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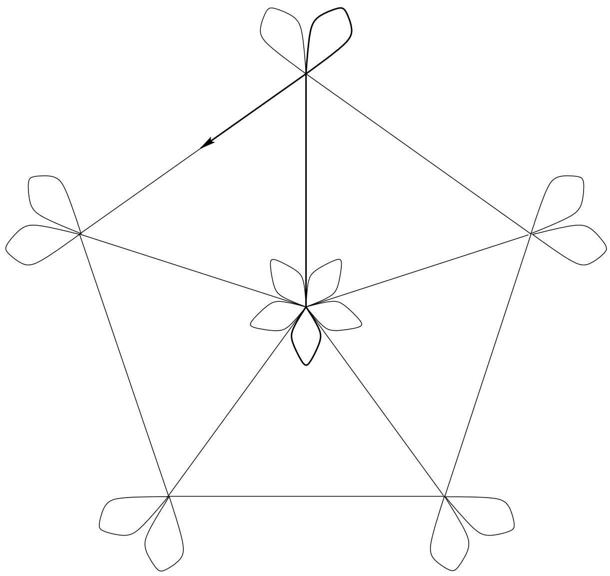

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NON–NEUMANNIAN REPRESENTATIONS OF ROTATION GROUP (TO THE ETHER THEORY). 1

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Here infinite dimensional non-self-adjoint irreducible representations of the Lie algebra $so(3)$ corresponding to the arbitrary complex spin are studied. These representations generate a new class of representations of the rotation group $SO(3)$ in whole (more exactly of a new Lie group connected with 1-chain fibration of the latter) non-unitary multivalued not subjected to the well known von Neumann axiom. A new physical reality stands behind the infinite complete set of such representationts called ether. In this Part general definition of 1-chain group and non-Neumannian group of linear operators acting in its carrier space (generalized functions of exponential type) are given. It might be called the main elements of semispinor analysis.

Jesus saith unto them, did ye never read in the scriptures, The stone which the builders rejected, the same is become the head of the corner: this is the Lord's doing, and it is marvellous in our eyes?
Matthew (21:42)

1. Introduction

For some reason or other mankind pays attention to the ideas that were materialized in the exact meaning of this word. Ancient thinkers remembered mankind three greatest *a priori* ideas about real: these are (in order of their generality) 1) hypothesis about existence of Creator of our Universe called God as an embrio of all being, 2) hypothesis of the ether as a God's emanation and the nearest reason of appearance of observed matter, and at last, 3) atomic (quantum) hypothesis of the matter building. To the present time only the latter was alaborated. Nowadays the time comes for the second one.[1]

Interesting sagacity of philosophers has been the thought that the ether is a binding link between the space and matter and the reason of both. However if the studying space-time (mathematics) and matter (physics) is highly successful and rather deep then ether has meanwhile slipped away from concrete description and became once even incongruous. The point is that every time it may be swooped for a pure *mathematical (namely geometrical) substance*. The well known substance in question is at present the Poincare-Minkovski 4-dimensional space-time continuum (pseudoeuclidean space). So till now one considered that ether=space-time (or metric; Poincare). It is, from a certain point of view, a non-proper phenomenological description of the ether.[2]

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[1]Concerning the first hypothesis see Plato's "Timaeus" and [1].

[2]However in quantized field theory necessity in a special physical substance regularizing the ultraviolet divergences is feeling long ago (for example, at the Pauli-Willars regularization procedure it was appeared as the fictive fields with indefinite metric and extreme large masses; not to mix of course it with physical vacuum as the zero vibrations of the real fields!).

Already in that time a question about extension of the Heisenberg-Schroedinger quantum theory in the region of very small distances was arisen (one considered that the theory to be a theory of moderate energies is insufficient for description of particle interactions in high energy region). Its direct generalization (extension of application region) - relativistic quantum field theory - it seemd must allow to penetrate in this region. However this extension, strictly speaking, is as a matter of fact illegal transfer of mathematical apparatus of quantum mechanics (finite number of degrees of freedom) to the dynamical systems with infinite uncountable number of freedom degrees (fields) and troubles with ultraviolet divergences testify this. It turns out the usual quantum mechanics is not complate in principle and may be complated. We think that the suggested in [2] new extended

Of course, from pure physical point of view ether is first of all *a material (dynamical) substance.* Physical theory of ether itself demands for its description the usage of proper, adequate mathematics (it is algebra as the most irreproachable part of mathematics). Therefore first of all we have to look for in mathematics of the past the fit tools for description of such a physical reality as ether. It turns out that the algebra in 19-th century elaborated such a tool: it is the Kummer's theory of ideal numbers. In [1] this idea is fitted to the fundamental particles situation.

In a certain sense elementary particles are the numbers: their spin properties are described by finite dimensional unitary representations of the rotation group $SO(3)$ and its covering $SU(2)$ (we call it further the spin group) the set of which forms a ring like usual numbers. This ring it turns out is algebraically nonclosed [1] and permits unique extension to the more fundamental (prime, ideal) non-unitary representations of spin group which are studied here and from which finite dimensional ones are built like usual numbers may be built from Kummer's ideal ones.

Elementary particles to be observed (measurable) form of matter exist in space-time continuum $A_{3;1}$ endowed by *differential structure and measure.* The symmetry group of this space is the Poincare group P . Due to such a structure, space H of sections $\psi(X)$ of vector fibration $E=(A_{3,1},S)$ used in particle theory (here $S=\Sigma_\Sigma S^\Sigma$ is the Whitney sum for the group $SO(3)$; among the S^Σ there is a spinor fibre with symmetry group $SU(2)$) is endowed by the Hermitian scalar product $(\psi,\psi^{'})=\int\overline{\psi}(\vec{X},t)\psi'(\vec{X},t)d^3X$. Due to this, representations of the Poincare group P and its subgroup $SO(3)$ in H are unitary. We see unitary axiom in quantum theory is conditioned ultimately by the measurablement property of space-time continuum.[3]

quantum theory based on the ether dynamics is well adopted to the description of the very high energy situation. Moreover we can say now that ether theory is the ground of particle theory and cosmology.

It is interesting to pay attention to the following remark. In empty space M with measure μ completedness condition of any system of local functions $\{\psi_n(X)\}$, $X\subset M$ on this space written as $\Sigma_n\psi_n(X)\psi_n(X^{'})=\delta_\mu(X-X^{'})$ contains the Dirac delta-function respectivelly the measure μ. Due to the δ_μ-function ultraviolet divergences in quantized field theory considered in such a space arise. But in the space M filled by ether (in which any function is a bilical one $\psi(X,Y)$, see [3]) smearing $\delta_\mu(X-X^{'};Y,Y^{'})$-function appears due to which ultraviolet divergences are absent.

[3] So space $A_{3;1}$ is considered to be a measurable (in Lebesgue sense) set of points. This circumstance has a pure physical reason: from elementary particles existing in this space macro objects in particular measuring equipment may be constructed by means of which physical measurements may be made. Hence the measurablement property of space-time is connected only with so called immediately observed forms of matter. Not any set of points is measurable. For example differentials dX as an uncountable quantity of points are not measurable sets, see [2]. Therefore the space and the forms of matter which might exist inside the differentials are not measurable. For description of such a matter form unusual non-measurable numbers are needed of course. These numbers come to life (are displayed) if our space becomes discontinuum (see further). It is very important remark for further consideration.

