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As discussion

M.Yu.Bogolyubsky, A.P.Meschanin

ON UNIFIED ELECTROMAGNETIC COMPOSITION OF MUON, PROTON AND NEUTRON

(Part 1. Electron-positron conception)

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Abstract

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In the present work an attempt has been undertaken to create an electromagnetic model of muon and nucleons on the base of conception of a force knot from extremely strong magnetic field and electron-positron “atomic” complex, in which charge has superstrong superlocalization. The force magnetic knot of nucleon is a carrier of baryon number in such model and the confinement problem, the origin of electrical charge, spin, magnetic moment and mass of particles finds its natural solution. The model ensures also mutual transformation principle of elementary particles through annihilation process $e^+e^- \rightarrow particles$. In this work the direction of progress to clarifying of the uniform electromagnetic composition of fundamental particles and to the understanding of the nature of unified interaction with one universal world constant has been pointed out.

Аннотация

Боголюбский М.Ю., Мещанин А.П. К единой электромагнитной составленности мюона, протона и нейтрона. Часть 1. Электрон-позитронная концепция: Препринт ИФВЭ 97-39. – Протвино, 1997. – 27 с., 4 рис., 2 табл., библиогр.: 37.

В работе предпринята попытка создания электромагнитной модели мюона и нуклонов на основе концепции силового узла частицы из экстремально сильного магнитного поля и электрон-позитронного “атомарного” комплекса, в которой заряд имеет сверхсильную суперлокализацию. В такой модели носителем барионного заряда является силовой магнитный узел нуклона, и решается проблема конфайнмента цветовых обьектов, а так же имеет место естественное объяснение возникновения электрического заряда, спина, магнитного момента и масс частиц. Модель так же обеспечивает принцип взаимопревращаемости элементарных частиц через аннигиляционный процесс $e^+e^- \rightarrow$ *частицы*. В работе указывается направление продвижения к единой электромагнитной составленности элементарных частиц и к пониманию природы единого взаимодействия с одной универсальной мировой константой.

Contents

Memorandum
of St.-Petersburg Academy

August 19, 1832. Under Lobachevsky's initiative the council of Kazan university directed his work "On foundations of geometry" to the Imperial St.-Petersburg Academy of Sciences. The Academy, in turn, transmitted this paper for reviewing to Academician M.V.Ostrogradsky who answered on November 7, 1832, that the work was unworthy attention of the Academy [1].

Introduction

It was found already long ago that the strong increase of electrical charge in NN-collisions and e^+e^--annihilation in hadrons at $\sqrt{s} \to \infty$ in events with asymptotic mulptiplicity occurred, when after realization of the full line-up of the weak decays the sum of charges (modulo) in final state strongly exceeded the similar sum for the initial one, and in these processes a substantial growth of magnetic moment, spin, masses of particles and number of neutrinos was also observed.

The above facts together with the concept of infinite electromagnetic energy of the physical vacuum [2] do not exclude a possibility that the electromagnetic structure of particles is actually realized in nature under unlimited propagation of electromagnetism in all its forms in the Universe. To avoid the misunderstanding, it should be noted, that the density of full energy of the vacuum is nevertheless a finite value due to the mutual compensation mechanism for the contributions of boson and lepton forms of matter [2].

Nowadays the most accepted conception is the Quantum Chromodynamics (QCD) operating with colour interactions to explain the nucleon structure. The distinction between electromagnetic and colour interactions is shown in fig.1 (a, b, c, and d). It follows from the universal mutual transformation of particles, that each elementary particle is somehow constructed from the remaining ones, i.e. all of them consist, in effect, of some uniform primary matter. It is possible, that physics will manage to define this primary matter and to construct from it all the known particles. What a role will be assigned thus to electromagnetism?

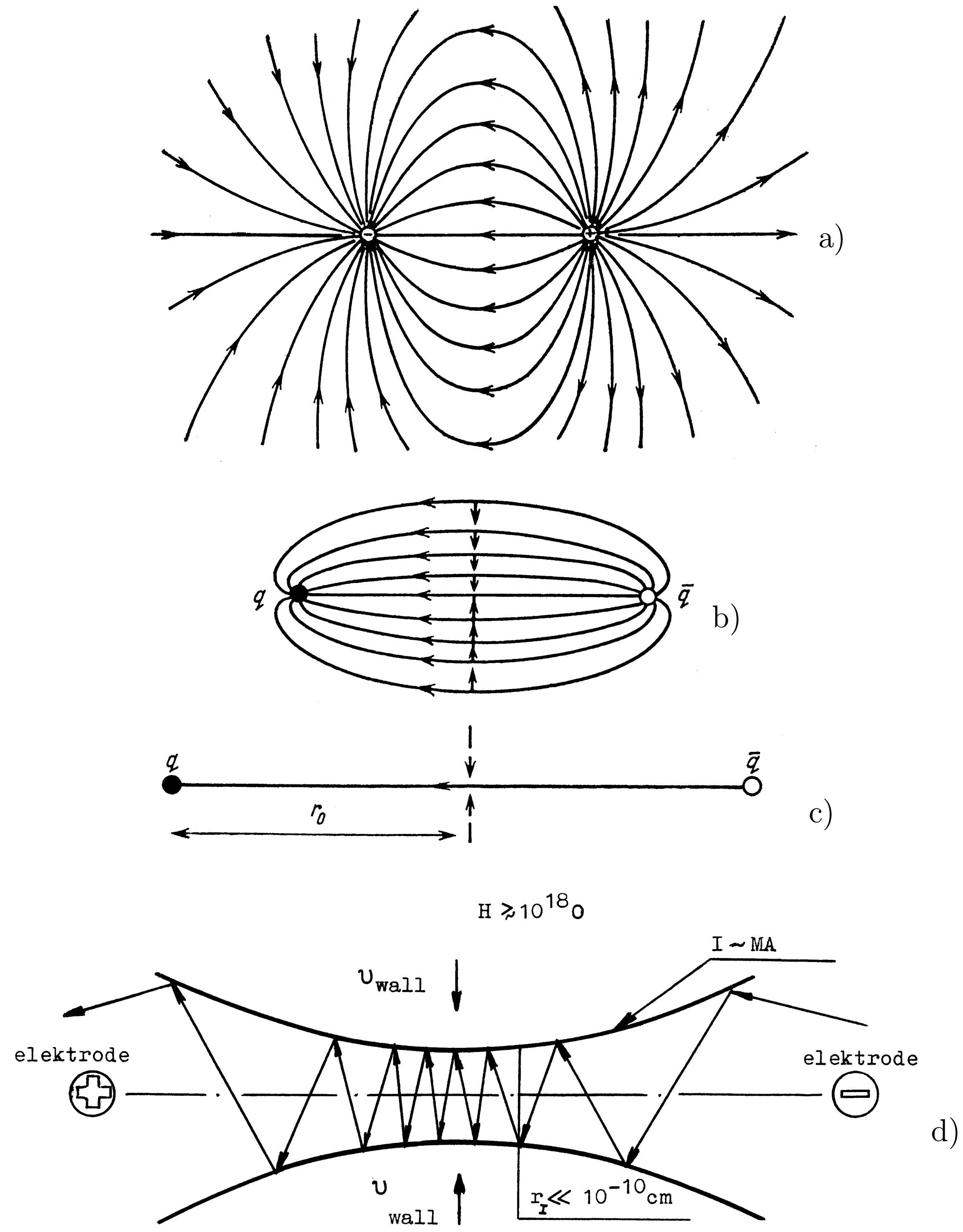

Fig. 1. Diagram illustrating the mechanism of action of various fields: a) force lines between electrical charges; b) force lines of colour charges; c) already formed colour string; d) magnetic field of current of pinch system contracting discharge is like a cylindrical piston collapsing to the longitudinal axis (from [11]).

L.D.Faddeev considered in his paper "Hadrons from leptons?" [3] the possibility of emerging hadrons as excitements of a system of weakly interacting fields. The specified mechanism permits to describe strongly interacting particles as collective excitements in the system of weakly bound fields, where it is enough to take leptons as fundamental objects together with vector fields transposing their interactions. The hadrons must appear thus as solitons or their bound states, and the soliton charges must play a role of baryon number. The classical equations of motion in this model suppose stationary solutions, where the energy is inversely proportional to the constant of the weak interactions, it entails also in a real four-dimensional case the solutions concentrated around a closed loop (string) having periodical nonlinear oscillations. The authors of [4] have proposed as such a contour the electromagnetic collapsing pinch-mechanism of hadronization (fig.2d) which forms particles with their force knots and spin structure, the mechanism of weak decay ensuring extremely small neutrino mass ($m_{\nu_e} < 4,35$ ev$/c^2$). All this shows that in the theory of leptons the excitements possessing large masses, nontrivial quantum numbers and strong interactions are possible.

