, and m is the mass of the vector boson) only in the Feynman calibration ($q_\circ = 1$). This propagator allows to construct the renormalizable quantum theory of interactions ($D_{ij}(p) \to 0$, by $p \to \infty$), not attracting hypothetical scalar fields (the search of Higgs scalar bosons, forecasted in the standard model of electroweak interactions, is unsuccessful one for quite more quarter of a century). As a result it can make the conclusion that elementary particles must be considered right from the start as the compound physical systems for the correct description of which's it is necessary to attract polarization fields too. Polarization fields may be interpreted as fields describing "coat" consisting of virtual particles and surrounding the original bare particle.

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