Symmetry group of the latter ($SO(3)$ and its complex extension $SO(3,1)$ - the special Lorentz group) is enlarged in the framework of material fibration E to the spin group ($SU(2)$ and its complex extension $SL(2,C)$). More over inside the spinor fiber the latter may be enlarged to the general linear group $GL(2,C)=SL(2,C)\otimes U(1)\otimes H(1)$ where $U(1)$ and $H(1)$ are elliptic and hyperbolic phase transformations with which so called fermionic charge F and dilatation D of fermions are connected correspondingly.

Further, we have to consider that at very small distances (inside the particle) physical space-time is splitting into its isolated points [2], i.e. becomes a discontinuum.[4] Such a space loses differential structure and measure. Hereby the space which stays inside the isolated point (inside the fiber or differential d^3X) has no Lebesgue measure, i.e. is a non-measurable, see [2]. At such a condition the unitary axiom is invalid and non-unitary representations of physical groups $SU(2)$, $SL(2,C)$, $GL(2,C)$ corresponding to the arbitrary spin (a sea of complex spin) are used thereat. A sapid elegant mathematics is connected with arbitrary spin. It is the theory of non-Neumannian representations of classical Lie groups, monoids and connected with them 1-chain fibrations (bundles).

Strictly speaking all these (multivalued indeed) representations corresponding to arbitrary spins are exact ones of a new group $\tilde{GL}(2,C)$ (and others) - Lie group of one dimensional chains on $GL(2,C)$ (briefly called 1-chain group), built over $GL(2,C)$ and locally isomorphic to the latter. They play the role of mentioned above Kummer's ideal numbers in usual representation theory and particle physics.

A new physical reality stands behind the 1-chain groups and their representations. Obviously it exists inside the isolated point of discontinuum and therefore is immediately non-observable. We call it bi-Hamiltonian form of matter, pre-matter (or ether).

Bi-Hamiltonian dynamical system (see [3]) is con-

[4] Particle constituents are connected with the discontinuum [2]. In its own (discrete) topology discontinuum is an uncountable set of isolated points. Due to the theorem about homeomorphism between any discontinuum (for example, "dispersed" or "pulverized" interval $[0,1]'$) and the Cantor's perfect set Π we can consider our discontinuum inside the particle to be set Π. So nothing losing in generality and proceeding from the fact that our discontinuum is a continuation (into fundamental particle) of usual (external) space endowed by usual topology and measure in which our discontinuum is the set of zero measure and dimension we will consider it to be set each point of which is (from the point of view of external usual topology) the point of *condensation.* This circumstance intentifies the confinement property of particle constituents. So, inside the particle there is "crumpted" (homeomorphic to) Cantor's perfect set and nothing more. However this set (Cantor's "spiral") has complicated dynamical structure, see [2].

nected with the Heisenberg algebra $h_8^{(*)}$ and its automorphism group $Sp^{(*)}(4,C)$ (dynamical group of the system). It is a kind of two level systems described by the non-Lagrangian fields $f(x)$ (upper level) and $\dot{f}(\dot{x})$ (lower level) correspondingly. In the beginning of our Universe there were only fields $f(x)$. Above mentioned non-unitary representations of the $GL(2,C)$ are realized in the space of these fields.

Bi-Hamiltonian (ether) dynamics includes the irreversible quantum transition (jump) $f \to \dot{f}$ described by matrix element $\langle \dot{f}(\dot{x}), f(x) \rangle$ (in the framework of quantum theory 2), where the state $\dot{f}$ enters with complex conjugation, see [3]. Fundamental particles arise in this process. This part of the theory is connected with a dual pair of spaces $(\dot{F}, F)$ where $f \in F$, $\dot{f} \in \dot{F}$. With it the Gaussian decomposition N_+HN_- of $GL(2,C)$ (and dynamical group too) is associated. (Such a decomposition is appeared when the so called singular elements Δ' of the group are pricked out, see Fig. 1 in Part 2).

Indeed, the jump $f \to \dot{f}$ is prepared by real turning f into $\dot{f}$ which is connected with topological closedness of the group $GL(2,C)$ to the monoid $M(2,C) = GL(2,C) \cup J(2,C)$ where $J(2,C) = \{g \in M | detg = 0\}$. Since $MJ = JM \subset J$ so we call the set J to be *absorbed* one. Due to this citcumstance any vector f is transferred into one and the same vector $\dot{f}$ under the action of J.

Turning f into $\dot{f}$ (in the framework of quantum theory 1) is connected with the sucking of field $f(x)$ into the point of discontinuum (picturally speaking like Jinn into the bottle) to which a quantum $\dot{f}$ is fastened. The latter process goes only in ensemble of the systems (we call it as a gas of quanta f or ether in whole). This dynamical system, leaved itself, begins gradually to collapse, i.e. to contract (like shagreen skin). Only after all these processes quantum jump is beginning (see Part 2).

We see that ether dynamics is quite complicated thing. After the quantum transition $f \to \dot{f}$ (it is necessary to emphasize that namely due to the irreversible quantum transition $f \to \dot{f}$ ground state $\dot{f}$ loses physical meaning at the next stages of Universe evolution, because $\dot{f} \sim \delta(0)$, see [3]) and arising fundamental particles and space-time continuum the subset J is pricked out and another closedness process of Gaussian decomposition goes genesis of the symmetry group $SL(2,C)$ (matter) and $SO(3,1)$ (space-time as a carrier of matter).

Here we study the infinite dimensional irreducible (non-Neumannian) representations of the spin group $GL(2,C)$ only and connected with it monoid $M(2,C)$. Although this group is any subgroup of the dynamical group of the system it contains the main information about the processes just described. Hereby our consideration is delivered in the volume and at the level of strictness that usually is accepted in physical literature.

Some words about character of the investigation. We use infinitesimal approach to the representation theory (rising to E. Cartan): in the beginning representations of the Lie algebra are built, then local group (groupuscle) and, at last, the group in whole are considered. In connection with the latter we apply to new mathematical objects: *1-chain Lie group and spaces of probe and generalized functions of exponential type* well adopted to the problem. The case of $\tilde{GL}(2,C)$ is considered in details.

We do not refer to the well known classical papers of E. Wigner and V. Bargman concerning unitary representations of the (small) Lorentz group. Reader sees a connection with those representations which is affinitally to the connection between Lobachevsky and Riemann geometries.

Mathematical part of the present paper is based on the first manuscript of series of papers [1] which has been discussed in the past with prof. S.D. Berman.

2. Basic Initial Theorem. Semispinor Representation of the Lie Algebra and Local Group

a) The way leading to a new class of $SU(2)$-representations meets the theorem concerning non-closedness of the ring of finite dimensional (unitary) representations of the $SU(2)$ group.

If to denote the latter $\overline{D}$ (it is endowed by usual addition and Kronecker multiplication laws; its subring of exact $SO(3)$-representations is denoted $D \subset \overline{D}$) so we can write $\overline{D} = D[D(1/2)]$, where $D(1/2)$ is the fundamental representation of $SU(2)$ corresponding to the spin $1/2$. Structure constants of $\overline{D}$ are the Clebsch-Gordan coefficients.