In connection with the above mentioned, we specify J.Schwinger's paper "A magnetic model of matter" [6]. In this work the existence of magnetic charge is also postulated alongside with electrical charge, and hadron substance is considered as the magnetic-neutral formation of fundamental dual charged particles — dyons. The elementary purely magnetic charge g_0 has a rather large value (such, that $g_0^2/\hbar c \simeq 36 \cdot 137$) and the intensity of interactions between magnetic charges is much stronger relatively nuclear forces (where the constant of interaction is of order 10.)

There is a significant amount of the publications devoted to the so-called "Darmstadt effect" (see, for example, [7]), when a superstrong electromagnetic field at collision of very heavy ions can cause a phase transition in the QED vacuum with the electromagnetic constant in this phase $\alpha_f \sim 1$. Thus, there is a possibility for the formation of multi-electron compact "atomic" complexes $2e^+e^-$ and $2e^-e^+$ due to relativistic compression of Coulomb orbits of positron and electron near nuclei with $Z_1 + Z_2 > 150$. Rapprochements of electrons and positrons to distances $\sim 2 \cdot 10^{-16}$ cm have been reached in TRISTAN experiments (Japan). As it was expected theoretically, the constant of electromagnetic interaction grows with rapprochement of particles (see [8]).

Occupying the leading position in modern hadron physics of hard processes, the QCD theory operates a huge amount of parameters ~ 100, but it faces, nevertheless, a number of problems not having a solution in its framework. They are: confinement of colour objects, recurrence of lepton-quark generations and its number, mechanism of particle mass generation and others. Note, that quark-gluon plasma, which existence follows from the QCD, was not experimentally observed until now in spite of the fact that the achieved energies already correspond to magnitudes up to ~ 200 GeV/nucleon. It may point out, that such plasma does not exist in nature at all.

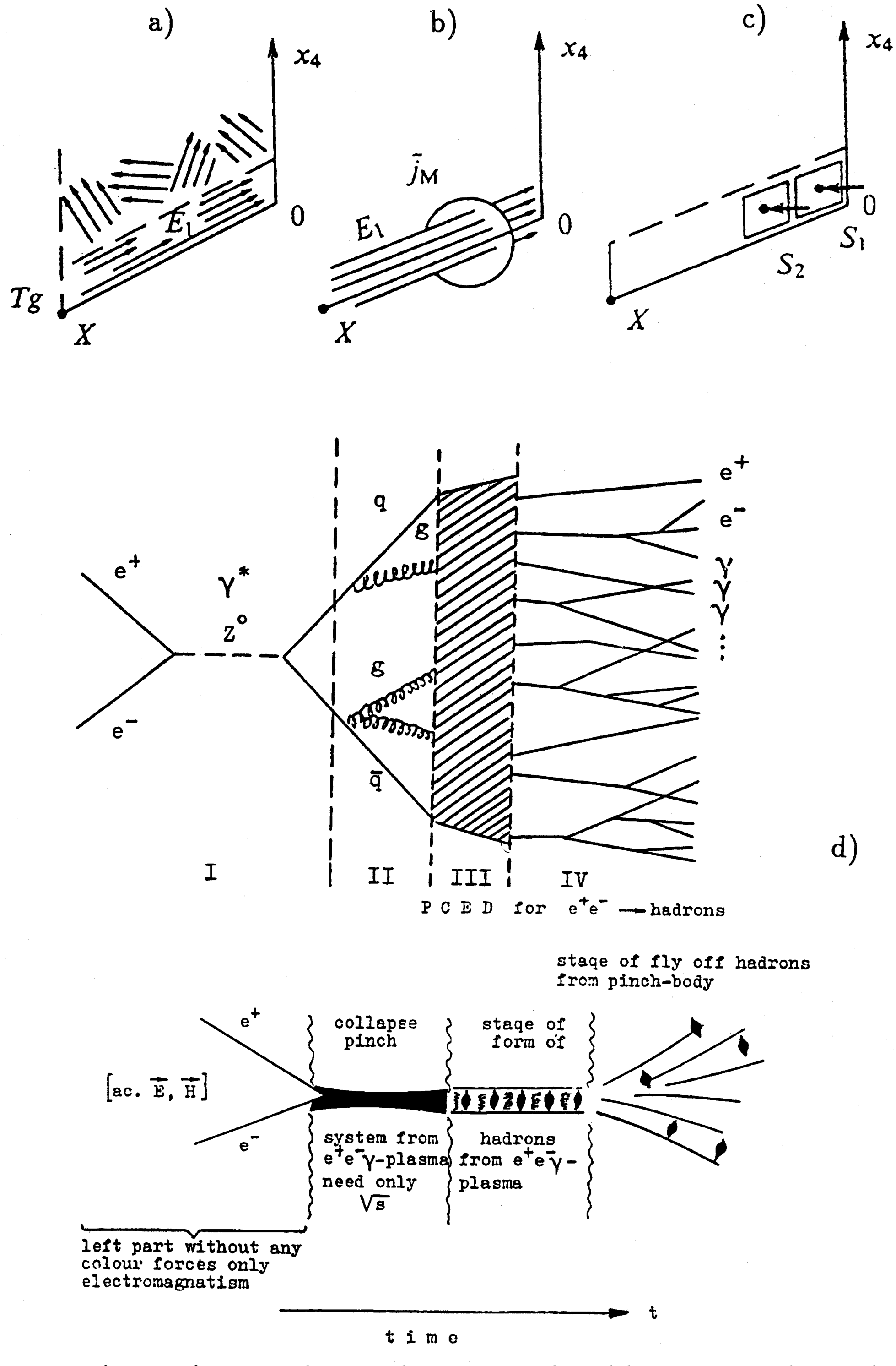

Fig. 2. Picture of string formation by nonrelativistic quark and heavy antiquark considered within the framework of three various approaches: a) formalism of fields correlators, b) dual superconductivity, c) model of stochastic distribution of streams (from [20]), d) dynamics of e^+e^--annihilation process in hadrons within the framework of two approaches: the modern QCD and electromagnetic pinch collapsing electrodynamics EPCE (from [4]).

One of the basic problems of modern physics of elementary particles is the problem of relativistic, quantum description of the nucleon structures. Selection of elementary components of substance is a difficult task. Schrodinger, Heisenberg, Dirac, etc. created the quantum mechanics to describe nuclear-electron systems, within the framework of which one can consider all phenomena of the surrounding world up to distances of the order of 10^{-12} cm. Let's remind that the quantum electrodynamics has been formulated on the base of experimental study of phenomena of scales $\sim 10^{-8}$ cm, but it appeared valid down to distances $\sim 10^{-17}$ cm. At the same time, it became clear already long ago, that "a natural limit of applicability" exists for the Maxwell-Dirac electrodynamics at large transferred momenta or small distances, and also at small transferred momentum phenomena, but considered at a high level of accuracy, where strong interactions will appear with their indeterminacy of the hadronization mechanism.

Thus, the electrodynamics, that considers only electrons and photons, seems to be broken. Nowadays the account of electromagnetic interactions influence on strong interactions appears very vague because of the lack of a self-consistent theory of proton. It is only obvious, that the electromagnetic properties of hadrons must play a definite role. In our judgement, beyond "the natural limit" of Faradey-Maxwell-Dirac electrodynamics ($r \leq 10^{-16}$ cm), the physics of extremely strong electromagnetisms merges with the physics of strong interactions within the framework of mechanism based on the formation of electron-positron complexes in the magnetic field of collapsing pinch-mechanism of hadronization, see fig.2d (details can be found in [4]). This statement can be supported by the fact, that the nuclei sizes of nucleon ($r_N \simeq 0.8$ Fm) appear approximately equal to its electromagnetic radius, and the density of electromagnetic energy around moving electrons (positrons) becomes commensurable with hadron density at distances ≤ 1 Fm and velocities tending to light velocity.

We list in brief basic exotic properties of muons and nucleons (for detailed analysis see work [18]):

- – abnormal strange values of nucleon magnetic moments, which are different from zero for neutral neutrons and too great for protons (according to measurements for proton and neutron: $\mu_p = 2.793\ \mu_N$ and $\mu_n = -1.913\ \mu_N$, where μ_N is nuclear magneton);
- – provisional equality of anomalous parts of proton and neutron magnetic moments ($\mu_p - 1 \simeq |\mu_n - 0|$), and also (to the great surprise) anomalous magnetic moment of nucleons and electrons (the latter only with accuracy of $\sim 19\%$), which testifies to the uniformity of main mechanisms of their origin; [1]

[1] Initial notion about nucleon structure has arisen just in connection with a detection of anomalous magnetic moments. The elementary explanation of this effect was given by Fermi, who has considered a nucleon as a complicated system consisting of "naked" nucleon with normal value of magnetic moment (i.e. zero and one μ_N for "naked" neutron and proton accordingly) and π-meson cloud responsible for the observable anomaly. In this scheme proton and nucleon must have the distributed electrical charge and magnetic moment, which can be experimentally measured in electron-nucleon scattering (see, for example, review [18]). We note, that our concept is certainly close to Fermi's idea, but with the difference, that his π-meson cloud is replaced with the electron-positron complex (see further).