$D(1/2)$ is realized in the complex vector (spinor) space $S_2(G)$ considered over Grassmann algebra G [1] by the Pauli 2x2-matrices $\frac{1}{2}\vec{\sigma}$.

Theorem 1. Ring $\overline{D}$ is algebraically non-closed and permits the extention to the ring of infinite dimensional semispinor representations corresponding in general case to arbitrary complex spin.

Proof of the theorem see in [1]. It follows from the construction of the proof that semispinor representation $D^+(-1/4)$ with spin $-1/4$ may be considered to be a generator of a new ring $\tilde{D} = \overline{D}[D^+(-1/4)]$ (minimal semispinor ring is given rise indeed by the representation $D^+(-1/2)$). Like from spinor representations elements of D may be constructed, so from semispinor representations $D^+(-1/4)$ and $D^+(-3/4)$ elements of $\overline{D}$ may be constructed. From explicite form of Clebsch-Gordan coefficients for semispinor representations, see [1], it follows that the ring $\tilde{D}$ is algebraically closed.

b) Semispinor representation $D^+(\lambda)$ [1] exists at arbitrary complex spin $\lambda \in C$ and is setting by three operators $L_k^{(\lambda)}(k=1,2,3)$ satisfying the commutation relations $[L_k^{(\lambda)}, L_m^{(\lambda)}] = i\epsilon_{kmn}L_n^{(\lambda)}$. We formulate the main properties of such a representation:

i) it is infinite dimensional algebraically and topologically irreducible [1]; it is completely characterized by its junior Cartan vector $f_0^{(\lambda)}(L_-^{(\lambda)}f_0^{(\lambda)}=0, L_\pm^{(\lambda)} = L_1^{(\lambda)} \pm iL_2^{(\lambda)})$,

ii) it is realized in the topological vector space $F_\lambda^\tau = \overline{M}_\lambda^\tau$ where $M_\lambda = U[L_+^{(\lambda)}]f_0^{(\lambda)} = l.c.\{f_n^{(\lambda)}\}$ (τ is topology, from here the sign $+$ in D^+ , l,c means linear cover), and $f_n^{\lambda)}$ is the canonical Cartan-Weyl basis.

iii) In it operators $L_k^{\lambda)}$ are setting by the formulas:

$$L_3^{(\lambda)}f_n^{(\lambda)} = (n-\lambda)f_n^{(\lambda)},$$
$$L_+^{(\lambda)}f_n^{(\lambda)} = \alpha_{n+1}^{(\lambda)}f_{n+1}^{(\lambda)}, \tag{1}$$
$$L_-^{(\lambda)}f_n^{(\lambda)} = \alpha_n^{(\lambda)}f_{n-1}^{(\lambda)},$$

where $\alpha_n^{(\lambda)} = -i\sqrt{n(n-2\lambda-1)}$. Thus

iv) the $D^+(\lambda)$ is a representation of the type I (or ladder one) in which operators $L_3^{(\lambda)}$, $\vec{L}^{(\lambda)^2}$ are diagonalized ($\vec{L}^{(\lambda)^2}f_n^{(\lambda)} = \lambda(\lambda+1)f_n^{(\lambda)}$).

It follows from (1) that

v) spectrum of operator $L_3^{(\lambda)}$ does not possess the Weyl symmetry: at the Weyl reflection w we have $wD^+(\lambda) = D^-(\lambda)$ (such a representation we call therefore non-Weyl one: $D^+(\lambda)$ contains only half of all possible projections of spin λ; from here the name *semispinor*).

Further we use the realization in which $L_k^{(\lambda)}$ are written in the form [1]

$$L_3^{(\lambda)} = \zeta\frac{d}{d\zeta}, L_+^{(\lambda)} = \zeta, L_-^{(\lambda)} = -\zeta\frac{d^2}{d\zeta^2} + 2\lambda\frac{d}{d\zeta}. \tag{2}$$

Hereby the Cartan-Weyl basis is the set of functions

$$f_n^{(\lambda)} = i^n\frac{\zeta^n}{\sqrt{n!\Gamma(n-2\lambda)}}, n = 0,1,2,..... \tag{3}$$

(note, that in this realization there are not finite dimensional representations).

vi) $D^+(\lambda)$ is non-self-ajoint representation dual to which is the representation $D^+(\overline{\lambda})$. This pair of representations is tied for invariant sesquilinear form [1]

$$< f^{(\overline{\lambda})}, g^{(\lambda)} >_\lambda = \int \overline{f^{(\overline{\lambda})}}(\zeta)Ig^{(\lambda)}(\zeta)d\mu_\lambda(\zeta), \tag{4}$$

where measure is $d\mu_\lambda(\zeta) = \frac{i}{\pi}\frac{1}{|\zeta|^{2\lambda+1}}K_{2\lambda+1}(2|\zeta|)d\zeta \wedge d\overline{\zeta}$ (here K_n are the Mac-Donald's functions, $\wedge$ is the external multiplication, and $Ig(\zeta) = g(-\zeta)$.

vii)The carrier spaces $F_{\overline{\lambda}}^{\tau'}$, F_λ^τ form dual pair relatively the form (4) (concretely topologies (τ', τ) will be given further).

c) As always [4] integration of an Lie algebra representation leads to the exponent $e^{iL_k\theta_k} = \sum_{n=0}^\infty \frac{(iL_k\theta_k)^n}{n!}$ which covers a certain neighbourhood of group unity and determines formal local group or groupuscle (that follows from the Campbell-Hausdorf formula $e^{iL''}e^{iL'} = e^{iL}$, here $L'' = L_k\theta_k''$, $L' = L_k\theta_k'$; $L = L_k\theta_k$, where $\theta = \theta(\theta'', \theta')$ is multiplication law in coordinates θ). As L_k are non-self-adjoint operators so $e^{iL_k\theta_k}$ are *non-unitary* ones and in general case are *unbounded*. Therefore convergence conditions of exponents are essential.

Now some general definitions.

Definition 1. Representation of a Lie algebra l given by operators L_k is integrable in a topological vector space F^τ if exponents $e^{iL_k\theta_k}$ are converged on a certain common dense subset $D \subset F^\tau$ when $|\theta_k| < \epsilon_\tau$, i.e. $e^{iL_k\theta_k}f \in F^\tau$ if $f \in D$.

Neighbourhood $|\theta_k| < \epsilon_\tau$ may be contracted (in dependence on topology τ) in zero (in point) then the representation is considered to be non-integrable. Convergence demand of the exponential process at the vector $f \in F^\tau$ restricts the usage of exponential mapping by a certain neighbourhood $U_f(e)$ of group unity e (exp is non-surjection mapping). In connection with this it is natural to take the following

Definition 2. If in the image of exponential mapping exp there are only elements of infinite small neighbourhood of the group unity $\tilde{\epsilon}(\tilde{e})$ (or nowhere dense set in group) so the Lie algebra and group in whole given rise by it are called non-classical. If exp covers the group almost completely so such an algebra and group are called classical.

The first situation takes place when $e^{iL_k\theta_k}$ are unbounded operators (in this case obstacles exist). In the framework of general topological groups this situation has been discovered by A.I.Maltcev [5].

Let G is a classical Lie group with Lie algebra l and $\epsilon(e) \subset G$ is its groupuscle. Let $T(l)$ is a non-classical algebra Lie isomorphic to the l and $\tilde{\epsilon}(\tilde{e})$ is a local group given rise by $T(l)$. Then $\tilde{\epsilon}(\tilde{e}) \approx \epsilon(e)$ (that follows from the Campbell-Hausdorf formula).

As is known connected component of a topological group is given rise by local group (see [6], Theorem 44). This means that any element of the group in whole may be written in the form of left-ordered product (P is ordering symbol) of exponents $e^{iT(l^{(N)})}\cdot \cdot\cdot e^{iT(l^{(1)})} = \Pi_{i\in I}e^{iT(l^{(i)})} = Pexp(i\sum_{i\in I}T(l^{(i)}))$ (here $l^{(i)} = l_k\theta_k^{(i)}$ and $I = [1,N]$) at sufficiently large N where all $e^{iT(l^{(i)})} = T(g_i) \in \tilde{\epsilon}(\tilde{e})$ and $g_i = e^{il^{(i)}} \in \epsilon(e)$. Of course we have to take now into account the convergence contition for the product of exponents (see further).

Set of elements $\{g_i\}_{i\in I}$ defines on G a certain discrete chain denoted $\tilde{g}$ which is formed by group elements $e, g_1, g_2g_1, ..., g_N\cdots g_1 = g$ where e is the start of chain and g is its end, denoted $p(\tilde{g}) = g$.

Statement 1 (another definition of the non-classical Lie group). For non-classical Lie group products $\Pi_{i\in I}e^{iT(l^{(i)})}$ depend on chains $\tilde{g}$ by essential manner, i.e. $\Pi_{i\in I}e^{iT(l^{(i)})} = T(\tilde{g})$.

At the limit when $g_i \to e, N \to \infty$ (hereby the end g of the chain is fastened) a continuous chain $\tilde{g}$ on G is obtained. (This conventional reason of standard analysis is in fact self contradictory, therefore further we go over to the non-standard analysis, see [7]).[5]

An Example [1]. Let h_2 is the Heisenberg algebra with two generators a^α $(\alpha = 1,2)$ and commutation relations $[a^\alpha, a^\beta] = \epsilon^{\alpha\beta}$ $(\epsilon = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix})$. Its automorphism group as a linear group of operators $T(v)$ acting in a topological vector space and entering into formula

$$T(v)a^\alpha T^{-1}(v) = v^\alpha_\beta a^\beta \tag{5}$$

where

$$v = \begin{pmatrix} \alpha & \beta \\ \gamma & \delta \end{pmatrix} \in Sp(1,C) \approx SL(2,C) \tag{6}$$

is a non-classical Lie group $\tilde{Sp}(1,C)$. We will see further that $T(v)$'s depend indeed on 1-chains $\tilde{v}$ on $Sp(1,C)$, i.e. we have in fact the mapping $\tilde{v} \to T(\tilde{v})$. Remarkable that from $p(\tilde{v}) = p(\tilde{v}^{'})$ and $T(\tilde{v})a^\alpha T^{-1}(\tilde{v}) = T(\tilde{v}^{'})a^\alpha T^{-1}(\tilde{v}^{'})$ it does not follow that $T(\tilde{v}) = T(\tilde{v}^{'})$ (with such a situation one deals at consideration of covering structures).

This example shows that the space of 1-chains over a classical group must be rather natural object in quantum theory.

3. 1-Chain Group over Topological Group (Elementary Description)

Definition 3. Let G is a connected, linearly one connected topological group. 1-chain space $\Gamma(G,e)$ over G is the set of chains $\tilde{g}$ starting in unity $e \in G$. The end of $\tilde{g}$ is $p(\tilde{g}) = g$ (p is projection: $\Gamma(G,e) \to G$). Subspace of closed 1-chains starting in e and ending in e denoted $C(G,e)$ is called space of cycles (loops). The subset of limiting 1-cycles called "moustache" is denoted $C_0(G,e)$ [8].[6]

Theorem 2 [8]. Factor-set $\Gamma(G,e)/C_0(G,e) = \tilde{G}$ is topological group called 1-chain group over G. It is free group in which multiplication of two chains $\tilde{g}_1$ and $\tilde{g}_2$ denoted $\tilde{g}_1 \circ \tilde{g}_2$ is a chain $\tilde{g}$ consisting of $\tilde{g}_1$ and $\tilde{g}_2 \cdot g_1$ (the latter is right translation of 1-chain $\tilde{g}_2$ in G along the group by means of group element $g_1 = p(\tilde{g}_1)$, which does not belong generaly speaking to the $\Gamma(G,e)$, $\cdot$ is multiplication in G) so that the end of $\tilde{g}_1 \in \Gamma$ and the start of $\tilde{g}_2 \cdot g_1$ coinside ($\circ$ is so called word multiplication law). Factor $C/C_0 = \tilde{\Omega}$ is invariant subgroup of cycles in $\tilde{G}$. Mapping p gives isomorphism $\tilde{G} \to \tilde{G}/\tilde{\Omega} = G$.

One can look at $\tilde{G}$ as an extention of G by means of cycle set $\tilde{\Omega}$. It is possible because the sequence $\tilde{\Omega} \to \tilde{G} \to G$ is exact (in fact the kernel of mapping $\tilde{G} \to G$ being $\tilde{\Omega}$ is the image of mapping $\tilde{\Omega} \to \tilde{G}$).

One can else look at $\tilde{G}$ as an locally non-trivial fibration or bundle $(\tilde{G}, G, p)$ with base G, fiber $p^{-1} = \tilde{\Omega} \circ \tilde{g}$ over $g \in G$ and projection p: $\tilde{G} \to G$. Hereby topology on $\tilde{G}$ is determined by product of topologies on G and $\tilde{\Omega}$, see [8] (topology on $\tilde{\Omega}$ is induced by topology on G). In such a topology $\tilde{G}$ is a group with small subgroup (all these are contained in $\tilde{\Omega}$) and is not a Lie group. Further only such representations T of $\tilde{G}$ will be considered for which $T(\tilde{\Omega})$ is a commutative set of operators (although $\tilde{\Omega}$ in general case is not central subgroup in $\tilde{G}$).

Introducing the notion of invariant subgroup of lasso $Y \subset \tilde{\Omega}$ as an infinite small cycles of the form $\tilde{g} \circ \tilde{\omega} \circ \tilde{g}^{-1}$ (hereby infinite small neighbourhood of unity $\epsilon(e) \subset G$ is considered in the spirit of non-standard analysis, i.e. G is considered to be hyperreal structure) and factorizing $\tilde{G}$ over Y we come to the locally euclidean group $\tilde{G}/Y$, i.e. to the Lie group $\tilde{G}_L$ locally isomorphic to the classical Lie group G. Hereby the factor $\tilde{\Omega}/Y$ is completely non-closed invariant subgroup in $\tilde{G}/Y$ so that $(\tilde{G}/Y)/(\tilde{\Omega}/Y) = G$.

It is interesting to notice that with $\tilde{G}$ such homogeneous spaces like $G^*_f = \tilde{G}/\tilde{\Omega}(U_f)$ are connected. Here $U_f \subset G$ is the analysity region of singular function $f(g) = T(g)f$ considered on G. We call G^*_f the Riemennian surface. It is minimal covering for U_f . Measure on G^*_f is obtained by means of sheet lifting of measure dg on G, see [1].