- – possibility for neutron to have very small electrical charge (the experimental restriction gives $Q_n < (4.3 \pm 7.1) \cdot 10^{-21}|e|$);
- – possibility also for neutron to have small polarizability (from experimental data $\alpha_p < 2 \cdot 10^{-3}$ Fm^3), which will violate CP-invariance;
- – neutron decay with violation of baryon number conservation ($\Delta B = 1$) $n \to e^+\pi^-$ with $\tau_n^{\Delta B=1} > 10^{32}$ years (theory makes an estimate of proton life time $\sim 10^{32} - 10^{33}$ years);
- – possibility of neutron-antineutron oscillations ($\Delta B = 2$) with the upper bound of theoretical estimations $\tau_{os} = 10^{37}$ s;
- – difference of muon from electron is not exhibited in anything, except for the mass value ($m_\mu \simeq 207$ m) with concurrence of all remaining quantum parameters;
- – existence in nature only of charged forms of both electron and muon and the lack of their neutral forms.

And in the end of this section we note, that the most essential drawback of all published till now works considering proton structure is the absence of a force knot concept. It is not offered and its nature is not defined.

1. Basic ideas of the suggested conception

It seems quite possible, that the problems, specified in the introduction, can find a natural solution by methods of the modern Ultra Quantum Physics (UQP) from the viewpoint of the electromagnetic conception of hadron structure, that can be an alternative to modern quark-gluon model in the QCD framework. A construction of hadrons from multielectronic complexes with the force knot from superstrong magnetic field is possible in the UQP concept due to the absence of principal restrictions on magnetic field (quantum effects in extremely strong magnetic field are detailed in an extensive review by I.M.Ternov and O.E.Dorofeev [5]).

In our model of electromagnetic structure of muons and nucleons electrons and positrons being in extremely strong magnetic field of the particle force knot act as Feynman partons, and magnetic system composed of photons of extremely strong magnetic field from rotating electron and/or positron is identified with gluon.

The electromagnetic field has an energy-momentum tensor T^{ij} (expression for it through vectors $\bar{E}$ and $\bar{H}$ of electrical and magnetic fields can be found in [9]), which has a number of specific and peculiar properties. Its spatial components form Maxwellian stress tensor $\sigma_{\alpha\beta}$

$$\sigma_{\alpha\beta} = (1/4\pi) \cdot [-E_\alpha E_\beta - H_\alpha H_\beta + (1/2) \cdot (E^2 + H^2)\delta_{\alpha\beta}],\ \alpha, \beta = 1, 2, 3.$$

The matrix of Maxwellian tensor is (we omit common factor $1/4\pi$ and due to symmetry of $\sigma_{\alpha\beta}$ indicate only matrix elements with $\beta \geq \alpha$)

$-(E_1^2 + H_1^2)/2$	$-E_1E_2 - H_1H_2$	$-E_1E_3 - H_1H_3$
...	$-(E_2^2 + H_2^2)/2$	$-E_2E_3 - H_2H_3$
...	...	$-(E_3^2 + H_3^2)/2$

It is thus seen, that there are possible configurations of fields, which have negative diagonal elements of Maxwellian tensor. It conduces to (as it has been marked back in [2]) the magnetic field having tension along a force line and pressure across the one. That's why the motion, that stretches longitudinal sizes and constricts transversal ones, results in the energy pumping and the initiation of forces growing with the increase of stretching and, accordingly, decreasing at small distances. Thus, the fundamental property of forces, existing between quarks and conducing to the so-called asymptotic freedom is reproduced.

The conception, proposed by us, is based on the use of electromagnetic collapsing pinch-mechanism of hadronization [4] (fig.2d) and it is mainly supported by the following points:

- – infinity of electromagnetic energy in the Universe (for more details see [2]) with continuous modification of its scales from $MTeV$ up to meV (see fig.3);
- – conservatism of magnetic field, that has no principal upper restrictions on its magnitude (unlike the electrical field, where a breakdown of the vacuum occurs at rather large strengths due to spontaneous generation of e^+e^--pairs), whereby the existence of extremely strong magnetic field is possible (for example, at distances $<<\ 0.01\ A^0$ from a moving point-like electrical charge e with its velocity $v \to c$);
- – high degree of spatial localization of a charged particle in extremely strong magnetic field and the existence in such field of stationary orbits at the expense of mechanisms resulting in the Bohr postulates (one of the possible their formulations is: the orbit length is multiple to the de'Broglie wavelength of the particle);
- – extremely small electron structural radius $\sim 10^{-20}$ cm and the existence of "darmstadt" electron-positron atomic complexes me^-ne^+;
- – ability of a system from fermions to transit into a superconducting state at low temperatures ($\sim 300^0\ K$) in the presence of anyhow weak attraction between them (for more details see [11]);
- – superfluidity of quantum liquid from bose-particles;
- – increase of electrical charge, magnetic moment, masses of particles and the number of neutrinos in the process of e^+e^--annihilation in hadrons at $\sqrt{s} \to \infty$;
- – possibility of transformation of Z^0-boson and proton in electrons and positrons (according to current data $B(Z \to e^+e^-) \simeq 3.37\%$ [12]), and proton decay in channel $p \to e^+\ \pi^0$ is required in Grand Unification models);
- – scribing the eye the similarity between electron, positron, photon, light quarks and gluons (see Table 1).

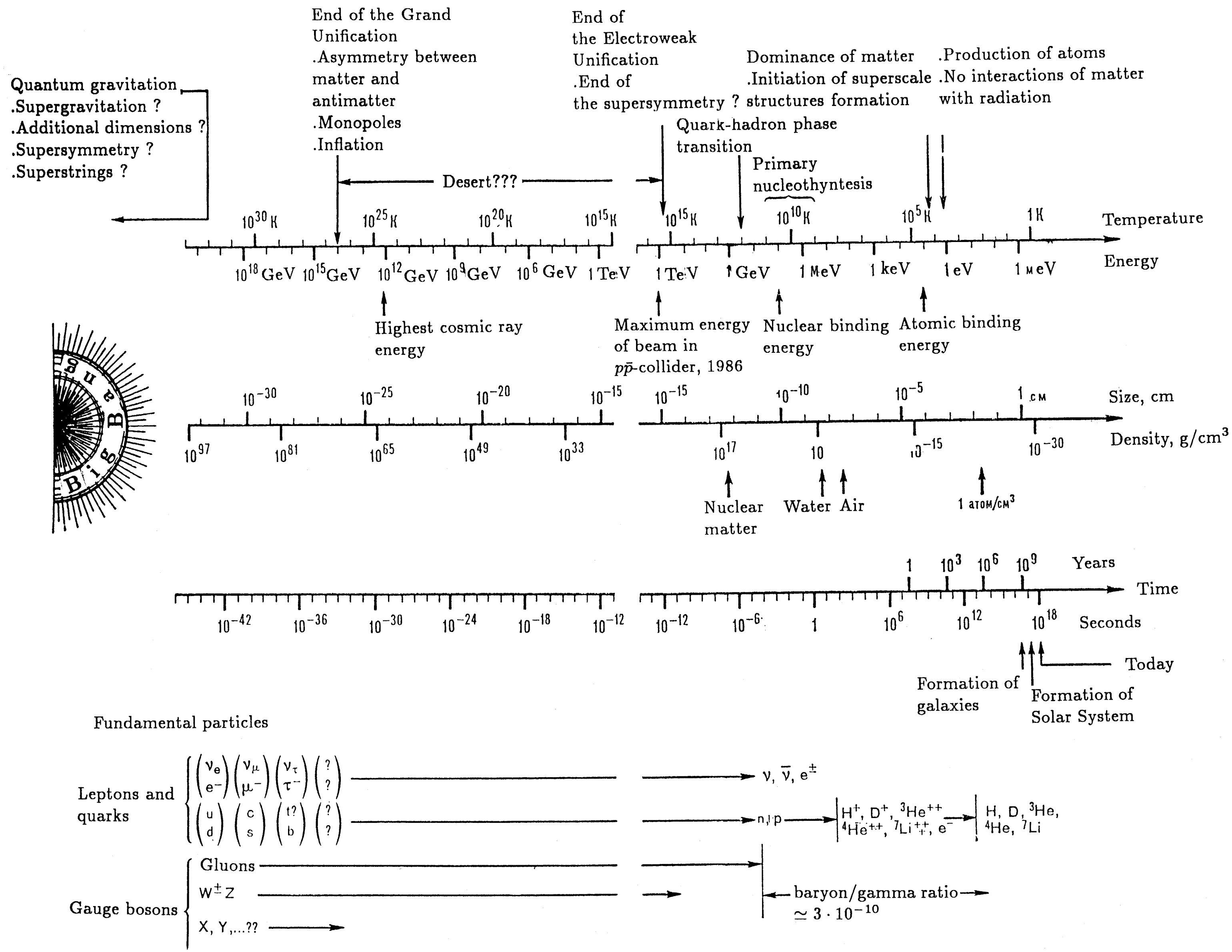

Fig. 3. Scheme of evolution of the Universe and energy scale [35].