4. Non-Neumannian Representations of a Topological Group (Main Definitions). A Little Generalization

It is very important that a finite system of axioms for non-Neumannian representations may be given.

Definition 4. Let G is a topological group. Non-Neumannian representation of G is three $\{(\dot{F}, F^{'})$, G, $T(g)\}$, where $(\dot{F}, F^{'})$ is a pair of topological vector spaces dual relatively some invariant sesquilinear form $< \cdot, \cdot >$ and $g \to T(g)$, $g \in G$ is homomorphism of G into set of unbounded operators $T(g)$ acting on $F^{'}$ (carrier space of representation) and satisfying the following axioms: i) $e \to T(e) = 1$, ii) $T(g_2)T(g_1^{-1}) = T(g_2 g_1^{-1})$ on common domain (subspace) $D_{T(g_2)T(g_1^{-1})} \cap D_{T(g_2 g_1^{-1})}$, iii) $T(g^{-1}) =$

[5] In fact at such a process we obtain a countable set of elements on G only, but not uncountable moreover continuous one.

[6] 1-chain may be determined as track of path in G [8]. Such a class of groups (with another multiplication of chains) one became to use in two dimensional quantum field theory, see for example [9].

$T^{-1}(g)$, iv) $(T(g_3)T(g_2))T(g_3) = T(g_3)(T(g_2)T(g_1))$, v) $\cap_{g\in G} D_{T(g)} = 0$ where $D_{T(g)} \in F'$ is a dense domain of definition of operator $T(g)$ — a non-closed subspace in F' .

It follows from these axioms that such a representation is setting by operators $T(g)$ without defect, i.e. 1) for every g operator $T(g)$ is dense defined on F' (it means that all $D_{T(g)}$'s are dense in F'), 2) for every g subspace $R_{T(g)} = T(g)D_{T(g)} = ImD_{T(g)}$ is dense in F', and $KerT(g) = 0$, therefore for every $T(g)$ there exists invers operator $T^{-1}(g)$ with domain of definition $D_{T^{-1}(g)} = R_{T(g)}$ and domain of rate $R_{T^{-1}(g)} = D_{T(g)}$, 3) for every pair of elements $g_1, g_2 \in G$ subspace $D_{T(g_2)T(g_1)} = D_{T(g_2)} \cap R_{T(g_1)}$ are dense in F', hereby intersection $D_{T(g_2 g_1)} \cap D_{T(g_2)T(g_1)}$ are dense in F' too, 4) if $Q \subset G$ is a countable everywhere dense subset in G, so v') $\cap_{g\in Q} D_{T(g)}$ is dense in F', 5) every operator $T(g)$ is continuous on its subspace of definition $D_{T(g)}$ in topology induced by topology in F', i.e. if $f_n \to f \in D_{T(g)}$, so $T(g)f_n \to T(g)f$.

We will see further that space F' which contains $D_{T(g)}$ at every $g \in G$ is the space of generalized functions of exponential type.

As usually [10] we may consider the set of all subsets $D_{T(g)}$ and their finite intersections denoting it $\Re_{F'}$. This set is invariant relatively operators $T(g)$ because $T(g)$ transfers $D_{T(g)}$ into $D_{T(g^{-1})}$ (these both subsets belong to $\Re_{F'}$). We say that a representation $g \to T(g)$ is Neumannian, if the condition v') draws the following condition: v") intersection $\cap_{g\in G} D_{T(g)}$ is dense in F' [11]. In such a case we can consider the latter to be carrier space of the representation. In general case condition v") does not follow from v') [8]. In such a case we say that the representation is non-Neumannian one.

From axiom v) it follows that at fixed $f \in F'$ there are such elements $g^f \in G$ that $T(g^f)f \notin F'$, i.e. $f \notin D_{T(g^f)}$. On the other hand at fixed $g \in G$ there are such vectors $f^g \in F'$ that $f^g \notin D_{T(g)}$ (as operators $T(g)$ are in general case unbounder, so $D_{T(g)} \neq F'$). If F' is the space of generalized functions of exponential type so for every $f \in F'$ there exists at least infinite small neighbourhood $U_f(e) \subset G$ that $T(g)f \in F'$ when $g \in U_f(e)$. Hereby common area $\cap_{f\in F'} U_f(e)$ is either unity of group or some closed subgroup in G of zero measure. Thus

Statement 2. If $g \to T(g)$ is non-Neumannian representation of G in F' so $\cap_{f\in F'} U_f(e)$ is nowhere dense closed subgroup in G.

This statement is dual to the axiom v).

Representation $g \to T(g)$ is continuous if from $g_n \to g_0$ (in topology on G) the convergence of sequence $T(g_n)f \to T(g_0)f$ follows (in topology on F') when f belongs to some dense subspace in F' (for example to the $\cap_{g\in U(g_0)} D_{T(g)}$ where $U(g_0)$ is a neighbourhood of element g_0 and $g_n \in U(g_0)$ beginning from any n).

Quite analogous way differentiable and analytical representations are defined. Speaking about irreducible and equivalent representations we understand the topologically irreducible and equivalent ones.

It is obviously that non-Neumannian representations exist for continuous groups only because only for such a group axiom v") does not follow in general case from axiom v').

b) It turns out that axioms i)-v) (and statements 1)-5)) determine a new mathematical category: non-Neumannian group of a topological vector space.

Let us consider the set $\hat{T}$ of all unbouded reversible operators of a topological vector space F' satisfying the axioms i)-v). Hereat it is convenient to generalize the axiom ii) formulating it in the form of ii'): operators T_1 and T_2 are equivalent if on common dense subspace $D_{T_1} \cap D_{T_2} \subset F'$ the equality $T_1 = T_2$ takes place.

Now we have to apply to the above mentioned set $\Re_{F'}$. On the definition we have $TD_T = R_T = D_{T^{-1}}$ so that operators $T \in \hat{T}$ act on $\Re_{F'}$ mapping subsets of $\Re_{F'}$ one to other $D_T \to D_{T^{-1}}$. We said already that set $\Re_{F'}$ is invariant relativily of set of operators $\hat{T}$. Factorizing $\hat{T}$ over above formulated equivalence relation (see [10]) we get the group $\tilde{T}$ of classes unbouded reversible operators of space F' which we call *the non-Neumannian group of space* F' (in our consideration it plays the role analogous the role of group of unitary operators of Hilbert space).

Subgroup of bounded operators we call Neumannian group of F'.

By quite analogous way one may define non-Neumannian ring of operators on spece F'.

Now non-Neumannian representation of a group G in space F' one may define to be homomorphism G into $\tilde{T}$, [12].

5. The Space of Fit and Generalized Functions of Exponential Type

At consideration of infinite dimensional representations of algebras and in particular of associative (Neumannian) rings of unbounded operators $T(l)$ the space of generalized functions of *degree* type (so called L.Schwartz space, see [1,13]) is well adopted. In fact from formula (1) it follows that $T^k(l)f_n \sim n^k f_n$ at $n \to \infty$ and arbitrary entire $k < \infty$.

In the case of finite dimensional Lie algebra integration of its infinite dimensional representation leads to the exponent $exp(iT(l)\theta) = T(\theta)$ and therefore $T(\theta)f_n \sim exp(\theta n)f_n \sim K^n f_n$ ($T(l)$ are non-self-adjoint operator; $|K| < \infty$). So that side by side with linear envelope of elements of Cartan-Weyl basis elements $K^n f_n$ and their infinite sums must belong to the carrier space of group representation in whole. Space including such vectors we call the space of generalized vectors of *exponential* type [12].

If in the case of algebra Lie representation there exists invariant (respectivelly envelope algebra $U[T(l)]$) space (it is the space of fit functions of degree type therefore $U[T(l)]$ is always Neumannian ring) so in the case of non-Neumannian irreducible representation of Lie group in whole such a space does not exist (see axiom v)).

Building the space, we interested, we may begin from consideration of pre-Hilbert space H with scalar product $(\psi,\varphi)_1 = \Sigma_n \overline{\psi}_n \varphi_n$ where φ_n are components of vector φ in orthonormed basis e_n: $\varphi = \Sigma_n \varphi_n e_n$. Then one may consider the infinite countable system of scalar products $(\psi,\varphi)_K = \Sigma_n |K|^n \overline{\psi}_n \varphi_n$ where $|K| = 1,2,3,\ldots$. Completion of H by means of norm $||\varphi||_K = \sqrt{(\varphi,\varphi)_K}$ let us denote H_K. Obviously we have $H_1 \supset H_2 \supset \cdots H_K \supset \cdots$. Limit of this narrowed sequence of complete Hilbert spaces we call the space of fit vectors of exponential type F [12], so that $F = \cap_K H_K$. Topology on such a countable-Hilbert space is setted by usual manner, see [13]. It is not difficult to show that the space of this type is nuclear [12].

Omitting further details the space of generalized function of exponent type F' we determine as the space of linear continuous functionals (F', F) on the space F. Not difficult to show that F' is the Frechet space, see [12]. Further we will consider a sesquilinear form $< F', F >$ connecting the pair of spaces F and F'.

Namely F' (the space of generalized functions of exponential type) is the carrier space for non-Neumannian representation (see the following Part 2).

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BULK VISCOUS FRW WITH TIME VARYING CONSTANTS REVISITED

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We study a full causal bulk viscous cosmological model with flat FRW symmetries and where the "constants" G, c and Λ vary. We take into account the possible effects of a $c-$variable into the curvature tensor in order to outline the field equations. Using the Lie method we find the possible forms of the "constants" G and c that make integrable the field equations as well as the equation of state for the viscous parameter. It is found that G, c and Λ follow a power law solution verifying the relationship $G/c^2 = \kappa$. Once these possible forms have been obtained we calculate the thermodynamical quantities of the model in order to determine the possible values of the parameters that govern the quantities, finding that only a growing G and c are possible while Λ behaves as a negative decreasing function.

1. Introduction

In a recent paper (see [1]) we study a cosmological model with flat FRW symmetries filled by a perfect fluid and where the "constants" G, c and Λ were considerate as function on time t. By different reasons exposed in such paper, we took into account the possible effects of a $c-$variable into the curvature tensor in order to outline the field equations. Through the Lie group method we studied the possible forms of the functions G and c that make integrable the field equations. In this way we were finding that G and c follow a power law solution verifying the relationship $G/c^2 = \kappa$. But unfortunately we were not able to determine if G and c are growing or decreasing functions on time t.

In order to determine if G and c are growing or decreasing functions we try to take into account thermodynamical considerations, that is to say, we hope that thermodynamical restrictions help us to determine the behaviour of such functions. For this purpose, in this paper we consider a cosmological model with flat FRW symmetries filled by a full causal bulk viscous fluid and where the constants G, c and Λ are considered as functions on time t. Once we have outlined the field equations (taking into account the possible effects of a $c-$variable into the curvature tensor) we rewrite them in order to obtain a second order differential equation in order to apply the standard Lie procedure. The study of this ode through the Lie group method allows us to obtain the precise form of the functions G and c that make integrable the field equations as well as the equation of state for the bulk viscous parameter ξ.

As we will see in section 3 the field equations only admit scaling symmetries (note that we are working with flat FRW symmetries) i.e. we are studying a self-similar model. This fact obligates that G and c follow a power law solution, $c = c_0 t^{K_1}$, verifying the relationship $G/c^2 = \kappa$, i.e. G and c are functions on time t but in such a way that this relationship must be verified. We find another restriction under this symmetry. The bulk viscosity ξ, must follow the law $\xi = k_\gamma \rho^{1/2}$, i.e. we have found a concrete equation of state for the viscous parameter $\gamma = 1/2$. All these results are in agreement with our previous paper ([2]).

Once we have found the possible forms of the functions G and c we calculate the energy density finding in a first approach that the only physical solution imply that G and c must be a growing functions on time t since $K_1 > 0$.

In section 4 we will calculate all the physical quantities in order to complete the solution for our model. In particular we are interested in calculating the entropy in order to obtain some restrictions for the physical parameters as K_1 and to elucidate if G and c are growing or decreasing functions. In this way we find an exact solution for Λ which behaves as a negative decreasing function.

We end summarizing all these results in the last section.

2. The Model

Following Maartens [3], we consider a Friedmann-Robertson-Walker (FRW) Universe with a line element

$$ds^2 = c^2(t)dt^2 - f^2(t)\left(dx^2 + dy^2 + dz^2\right), \tag{1}$$

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filled with a bulk viscous cosmological fluid with the following energy-momentum tensor:

$$T_i^k = (\rho + p + \Pi)\, u_i u^k - (p + \Pi)\, \delta_i^k, \tag{2}$$

where ρ is the energy density, p the thermodynamic pressure, Π is the bulk viscous pressure and u_i is the four velocity satisfying the condition $u_i u^i = 1$.

The gravitational field equations with variable G, c and Λ are:

$$R_{ik} - \frac{1}{2} g_{ik} R = \frac{8\pi G(t)}{c^4(t)} T_{ik} + \Lambda(t) g_{ik}. \tag{3}$$

Applying the covariance divergence to the second member of equation (3) we get:

$$div\left(\frac{G}{c^4} T_i^j + \delta_i^j \Lambda\right) = 0, \tag{4}$$

$$T_{i;j}^j = \left(\frac{4c_{,j}}{c} - \frac{G_{,j}}{G}\right) T_i^j - \frac{c^4 \delta_i^j \Lambda_{,j}}{8\pi G}, \tag{5}$$

that simplifies to:

$$\dot{\rho} + 3(\rho + p) H + 3H\Pi = -\frac{\dot{\Lambda} c^4}{8\pi G} - \rho \frac{\dot{G}}{G} - 4\rho \frac{\dot{c}}{c}, \tag{6}$$

where H stands for the Hubble parameter $(H = \dot{f}/f)$.