Table 1.

Type of particle	Spin	Radius (см)	Charge ($\|e\|$)	Mass
Leptons e^+, e^-	1/2	$\sim 10^{-20}$	± 1	0,511
Light quarks u, d	1/2	$< 5 \cdot 10^{-17}$	2/3, $-1/3$	2–8 MeV 5–15 MeV
Photons γ	1	$\sim 10^{-15}$	0	$< 10^{-41}$ g -
Gluons g	1		0	

Notes:

- a) In the scientific publications there are quarks of both types with fractional charge, and with integer one (for example, in Han-Nambu models [36]).
- b) The values of quark masses are model-dependent ones due to the absence of self-consistent model of proton and cannot be defined unambiguously.
- c) Pointlike electron and positron size is in agreement with experimental results and with quantum-electrodynamic calculations up to distances $\sim 10^{-17}$ cm. The presence in electron of some electron-positron cloud with radius $r \sim \lambda_e \simeq 3.86 \cdot 10^{-11}$ cm does not change the essence of the problem, due to its small density of order $\alpha = 1/137$.

2. Extremely strong magnetic field

Let's consider briefly a conception of extremely critical magnetic field. There is a critical value of magnetic field, when the rotation electron energy $\hbar\Omega$ ($\Omega = eH/mc$ is cyclotron frequency) reaches the electron energy mc^2 at rest. Then we obtain the result for the critical field value: $H_c = m^2c^3/e\hbar = 4.413 \cdot 10^{13}$ Oe [5], where e and m are accordingly charge and mass of electron, c and $\hbar$ are the conventional notations for the light velocity and the Planc constant.

Owing to gyromagnetic properties, the magnetic field does not produce work (the Lorentz force is perpendicular to the trajectory of particle). By virtue of this the vacuum remains stable even under the action of critical field. It is of special interest for researches of processes in so extreme field, where the area of the ultraquantum physics occurs.

In recent years the problem of extremely strong magnetic field origin has been under consideration in connection with possible physical processes, which can take place in colliding proton-antiproton beams of the new generation of colliders like LHC. Here fields, originating during collision, can achieve values H_W, at which the lower electron energy level in magnetic field $\sim \hbar\Omega$ will reach $M_{W^\pm}$-boson mass (whence $H_W = M_W^2 c^3/e\hbar = 10^{24}$ Oe), which creates conditions for the formation of $W^\pm$- and Z^0-boson condensate decaying further on leptons.

If one imagines, that proton mass is gathered at the expense of magnetic field $\bar{H}$ inside it, for average value $< \bar{H}^2 >$ it is possible to obtain an estimation from relation:

$$(<\bar{H}^2>/8\pi)\cdot(4/3)\pi r^3 = m_p c^2,$$

where m_p and $r = 0.8$ Fm are accordingly proton mass and radius. One obtains herefrom $\sqrt{<\bar{H}^2>} \simeq 5\cdot 10^{18}$ Oe (which corresponds to $\sqrt{<\bar{H}^2>}/H_c \sim 10^5$).

An electron, being under the effect of extremely strong magnetic field, is essentially localized in the direction perpendicular to the field. The degree of localization is characterized by radius [5]

$$r = \lambda_e \cdot \sqrt{H_c/H}, \tag{1}$$

where $\lambda_e = \hbar/mc \simeq 3.86\cdot 10^{-11}$ cm is electron Compton wavelength. It is thus seen, that at $H \sim 5\cdot 10^{18}$ Oe (which corresponds to $H/H_c \sim 10^5$) $r \sim 0.8$ Fm, i.e. r decreases to hadron sizes.

An electron moving with velocity v round a circle of radius r forms, in its turn, a current coil, which generates around itself a dipole type magnetic field. The magnitude of magnetic field in the center of rotation circle is

$$H = (v/c)\cdot(e/R^2) = \alpha\cdot(v/c)\cdot(\lambda_e/r)^2\cdot H_c\ , \tag{2}$$

where $\alpha = e^2/\hbar c \simeq 1/137$.

Note for the further references, that magnetic moment of a current coil with radius r, formed by a charged particle with mass M which moves with velocity v is equal to

$$\mu = (v/c)\cdot(r/\lambda_M)\cdot(e\hbar/Mc), \tag{3}$$

where $\lambda_M = \hbar/Mc$ is the Compton wavelength of considered particle.

Electron movement is representable in strong magnetic field as fast rotation round a cyclotron circle with radius r (see formula (1)), which leading center has a rather slow drift along a magnetic force line due to magnetic field heterogeneity. The drift effect exists for both relativistic and nonrelativistic particles. We did not find in the literature the analytical answer for the relativistic case, in the nonrelativistic approximation the drift velocity is determined by the expression (H.Alfve's problem, its solution see, for example, in [9]):

$$\overline{v}_d = (1/\Omega R)\cdot(v_L^2 + v_T^2/2)\cdot[\overline{\nu}\ \overline{n}], \tag{4}$$

where Ω is cyclotron frequency, R is radius of magnetic force line curvature, v_L and v_T are accordingly parallel and transversal components of velocity respect to magnetic field vector $\overline{H}$, $\overline{\nu} = \overline{H}/|\bar{H}|$ and $\overline{n}$ is the unit vector looking at the particle from the center of force line curvature.

It is very important for the understanding of the confinement problem, that a charged particle, moving in inhomogeneous magnetic field, can be locked. It is based on the conservation of so-called adiabatic invariants [9], which are circulations of generalized momentum $\overline{P_T} = \overline{p_T} + (e/c)\cdot\overline{A}$ round a closed loop, obtained for a full period of motion:

$$I = (1/2\pi) \cdot \oint \overline{P}_T \cdot d\bar{l} = 3cp_T^2/(2eH), \tag{5}$$

where $\overline{p_T}$ and $\overline{A}$ are accordingly the transversal (respect to the force line) component of usual momentum and the field vector potential.

It follows from (5) , that the value of transversal momentum grows with the growth of field as $p_T \sim \sqrt{H}$, but at the same time the magnetic field is the conservative one and the energy (together with squared momentum p^2) remains constant. Herefrom it is seen, that the penetration in the region of strong enough field is forbidden, with p_T reaching the greatest possible value, the reflection from these field regions occurs, in this the drift direction of particle varies to the reverse one, but the direction of rotation around the field force line remains the same.

One can remark, that, apparently, a simple magnetic dipole (easily realizable by rotating electron or bound state monopole-antimonopole, where monopole is hypothetical magnetic charge) can act as such trap. A charged particle, if it hits the capture cone, will do fast cyclotron rotation around of a force line and slow drift oscillations between dipole poles, every time being reflected from them.

3. About the nature of hadronization mechanism

To understand the dynamics of hadronization mechanism we refer to the process of e^+e^--annihilation in hadrons at $\sqrt{s} \to \infty$. Jet structure in hadron production was observed in e^+e^--annihilation in accumulative rings SPEAR (Stanford, USA, 1975). And the start-up of e^+e^--collider LEP in CERN has enabled one to obtain multiplicity distributions for charged hadrons in e^+e^--annihilation in the Z^0-boson region at $\sqrt{s} \sim 91$ GeV. The average value of this multiplicity was $n^{ch} = 20.9 \pm 0.2$ (for more details about multiplicity distributions see review [24]). The obtained value n^{ch} is surprisingly small when comparing it with the greatest possible value, the so-called asymptotic multiplicity allowed by the energy conservation law, which with such $\sqrt{s}$ is $n_{ch}^{as} = \sqrt{s}/m_\pi \sim 600$.

Let's denote by m and e accordingly mass and charge of an electron. If one compares in e^+e^--annihilation the initial state (electron and positron with total mass $2m$ and sum of absolute values of charges $2|e|$) and the final one (after all decays: electrons, positrons, γ-quanta and neutrinos), then the impressive effect is the large increase of *electrical charge* (modulo), *magnetic moment*, *mass* and the number of *neutrinos*.

But the most remarkable effect is the detection of basic properties similarity in the development and then hadronization of quark-parton showers during hadron formation in $e^+e^- \to h \ldots h$ and in hadron reactions, i.e. the mechanism of hadronization has the uniform nature.

As is known, in the quark-parton model hadrons are generated in e^+e^--annihilation by sequential transformation of e^+e^--pair into virtual photon, then transformation of this photon into quark-antiquark pair with subsequent fragmentation of each quark in separate hadron jets (see fig.2a). In review [27] devoted to the study of thermodynamic properties of nuclear substance in the region of first-order phase transition of quark-gluon plasma, the importance of involving, alongside with the QCD methods, alternative representations complementing each other, is also marked.

Primarily in the process of e^+e^--annihilation we have the acceleration of e^+ and e^- (which are the same fundamental objects as quarks, photon ...) through an absorption of electromagnetic energy in HF-resonators of e^+e^--collider without any colour interactions (see fig.2b). There are no principal prohibitions for considering a possibility of existence of a new virtual neutral state instead of presently conventional virtual γ^*-quantum or Z^0-boson.

The new natural virtual neutral state, offered instead of γ^* and Z^0, proceeding from a similarity of quark and gluon jets, must possess a superforce equivalent to the force of colour interaction in the modern QCD and contain electromagnetic part (charges, magnetic moments, etc.). Only really existing in nature relativistic collapsing pinch system of charge-magnet-photon electroneutral plasma ($\delta Q = 0$) has such parameters, i.e. instead of virtual γ^*-quantum, the collapsing pinch system (fig.2b) can be considered in the e^+e^--annihilation process.

On the other hand, the electrical charge unit is the universal constant. Electrical charges of all charged particles appear multiple to each other with a fantastic accuracy, whichever characteristics they had. What unknown general principle does work here? It is also necessary to note, that in the QED there is the method of equivalent photons (MEP) [28], according to which the state of virtual γ^*-quantum in the process of $e^+e^- \to h \dots h$ is equivalent to the state from an energy allowed sum of real γ-quanta. This analogy is not an accident, and it displays a deep relation between processes with participation of virtual and real photons which is stipulated, in turn, by the fact that the electromagnetic field of a fast charged particle is very close in its properties to the field of a light wave. It is possible to understand this general principle today, if we take into account that around a moving ultrarelativistic charged particle (electron and positron) the extremely strong magnetic field $\geq 10^{20}$ Oe is formed. And then in process $e^+e^- \to h \dots h$ the electron, hitting extremely strong magnetic field of the positron, begins emitting high energy γ-quanta, which are converted in the same magnetic field into e^+e^--pairs, i.e. the action of the ultrarelativistic electron is equivalent to that of the real photons. Then e^+e^-- pairs can be transformed in such field in γ-quanta (see details in [5]).

The similar process accompanies the ultrarelativistic positron, but already in the extremely strong magnetic field of electron. Thus, the cascade process with the formation of $(e^+e^-\gamma)$-plasma, being alternative to quark-gluon plasma, can be initiated, which then is transformed in the process of e^+e^--annihilation in hadrons into electromagnetic collapsing pinch system with the extremely strong quantizing magnetic field. The nature of general principle is, that in the collapsing pinch system the magnetic field "is frozen" into charge liquid or the charge has a strong superlocalization. In such electromagnetic approach the confinement problem is being resolved as well as problems of the arising of electrical charges, spins, magnetic moments and masses of particles.

So, if we take into account quark confinement phenomenon, transmutation of elementary particles, simultaneity of particles production ($\sim 10^{-24}$ s), nonobservation of indications on quark-gluon plasma in experiments with energy up to 200 GeV/nucleon [2]; nonconfirmation as yet of the Higgs mechanism of mass origin, multiplicity of electrical charge of elementary particles to the electron charge, multiplicity of their spin to the magnitude 1/2 (spin of electron), increase of *electrical charge* (modulo), *magnetic moment*, *mass* and *amount of neutrinos* in events of e^+e^--annihilation in hadrons, possibility of formation of $(e^+e^-\gamma)$-plasma in the regime of collapsing pinch system instead of quark-gluon plasma and an infinite value of electromagnetic energy of the physical vacuum, then it is naturally to assume, that instead of virtual photon γ^* or Z^0-boson (at $\sqrt{s} = 90$ GeV) in e^+e^--annihilation in hadrons we deal with a collective relativistic electromagnetic collapsing pinch system from electroneutral ($\delta Q = 0$) charge-magnet-photon plasma, in which the phase hadron transition in extremely strong magnetic field $H > 10^{20}$ Oe with force "freezing" is possible.

Thus, two probable mechanisms of hadronization can be seen: with the first of them [4] the formation of hadron micropinches with redrawings and then their flight out occurs, in the second script (which seems to us more preferable) electron and positron superlocalized current loops are generated on collapsed pinch wall in an extremely strong magnetic field, which can form multielectron hadron complexes with their force center. Other scripts, especially with the growth of energy, are not also excluded.

The electromagnetic collapsing pinch system includes most effectively thermodynamics, hydrodynamics and electrodynamics in the e^+e^--annihilation process in hadrons and corresponds to the models of Landau-Pomeranchuk-Fermi-Heisenberg hydrodynamic theory of multiple processes. It is the "microhot Universe" in the laboratory conditions provided that the pinch is ~ 1 Fm long with diameter $\sim 10^{-18}$ cm.

Presently the mechanisms of hadronization and confinement are unknown, being the subject of analysis in various theoretical models. It is the principal reason of indeterminacies connected with the explanation of hadron interactions. Thus, the known models of the confinement are usually reduced to the formation of a colour string with circular current of monopoles (see fig.2 a-b) [20]. In our judgement, all of them can be presented as one generalized mechanism basing on the existence of coherent areas of fields distributions with size T_g (about string diameter), outside which fields are already independent and stochastic. Apparently, the electromagnetic collapsing pinch-mechanism corresponds most fully to this physical conception at $r \to 0$ (r is pinch radius in the direction perpendicular to the magnetic field vector) and does not appeal to the objects like monopole (dyon).

Underline that hadronization develops in such a way that the transition of superexcited matter in hadrons forms in them a spin structure and dynamics of the weak decay mechanism (for pions, kaons, etc.), which ensures quantization of the smallest mass for neutrino ($m_{\nu_e} < 4.35\ eV/c^2$).

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[2] Nowadays theorists frequently prefer the model of independent collisions of nucleons in AA-interactions with formation of phase "hadron gas", to the phase of quark-gluon plasma.

4. On full absolute electrical proton charge through Pauli electroneutral neutrino

The electrical charge unit is the universal constant. The charges of all particles (whichever properties they had) with a fantastic accuracy are multiple to the electron charge e. Equality of lepton and hadron absolute values of charges has been reliably established experimentally $|Q_{\mu^\pm}| = |Q_{p^\pm}| = |Q_{\pi^\pm}| = |Q_{K^\pm}| = |e|$ with a relative precision better than 10^{-17}. In this, spins of all particles are also multiple to 1/2 without a dependence on their properties and any other characteristics (mass, charge, etc.). At the same time mass and magnetic moments (see Table 2) have no indications (even strong broken) of multiplicity, i.e. their appropriate quanta are absent. What does unknown principle does work here?

Table 2.

Particle	Magnet moment (quark model)	Calculated value , μ_N	Experiment, μ_N
p	$(4/3)\mu_u - \mu_d$	2.79	2.793
n	$(4/3)\mu_d - \mu_u$	-1.86	-1.913
Λ	μ_s	-0.58	-0.6 ± 0.01
Σ^+	$(4/3)\mu_u - (1/3)\mu_s$	1.86	-1.913
Σ^0	$(2/3)(\mu_u + \mu_d) - (1/3)\mu_s$	0.82	–
Σ^-	$(4/3)(\mu_d - (1/3)\mu_s$	-1.05	-1.41 ± 0.25
Ξ^0	$(4/3)\mu_s - (1/3)\mu_u$	-1.40	-1.20 ± 0.06
Ξ^-	$(4/3)\mu_s - (1/3)\mu_d$	-0.47	-1.85 ± 0.75

Let's consider, at first, the current situation with the charge of neutrino, a particle which exhibits itself only in the weak interactions. L.B.Okun writes in his book " Leptons and quarks" [10] that interest to the weak interactions is mainly explained by the fact that these researches open the way to the construction of the unified theory of elementary particles. It seems natural, that neutrinos have not electrical charge inside itself, because they pass through, without interaction, extremely huge strata of substance ($L \sim Mparsec$) and thus, they do not endure anyhow small ionization looses of energy, initiate neither electromagnetic shower nor hadron cascade (with vanishing negligible values of mass and magnetic moment $\mu_\nu << 10^{-9}\ \mu_B$, where μ_B is the Bohr magneton). Astrophysical data, based on the analysis of energy losses in central regions of such stars as our Sun, due to neutrino emission during thermonuclear cycle, give the following restriction on the neutrino charge: $Q(\nu_e) < 10^{-13}\ e$ [13]. From the available nowadays data for the upper bound of elastic interaction cross-section of reactor neutrino with electrons, one can obtain taking into account the charge conservation law: $Q(\nu_e) < 3 \cdot 10^{-10} e$ [14]. And, at last, the best estimation $Q(\nu_e)$ can be obtained from the analysis of results of the experiments on neutron β-decay also with taking into account the charge conservation law: $Q(\nu_e) < 3 \cdot 10^{-19}\ e$ [15].

It is well known that the full electrical charge of hydrogen atom is $Q_H = 0$. But today we know beyond doubt, that the considered atom contains one electron and one proton, i.e. the sum of absolute values of electrical charges is $Q_H^{abs} = 2|e|$. It is reliably established today that proton consists of partons (quarks) with its charge $Q_p = |e|$. But then naturally the analogous problem arises: how many in absolute values of electrical charges can be in proton similarly to hydrogen atom, $Q_p^{abs} =?$

For the further clarifying of the problem of full absolute electrical proton charge we consider the process of $p\bar{p}$-annihilation. From the viewpoint of thermodynamic models the energy dissipation happens in nuclear annihilation with equal probability distributed over all secondary particles, i.e. we have statistical production. And really, it has proved, that the energy distribution of secondary particles and the multiplicity distributions do not contradict this model ($n^{\pm} \sim s^{1/4}$ [16]).