Therefore, our model (with FRW symmetries) is described by the following equations:

$$2\dot{H} - 2\frac{\dot{c}}{c} H + 3H^2 = -\frac{8\pi G}{c^2}(p + \Pi) + \Lambda c^2, \tag{7}$$

$$3H^2 = \frac{8\pi G}{c^2}\rho + \Lambda c^2, \tag{8}$$

$$\dot{\rho} + 3(\rho + p + \Pi) H = -\frac{\dot{\Lambda} c^4}{8\pi G} - \rho \frac{\dot{G}}{G} + 4\rho \frac{\dot{c}}{c}, \tag{9}$$

$$\tau \dot{\Pi} + \Pi = -3\xi H - \frac{\epsilon}{2} \tau \Pi \left(3H + \frac{\dot{\tau}}{\tau} - \frac{\dot{\xi}}{\xi} - \frac{\dot{T}}{T}\right) \tag{10}$$

We would like to emphasize that deriving (8) and taking into account (7) it is obtained (9), that is to say, the conservation equation (9) could be deduced from the field equation as in the standard case where the "constants" G, c and Λ are true constants (see [1]).

In order to close the system of equations (7-10) we have to give the equation of state for p and specify T, ξ and τ. As usual, we assume the following phenomenological (ad hoc) laws [3]:

$$p = \omega\rho,\ \xi = k_\gamma \rho^\gamma,\ T = D_\delta \rho^\delta,\ \tau = \xi\rho^{-1} = k_\gamma \rho^{\gamma - 1}, \tag{11}$$

where $0 \le \omega \le 1$, and $k_\gamma \ge 0$, $D_\delta \ge 0$ are dimensional constants, $\gamma \ge 0$ and $\delta \ge 0$ ($\delta = \frac{\omega}{\omega+1}$ so that $0 \le \delta \le 1/2$ for $0 \le \omega \le 1$) are numerical constants. Eqs. (11) are standard in cosmological models whereas the equation for τ is a simple procedure to ensure that the speed of viscous pulses does not exceed the speed of light. These are without sufficient thermodynamical motivation, but, in absence of better alternatives, we use these equations and expect that they will at least provide an indication of the range of possibilities. For the temperature law, we take, $T = D_\delta \rho^\delta$, which is the simplest law guaranteeing positive heat capacity.

The growth of the total commoving entropy Σ over a proper time interval (t_0, t) is given by [3]:

$$\Sigma(t) - \Sigma(t_0) = -\frac{3}{k_B} \int_{t_0}^{t} \frac{\Pi H f^3}{T} dt, \tag{12}$$

where k_B is the Boltzmann's constant.

Therefore, with all these assumptions and taking into account the conservation principle, i.e., $div(T_i^j) = 0$, the resulting field equations are as follows:

$$2\dot{H} + 3H^2 - 2\frac{\dot{c}}{c} H = -\frac{8\pi G}{c^2}(p + \Pi) + \Lambda c^2, \tag{13}$$

$$3H^2 = \frac{8\pi G}{c^2}\rho + \Lambda c^2, \tag{14}$$

$$\dot{\rho} + 3(\omega + 1)\rho H = -3H\Pi, \tag{15}$$

$$\frac{\dot{\Lambda} c^4}{8\pi G} + \rho \frac{\dot{G}}{G} - 4\rho \frac{\dot{c}}{c} = 0, \tag{16}$$

$$\dot{\Pi} + \frac{\Pi}{k_\gamma \rho^{\gamma - 1}} = -3\rho H - \frac{1}{2}\Pi \left(3H - W\frac{\dot{\rho}}{\rho}\right), \tag{17}$$

where $W = \left(\frac{2\omega+1}{\omega+1}\right)$ is a numerical constant.

3. Lie method

The field equations (13-17) represent a system of odes with 5 unknowns. In order to integrate them and to obtain a complete solution for the proposed model we will need to make some simplifying hypotheses (this is always a dangerous way) or to study if the system admits symmetries. In this way, studying the possible symmetries that admit the system, we will be able to determine the possible forms for which such system is integrable.

In order to apply the standard Lie procedure (see for example [5]- [7]) we need to rewrite eq. (13-17) by a single one and imposing that such ode (second order ode) admits a concrete symmetry we will be able to determine the equation of the state for the viscous parameter i.e. $\xi = k_\gamma \rho^\gamma$ and the exact of the "constants" G and c for which the ode is completely integrable.

We start with the assumption $\Pi = \varkappa\rho$, with $\varkappa \in \mathbb{R}^-$ (see [2] for a complete discussion of this hypothesis).The bulk viscosity evolution equation can then be rewritten in the alternative form

$$\delta \frac{\dot{\rho}}{\rho} + k_\gamma^{-1} \rho^{1-\gamma} = -3\beta H, \tag{18}$$

where $\beta = \left(\frac{1}{\varkappa} + \frac{1}{2}\right)$ and $\delta = \left(1 - \frac{W}{2}\right)$.

Taking the derivative with respect to the time of this equation and with the use of the equation

$$\dot{H}=\frac{\dot{c}}{c}H-4\pi\alpha\frac{G(t)}{c^{2}(t)}\rho, \tag{19}$$

obtained from the field equations (13) (where $\alpha=(1+\omega+\varkappa)$). and taking into account eq. (15)

$$H=-\frac{1}{3\alpha}\frac{\dot{\rho}}{\rho} \tag{20}$$

we obtain the following second order differential equation describing the time variation of the density of the cosmological fluid:

$$\ddot{\rho}=\frac{\dot{\rho}^{2}}{\rho}-As\rho^{s}\dot{\rho}+B\frac{\dot{c}}{c}\dot{\rho}+D\frac{G}{c^{2}}\rho^{2}, \tag{21}$$

where $A=\frac{k_{\gamma}^{-1}}{\delta}$, $s=(1-\gamma)$, $B=\frac{\beta}{\delta\alpha}$ and $D=\frac{12\pi\alpha\beta}{\delta}$.

We go next to apply all the standard procedure of Lie group analysis to this equation (see [6] for details and notation). In this way we find that the admissible symmetries for our ode being determinate by the following system of pdes

$$\rho\xi_{\rho\rho}+\xi_{\rho}=0, \tag{22}$$

$$2\rho^{2}\left(\frac{1}{2}\eta_{\rho\rho}-\xi_{t\rho}+\left(As\rho^{s}-B\frac{\dot{c}}{c}\right)\xi_{\rho}\right)- \\ -\rho\eta_{\rho}+\eta=0, \tag{23}$$

$$2\eta_{t\rho}-c^{-2}\xi_{tt}-2\eta_{t}\rho^{-1}+As^{2}\eta\rho^{s-1}+ \\ +\xi_{t}\left(sA\rho^{s}-B\frac{\dot{c}}{c}\right)+\xi B\left(-\frac{\ddot{c}}{c}+\frac{\dot{c}^{2}}{c^{2}}\right)- \\ -3\rho^{2}D\frac{G}{c^{2}}\xi_{\rho}=0, \tag{24}$$

$$\eta_{tt}+\eta_{t}\left(sA\rho^{s}-B\frac{\dot{c}}{c}\right)+ \\ +D\frac{G}{c^{2}}\rho^{2}\left(-2\xi_{t}+\eta_{\rho}-2\rho^{-1}\eta\right)- \\ -D\frac{G}{c^{2}}\rho^{2}\xi\left(\frac{\dot{G}}{G}-2\frac{\dot{c}}{c}\right)=0, \tag{25}$$

Solving (22-25), we find that

$$\xi(\rho,t)=at+b,\ \eta(\rho,t)=-2a\rho,\iff s=\frac{1}{2}, \tag{26}$$

with the constraints, from eq. (24)

$$\ddot{c}=\frac{\dot{c}^{2}}{c}-\frac{a}{at+2b}\dot{c}, \tag{27}$$

and from eq. (25)

$$\frac{\dot{G}}{G}=2\frac{\dot{c}}{c},\qquad\Longrightarrow\frac{G}{c^{2}}=\kappa \tag{28}$$

being a and b numerical constants and we will assume that $\kappa>0$.