For our purposes it is important to analyze the nuclear annihilation at rest (which is a more difficult problem in the QCD framework), where at $\sqrt{s} \simeq 1.88$ the baryon number erasure and the formation of pion product occurs at maximum of parton-parton interactions. The large statistics has been obtained in two basic experiments with the CERN and FNAL 80-cm bubble chambers, which involves of $1.6 \cdot 10^6$ events for the former and $7.5 \cdot 10^5$ events for the latter, respectively [16]. For the average value of generated in annihilation pions and the appropriate dispersions the following experimental results are available: $< n_\pi >= 5.01$; $D_\pi^2 =< n_\pi^2 > - < n_\pi >^2 = 1.04$ with some redundance of π^0-mesons above $\pi^{\pm}$-mesons $< n_{\pi^{\pm}} > - < n_{\pi^0} >= 0.44 \pm 0.23$.

The analysis of multiplicity distribution of the secondary pions [17] has shown, that it is well fitted by Gaussian with the average value $< n_\pi >= 5$ and dispersion $D_\pi^2 = 0.9^2$. It is interesting, that this distribution practically vanishes at multiplicities exceeding the limit value $n^{max} = 9$, though the final states with the number of pions up to $2m_p/m_\pi \sim 13$ are yet allowed in accordance with the energy conservation law.

When defining the absolute electrical proton charge the question about the electrical neutrino charge arises very acutely, which we take to be equal to zero in accordance with the stated above. Now we take as a postulate the statement, that the absolute electrical charge of proton must be defined by maximum absolute charge of the final product from weak decays of mesons formed in $\bar{p}p$-annihilation at rest, then we obtain $Q_p^{abs} = n^{max} \cdot |e| = 9|e|$.

5. About a force knot of nucleons

The role of a force knot in physics, in particular, in physics of high energies, is detailed in review [20] on a large experimental and theoretical material, where it is shown, that the rotary motion and force knot are indivisible parameters of quantum objects. Therefore, the determination of the force knot nature is generally the main point in our approach to the nucleon and hadron structure with sizes of their constituents-partons $< 10^{-16}$ cm, which is less than one thousandth part of the proton size.

Since the neutrino electrical charge may be taken equal to zero with its negligible mass $m_{\nu_e} << 4$ eV/c^2, apparently, neutrinos will not enter the nucleon force knot, that can be constructed only from the extremely strong magnetic field. In principle, if the mechanism of hadronization has the electromagnetic collapsing pinch-origin [4], two versions are possible:

- 1) the former is, that the proton is still considered as in the additive quark model consisting of three valent quarks, two of which are constructed from the "darmstadt" multielectron compact complexes $2e^+e^-$, and one is constructed from the similar complex $2e^-e^+$;
- 2) the latter is reduced to the alternative concept, when proton electrical charge, equal to unit, is formed with the help of five positrons and four electrons being in the field of proton force knot. Let's mark, that the total amount of necessary electrons and positrons in both versions is the same and equal to nine, and electrons and positrons are identified with partons.

It is supposed [16], that between nucleons and mesons a deeper distinction exists, than the difference in the number of quarks, namely, there is the string knot (or "*string junction*") in baryon, where three colour strings outgoing from each quark merge. According to [20] the formation of a string between colour charges requires circular current of monopoles or dyons (see fig.2), however, today they are not found in either of numerous experiments that have been carried out in their search back to the Heaviside time. The destruction of baryon means vanishing of "string junction" or baryon charge, as, for example, in the reaction of baryon annihilation $B + \bar{B} \to mesons$. As the carrier of baryon charge is "string junction", the annihilation is reduced to mutual erasure of "junction" and "antijunction". A detailed study of annihilation and events with large asymptotic multiplicity at nonelasticity $K \to 1$ and $\Delta Q >> 1$, allows one to deeply understand the distinction between mesons and nucleons, structure of the force knot, and also to improve the understanding of the hadronization mechanism. The existing experimental data do not contradict the hypothesis of vanishing in the annihilation just of the string knot. So, for example, the average value of charge emitted in forward hemisphere of secondary mesons, is essentially different from zero [21], which testifies to the conservation of quarks (at least partial) in annihilation.

6. What do quarks consist of?

What is there behind a large number of quarks, leptons and other particles ? Are they really elementary ones, representing various components of one superparticle or similarly to the previous structures (such as molecules, atoms, hadrons) are constructed from any more elementary objects ? This problem was already posed long ago (see, for example, the book by L.B.Okun [10]), and the advocates of a picture of substance structure as the Russian matreshkas, have already prepared the names for such hypothetical objects: preons, subquarks, protoquarks, etc. However, this branch leads to the mass of such exotic object being equal in the nth generation to the mass of substance in the whole Universe ($\sim 10^{50}$ of tons [32]) with its radius $<< 10^{-20}$ cm. Such way seems unpromising in the energy aspect. Today, when the idea of quark confinement is so popular, it is quite possible to think about subquarks as easy and even massless particles, locked at small distances in the force knot of particle, which corresponds to our idea of uniform electromagnetic composition of muons and nucleons.

Certainly, the answer on the posed question is largely open nowadays both from theoretical and experimental points of view. Apparently, the problem will be solved when studying the collisions at superhigh energies, similar to that as in the beginning of this century Rutherford's experiments on the scattering of α-particles with nuclei proved the presence in atom of a rigid kernel, as quite recent experimental data on deep inelastic processes revealed the existence of quarks-partons.

Now available some experimental data can be interpreted as the evidence on the composite picture of quark structure. In FNAL it was found at proton-antiproton collisions, that if the transversal energy was great enough $E_T > 200$ GeV, the amount of registered jets considerably exceeds the value expected from the QCD [23]. The similar phenomena were found at LEP as well [24]. A possible explanation of the observed excess is that the scattering happens at some elementary and more compact (with radius $r << 10^{-17}$ cm) than quark objects – subquarks. Nevertheless, it is necessary to note, that nowadays more correct data reprocessing in FNAL probably does not confirm an earlier declared excess. Recently the information became available [25],[26] on the observation of similar effects in experiments at the accelerator HERA (Hamburg, Germany) in deeply inelastic collisions of positrons and protons with energies 820 and 27.5 GeV respectively. According to the data from two independent detectors ZEUS and H1, the number of the registered events exceeds by several times that predicted by the Standard Model, which can testify to the presence of new interactions between quarks and leptons or to the existence of a new elementary particle-leptoquark with mass 200 GeV.

The authors of the given paper pioneered the supposition that the role of subquarks can play electrons and positrons within the framework of ultraquantum electromagnetism (for details see Table 1), forming complexes ne^+me^- (n and m are integers), which are analogs of quarks in the modern QCD. Thus, the concept of "colour" is reduced to the hypothesis expressed long ago by A.A.Tiapkin [22], where this quantum number is interpreted from a viewpoint of occurrence of electronic complexes in three various eigen charge states, each is characterized by quite definite and, besides this, integer value of electrical charge. The fractional electrical charge of quark arises as effective magnitude at the expense of averaging through superposition of the colour states. In our model the extremely strong magnetic field from current coil of gyrating electron (positron) acts as gluon, which forms magnetic dipoles with two poles — Northern and Southern ones. An essential difference of our hypothesis from that of J.Schwinger [6] is, that he postulates additionally the existence of magnetic charges (Schwinger dyons). Note, that the experiment does not confirm the existence of such magnetic dyons.

7. Muon as cyclotron electron

The comparison of all electron and muon properties shows their full identity with the exception of only one characteristic, that is mass. Muon has mass $m_\mu \simeq 105.6$ MeV, that approximately by 207 times larger, than electron mass. It justifies wide spread statement, that muon is heavy electron. Really, muons and electrons have identical electrical charges and spins equal to ± 1 and $1/2$, respectively, and also they have zero baryon numbers. Both participate in a similar way in weak interactions with all their peculiarities (small cross-section, spatial parity violation, etc.). They do not participate in strong interactions and have identical electromagnetic interactions. For example, negative muons, similarly to electrons, can come into the so-called μ-atom, in which energy transitions of muon are also accompanied by emission of electromagnetic radiation.

It is possible, that a solution of the lepton mass problem will be obtained in the now developing unified theories of weak and electromagnetic forces, where the existence of "massmaking" Higgs bosons is postulated with the estimated mass ~ 1 TeV, which are expecting their discovery in future.

In [4] the authors consider the nature of hadronization within the framework of annihilation process of $e^+e^- \rightarrow$ *hadrons* with $\sqrt{s} \rightarrow \infty$, ensuring superlocalization of charge, and propose to consider muon as electron, "gyrating" in extremely strong magnetic field. The radius of localization r_μ is defined by formula (1). If we take into account that muon is pointlike particle and accept its radius as $r_\mu = 10^{-16}$ cm, then according to formula (2) with $v = c$ (motion is ultrarelativistic one in extremely strong magnetic field) we obtain $H \simeq 0,3 \cdot 10^{23}$ Oe, and then we have for accumulated in muon volume the magnetic energy

$$M_0 = (H^2/8\pi) \cdot (4/3)\pi r_\mu^3 \simeq 105\ MeV, \tag{6}$$

which coincides with the muon mass value. So, apparently, muon represents cyclotron particle, i.e. electron gyrating practically with light velocity in the extremely strong magnetic field, that gives the basic contribution to mass, and the summarized contribution from its kinetic and potential energy in the field is rather insignificant.

Taking into account, that muon is the simplest elementary one-electron complex e^-, bound in the strong magnetic field, it is possible to write down for muon mass the empirical formula (which usefulness will become clear further)

$$M_\mu = n \cdot m_0, \tag{7}$$

where $n = 1$ is the number of electrons in this complex.

Since according to formula (3) magnetic moment from a current coil of relativistic electron is extremely small and equal to $\sim 2.5 \cdot 10^{-6}\mu_B$, the muon magnetic moment is defined almost completely by the electron magnetic moment μ_e. But the electron itself is in the superstrong interior magnetic field, which results in the sharp diminution of the exterior field action. Therefore, for the exterior field the observed effective electron magnetic moment is considerably suppressed. We accept for estimations, the suppression factor to be equal to ratio of masses $k = m/m_\mu$. As a result for muon magnetic moment we have $\mu_\mu = k \cdot \mu_e = (m/m_{\mu)}\mu_B$.

Let's remark, that from the Dirac equation when regarding muon as an unstructured pointlike particle, it follows that $\mu_\mu = e\hbar/(2m_\mu c) = (m/m_\mu)\cdot e\hbar/(2mc) = (m/m_\mu)\ \mu_B \simeq 5\cdot 10^{-3}\mu_B$.

The lack of neutral forms of both electron and muon and the existence only of charged forms is a strong argument to benefit our concept, that the muon is the cyclotron electron with mass $\sim$ 207 m as accumulated magnetic field energy of current coil.

8. Attempt to construct completely electromagnetic proton and neutron model

In 1920 Rutherford offered the supposition, that, alongside with proton, the simplest neutral nucleon (neutron) must exist in the form of bound proton-electron state and also he predicted its basic properties: zero electrical charge, high penetrating ability and strong interactions with nuclei (see, for example, [18]).

In the modern representations neutron consists of one u – and two d-quarks. We offer the model for analysis of more fundamental structure level of substance, where electrons and positrons are considered as subquarks, i.e. search for more elementary than quark, objects. As it has been already specified above, two versions of hadron structure are analyzed. In the first one the hadron consists of composite quarks, which are constructed, in turn, from "darmstadt" multielectron complexes $2e^+e^-$ and $2e^-e^+$. Quarks (we imply here quarks, dressed in the fur coat of virtual QCD interactions) have significant mass $\sim$ 300 MeV/c^2, much exceeding $e^\pm$-masses. This implies, that the electrons and positrons are locked by the extremely strong magnetic field and the mass of quark is explained not by static summing of masses of particles (electrons and positrons) forming quark, but it has the dynamic origin as their full energy (sum of kinetic and potential energy) plus the energy of field obtained by integration of magnetic energy density $|H|^2/8\pi$ through the whole quark volume.

It is interesting, that we have the following empirical relation for quark mass m_q (by analogy with the written earlier formula for muon mass)

$$m_q = n\cdot m_\mu \simeq 315\ MeV, \tag{8}$$

where m_μ is the muon mass and $n = 3$ is the total number of electrons and positrons of the complex from which the quark is built. The considering formula is in a good agreement with masses of u- and d-quark in the additive quark model (from mass- spectroscopy of baryons: $m_u = m_d = 363$ MeV; from meson spectroscopy: $m_u \simeq m_d = 308$ MeV [29]).

In the second version of our model, just as earlier partons were identified with quarks, it is suggested that electrons and positrons be identified with partons of nucleons (as it follows from Table 1, there is no essential difference between parameters u- and d-quark on the one hand and electrons and positrons on the other hand) and to construct proton from five positrons and four electrons, and neutron from five electrons and five positrons plus antineutrino. In this, electrons and positrons rotate towards each other in the extremely strong magnetic field of nucleon force knot. In this version proton charge and spin have natural explanation as charge and spin of the fifth uncompensated positron (remember J.Schwinger's note concerning a surprising equality of electrical charges of muon, proton, pions, etc.). Now it is necessary for the demonstrating of a full understanding of nucleon structure to explain the mechanism of origination of mass and magnetic moment.

Let's look at first how magnetic moments are explained within the framework of quark constituent model. The baryon magnetic moments, calculated within the framework of additive quark model, are summarized in Table 2 [29]. For example, in proton $|uud>$ two u-quarks should be in the symmetric state, d - quark in the state with z-projection of spin $S_z = +1/2$, and for full proton wave function $J = 1/2$. Therefore, using the Clebsch-Gordon coefficients, we obtain the proton magnetic moment $\mu_p = (2/3) \cdot (2\mu_u - \mu_d) + 1/3\mu_d = (4/3) \cdot \mu_u - (1/3) \cdot \mu_d$, where the Dirac magnetic moment of quark $\mu_q = e_q\hbar/2m_qc$. Then $\mu_u = (2/3) \cdot (e\hbar/2m_pc)(m_p/m_u) = (2/3) \cdot (m_p/m_u)\mu_N$ and $m_d = -(1/3) \cdot (m_p/m_d)\mu_N$ (where μ_N is nuclear magneton). For neutron, obviously, it is necessary to interchange of u- and d-quarks. If one takes $m_u = m_d$, then $\mu_p/\mu_n = 3/2$, the experiment value is $\mu_p/\mu_n \simeq 1.46$. As is marked in [29], though the findings of naive quark model in evaluations of magnetic moments are rather limited, it concedes also in the scientific significance to the modern QCD, nevertheless, its application is frequently useful and rather obvious, and, on the whole, satisfactory and sometimes very good agreement with experiment exists. For example, $SU(3)$-symmetry predicts the following relations between baryon magnetic moments: $\mu_p = \mu_{\Sigma^\pm}$; $\mu_{\Sigma^\pm} = \mu_\Xi = -(\mu_p + \mu_n)$; $\mu_n = \mu_{\Xi^0} = 2\mu_\Lambda = -2\mu_{\Sigma^0}$.

However, nowadays magnetic moments of baryons are measured and they do not often agree with these predictions. Despite some success, the naive quark model comes under a storm of criticism in many works. One manages to use it in calculations only at the phenomenological level, and the predictions have more or less qualitative character. In such a situation the authors consider, that within the framework of modern QCD the problem of evaluation of magnetic moments and spins of nucleons remains unsolved and open for further researches.

The magnetic moment can be qualitatively explained from the viewpoint of the existence of the charged meson fur coat rotating around nucleon and inducing, thus, current. The current model of magnetic moment of neutron for the first time was advanced back in 1937 by J.Schwinger [18]. The competing hypothesis was suggested by Bloch, who had introduced into the theory the pointlike magnetic dipole [18]. However, experiments on the study of magnetic scattering of neutrons have not confirmed the existence of such pointlike dipoles and are in a good agreement with J.Schwinger's current concept.

In our electromagnetic model of proton and neutron, their magnetic moments and spin structure have the natural origin. In the extremely strong magnetic field the probability of spontaneous transitions is independent of the orientation of electron (positron) spin, i.e. transitions with the change of spin orientation happens with the same probability as without spin flip:

$$W = 0,421/T_0 \cdot (E/m^2), \quad T_0 = \hbar^2/mce^2 = 1,7 \cdot 10^{-19}\ s, \tag{9}$$

where E is energy of particle. Thus, electrons and positrons align spins very fast in the field in an appropriate way and the electron-positron nucleon complex must consist of two subsystems: electrons ($\xi = -1,\ n$) and positrons ($\xi = +1,\ n$), where ξ is the sign of spin projection on the magnetic field vector and n is the main quantum number [5].

In an extremely strong magnetic field the electron and positron positron anomalous magnetic moments (AMM) brightly exhibit their dynamic nature, being nonlinear function of energy of particle and strength of magnetic field [5]. It is important for us, that its value sharply decreases with the field growth. One easily understands it with taking into account, that both real and virtual states are strongly localized in the transversal direction to the superstrong magnetic field and they are limited by the square of circle πr^2, where for r expression (1) is valid. However, the AMM is proportional to the product of virtual current by the specified square of this circle, which is, in its turn, proportional to $\sim 1/H$, i.e. the magnitude of the AMM tends to zero with the increase of the field. Therefore, in calculations the anomalous magnetic moment should appear in the form multiplied by the appropriate suppression factor.

The last mentioned rule is also true for normal (Dirac) magnetic moment, that must be taken into account with additional suppression factor as well, if electron (positron) is in the region of superstrong interior magnetic field of nucleon, which leads to the sharp diminution of the exterior field action and fall down of the effective magnetic moment value.

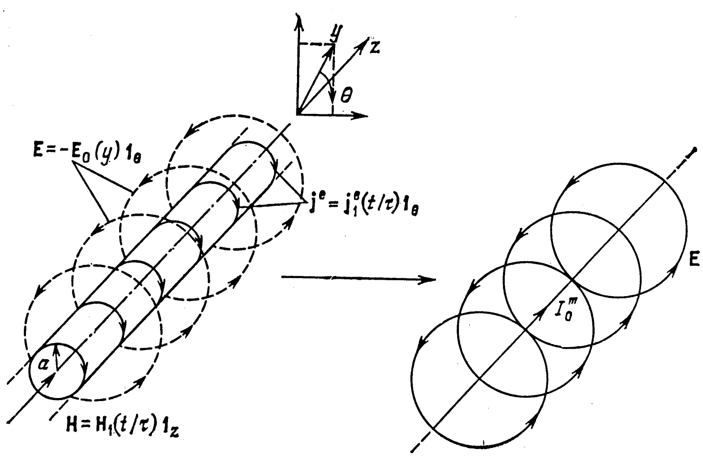

Fig. 4. Schematic representation of the idea of electromagnetic nucleon composition as ideal solenoid, on which purely transversal ring currents flow. It is the simplest example of removal of the exterior area from magnetic field $\overline{H}$, outside with $r > a$ there is only electrical field $E_\theta = -(a^2/4c\tau) \cdot H_1$ (see [33]).

By virtue of the above said, the proton magnetic moment is defined the by sum of orbital magnetic moments of electrons and positrons (see fig.4), gyratings round the circle with radius r in the force magnetic knot, and magnetic moments (Dirac and anomalous ones) of noncoupled positron:

$$\mu_p = \xi \cdot \sum_{i=1}^{N} \mu_{e^\pm}^{L_i} + k_1 \cdot \mu_{e^+} + k_2 \cdot \mu_{e^+}^{an} \ , \tag{10}$$

where $N = 9$, ξ is the sign of projection of spin of noncoupled positron on the magnetic field vector, $\mu_{e^\pm}^{L_i}$ is the orbital magnetic moment of ith electron or positron, μ_{e^+}, $\mu_{e^+}^{an}$,

k_1 and k_2 are Dirac and anomalous magnetic moments of the noncoupled positron and appropriate suppression factors, accepting very small values, due to their "freezing" into the extremely strong interior magnetic field of nucleon.

Further we shall take into account, that the anomalous magnetic moment is defined within the framework of quantum electrodynamics (J.Schwinger was the first to calculate it with the accuracy up to the terms of order α inclusively, details can be found, for example, in [37]), and it is equal in the Bohr magnetons to $\mu_{e^+}^{an} = \alpha/2\pi$. For particular estimations we accept $k_1 = m/m_p$ and $k_2 = 0.033$, where m_p is proton mass and $r = 3.8 \cdot 10^{-15}$ cm. Now, having in mind, that in the extremely strong magnetic field motion has ultrarelativistic character ($v \simeq c$), we have according to formula (3) in average for magnetic moment of one current coil $\mu \simeq 0.19\mu_N$. As a result one obtains for the proton magnetic moment $\mu_p = 0,19 \cdot 9\mu_N + k_1 \cdot \mu_{e^+} + k_2 \cdot \mu_{e^+}^{an} = 2.8\mu_N$.

The proton spin is defined only by the spin of noncoupled positron, since the contribution from the proton electromagnetic complex is equal to zero due to mutual compensation of electron and positron spins, because in the force knot they are oriented in the opposite directions. It is noteworthy, that such electromagnetic proton structure is a superstable one [3] and it, probably, ensures its life time $\tau_p > 10^{33}$ years.

So, within the framework of model of extremely strong magnetic field with electron-positron complex $5e^+4e^-$, it is possible to determine all the proton quantum numbers , namely: a) charge $+e$, b) spin 1/2, c) mass ~ 945 MeV (in the first approximation as the trebled mass of quark from (8)) and d) magnetic moment $\sim 2.8\ \mu_N$ without envolving colour forces and objects.

We regard now the construction of a model for neutron. In this connection we remember that Rutherford suggested long ago considering neutron as an electroneutral proton-electron complex pe^-. In our model it is equivalent to $5e^+5e^-$. However, such representation is not convincing, as it fails to reproduce the neutron spin (equal to 1/2), but also in this case neutron could not be formed in the period before the onset of nucleosynthesis era in the early Universe due to impossibility for electron to enter the area of extremely strong fields of the proton force knot (Bohr postulates, lepton number conservation, etc.). Therefore, the problem of neutrino origin mechanism (not in the QCD framework) is naturally arising.

In the period of the early Universe nonspin complexes, consisting of electron and antineutrino $e^-\bar{\nu}_e$ (total lepton charge and spin are zero), could arise abundantly due to big concentration of electrons and antineutrino. So, if neutrino has a small magnetic moment (which should thus be no more than $\sim 10^{-9}$ of electron magnetic moment), then at the distances between electron and neutrino $r \sim 10^{-15}$ cm, the long-range potential (the effects of long-range electromagnetic potentials for nucleosynthesis are explicitly considered in [30]) of interaction of magnetic moments proportional to $\sim r^{-3}$ will exceed the neutrino energy $E_\nu \sim 3$ MeV. At the onset of the early Universe the stable $e^-\bar{\nu}_e$-complexes might be produced with zero spin ($e^-\bar{\nu}_e$-"boiler") which carried electromagnetic interaction, because they had electrical charge and magnetic moment of electron.

[3]For example, diminution of magnetic field of the force knot generates circular rotational electrical field accelerating electrons, which, thus, increases magnetic field and restores its primary value.

Now one can see, that the neutrons as complexes $pe^-\bar{\nu}_e$ can be formed in the period of the early Universe before the era of nucleosynthesis, due to the existence of two electromagnetic long-range potentials $V^m \sim r^{-3}$ and $V^c \sim r^{-1}$, originating accordingly from the interaction of magnetic moments of proton and $e^-\bar{\nu}_e$-complex and from their Coulomb interaction. In this period of life of the Universe there were $\sim\ 10^9\ \bar{\nu}_e$ per one electron, i.e. such electromagnetic neutron composition is supplied by the presence of necessary amount of electrons and antineutrinos in the early hot Universe. Let's remark, however, that the generation mechanism of electrons and positrons, and also neutrinos and antineutrinos prior to the onset of nucleosynthesis era is still waiting for its solution [31].

So, within the framework of the model proposed, neutron is considered as electroneutral complex $5e^+5e^-\bar{\nu}_e$. Magnetic moments and spins of electrons and positrons are mutually compensated in the extremely strong magnetic field of neutron force knot, neutron magnetic moment is determined only by the sum of orbital magnetic moments in accordance with formula (10), where now $N = 10$, $\xi = -1$ is the sign of projection of $\bar{\nu}_e$-spin on magnetic field vector (for this it is enough to suppose the presence in $\bar{\nu}_e$ of very small in magnitude and negative in sign of magnetic moment), and $k_1 = k_2 = 0$, because in this case there is no noncoupled positron, and the absolute value of $\bar{\nu}_e$-magnetic moment is negligible. As a result, for neutron magnetic moment, we have $\mu_n = -1 \cdot 10 \cdot 0.19\ \mu_N = -1.9\ \mu_N$. The spin of neutron is equal to the demanded value 1/2 due to the presence of $\bar{\nu}_e$ in complex.

Neutron mass will be mainly defined by the mass of electron-positron complex $5e^+4e^-$ (i.e. proton mass) plus masses of the additional fifth electron m and antineutrino ($m_{\bar{\nu}_e} \simeq 0$) and small contribution from their stored energy.

Conclusion

In conclusion we mark, that the idea of the purely electromagnetic composition of muons and nucleons was generated by the superforce of the modern QCD [32], current electrodynamics by E.Miller [33] and the book "Electromagnetic structure of nucleons" by S.D.Drell and F.Zacharizen [34], and also by the fact of infinity of electromagnetic energy in our Universe [2]. In this work the general frameworks of direction to the uniform composition of muons and nucleons on the basis of concept of magnetic force knot with ultraquantum field and superlocalized electron-positron complex me^-ne^+ ($m,\ n$ are integers) are indicated. Within the framework of such electromagnetic picture the problem of confinement is resolved and the quantum numbers of muons and nucleons (charge, mass, spin, magnetic moment) has natural explanation without engaging colour or any other exotic forces, except the electromagnetic ones.

It seems to the authors, that the identification of electrons and positrons with preons at scale level of 10^{-20} cm is really a natural and realistic preon model of the structure of substance, about which L.B.Okun is so passionately dreaming in his widely known book "Physics of elementary particles" [35]. As to spectroscopy problems, they require separate special analysis that goes beyond the scope of the given publication, in which only the general principles of proposed model are expounded (we suppose to do this elsewhere).

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М.Ю.Боголюбский, А.П.Мещанин
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