In order to solve (27), we consider the following cases.

1. Case I. Taking $a=0,b\neq0$, we get

$$c''=\frac{c'^{2}}{c},\qquad\Longrightarrow\qquad c(t)=K_{2}e^{K_{1}t}, \tag{29}$$

where the $(K_{i})_{i=1}^{2}$ are integration constants. Therefore the equation (21) yields:

$$\ddot{\rho}=\frac{\dot{\rho}^{2}}{\rho}-\frac{A}{2}\sqrt{\rho}\dot{\rho}+BK_{1}\dot{\rho}+D\kappa\rho^{2}, \tag{30}$$

the solution obtained through invariants is:

$$\frac{dt}{\xi}=\frac{d\rho}{\eta}\Longrightarrow\rho\approx const. \tag{31}$$

this solution seems not to be physical.

2. Case II. Taking $b=0,a\neq0$, we get that the infinitesimal X is $X=t\partial_{t}-2\rho\partial_{\rho}$ which is precisely the generator of the scaling symmetries. Therefore the solution will be the same than the obtained one with the dimensional method.

With these values of a and b equation (27) yields

$$c''=\frac{c'^{2}}{c}-\frac{c'}{t},\quad\Longrightarrow\quad c(t)=K_{2}t^{K_{1}}, \tag{32}$$

as we expected, $c(t)$ follows a power-law solution. Therefore equation (21) yields:

$$\ddot{\rho}=\frac{\dot{\rho}^{2}}{\rho}-\frac{A}{2}\sqrt{\rho}\dot{\rho}+B\frac{K_{1}}{t}\dot{\rho}+D\kappa\rho^{2}, \tag{33}$$

the solution obtained through invariants is:

$$\frac{dt}{\xi}=\frac{d\rho}{\eta}\Longrightarrow\rho\approx t^{-2},\qquad\rho=\rho_{0}t^{-2}, \tag{34}$$

where ρ_{0} is a numerical constants that must verifies eq. (33) in such a way that

$$\rho_{0}=\frac{A\left(A+\sqrt{A^{2}+8D\kappa\left(1+BK_{1}\right)}\right)}{2D^{2}\kappa^{2}}+ \\ +\frac{2\left(1+BK_{1}\right)}{D\kappa} \tag{35}$$

now, since ρ_{0} must be a positive numerical constant, in a first approach, and taking into account the definition of the constants A,B and D we see that $\rho_{0}>0$ iff $(1+BK_{1})<0$, which imply that $K_{1}>0$ since $A>0,B<0,\kappa>0$ and $D<0$ (since $\varkappa<0$). Therefore K_{1} must be a positive numerical constant.

Once again if one insists in solving equation (33) through DA (applying the Pi-theorem) it is found that with respect to the dimensional base $\mathfrak{B}=$

$\{\rho, T\}$ each quantity has the following dimensional equation $[\rho] = \rho, [t] = T$ and $[A] = \rho^{-1}T^{-2}$. Therefore, we find in a trivial way that:

$$\begin{array}{c|ccc} & \rho & A & t \\ \hline \rho & 1 & -1 & 0 \\ T & 0 & -2 & 1 \end{array} \Longrightarrow \rho \approx \frac{1}{At^2}. \tag{36}$$

3. Case III. Taking $a, b \neq 0$, we get

$$c'' = \frac{c'^2}{c} - \frac{ac'}{at+b}, \Longrightarrow c(t) = K_2 (at+b)^{\frac{K_1}{a}}, \tag{37}$$

hence equation (21) yields:

$$\ddot{\rho} = \frac{\dot{\rho}^2}{\rho} - \frac{A}{2}\sqrt{\rho}\dot{\rho} + B\frac{K_1}{at+b}\dot{\rho} + D\kappa\rho^2, \tag{38}$$

the solution obtained through invariants is:

$$\frac{dt}{\xi} = \frac{d\rho}{\eta} \Longrightarrow \rho \approx (at+b)^{-2/a}, \tag{39}$$

As we can see case II is a particular situation of case III.

Through the symmetry analysis of eq. (21) we have been able of determining the equation of state that must follow the viscous parameter ξ, obtaining that $\gamma = 1/2$, as well as, that under the scaling symmetry c and G must follow a power law solution in such a way that they must verify the relationship $G/c^2 = \kappa$.

4. A Complete Solution

Once we know the behaviour of the quantities ρ, G and c, in this section, we are going to determine the rest of the quantities i.e. the scale factor and mainly the behaviour of the entropy with the hope that this quantity help us to determine the possible values of the constant K_1. For this purpose we begin considering eq. (15)

$$\dot{\rho} + 3(\omega + 1 + \varkappa)\rho H = 0, \tag{40}$$

which trivially leads us to the well known relationship between the energy density ρ and the scale factor f

$$\rho = A_\omega f^{-3(\omega+1+\varkappa)} \quad or \quad \rho = A_\omega f^{-3\alpha}, \tag{41}$$

where $\alpha = (\omega + 1 + \varkappa)$. Now, taking into account the eq. (17) and simplifying it, we obtain,

$$\left(1 - \frac{W}{2} - \frac{1}{\varkappa\alpha} - \frac{1}{2\alpha}\right)\dot{\rho} = -\frac{\sqrt[3]{\rho}}{k_\gamma}, \tag{42}$$

thereby obtaining $\rho = \rho(t)$. On simplifying further, we obtain,

$$\frac{\dot{\rho}}{\sqrt[3]{\rho}} = -\frac{1}{Kk_\gamma} \quad \Longrightarrow \quad \rho = \rho_0 t^{-2}, \tag{43}$$

where

$$K = \left(1 - \frac{W}{2} - \frac{1}{\varkappa\alpha} - \frac{1}{2\alpha}\right), \quad \rho_0 = (2Kk_\gamma)^2. \tag{44}$$

From equation (41) we obtain:

$$f = \left(\frac{A_\omega}{\rho_0}t^2\right)^{1/3\alpha}, \quad i.e. \quad f \propto t^{\frac{2}{3(\omega+1+\varkappa)}}. \tag{45}$$

An important observational quantity is the deceleration parameter $q = \frac{d}{dt}\left(\frac{1}{H}\right) - 1$. The sign of the deceleration parameter indicates whether the model inflates or not. The positive sign of q corresponds to "standard" decelerating models whereas the negative sign indicates inflation. In our model, the deceleration parameter behaves as:

$$q = -1 + \frac{3\alpha}{2}. \tag{46}$$

In this way we find that for $\omega = 1$, $\varkappa = -4/3$ is a critical value since $q = 0$, therefore and under these considerations, $q < 0$ if $\varkappa < -4/3$ and $q > 0$ if $\varkappa > -4/3$.

We proceed with the calculation of the other physical quantities under the condition $\gamma = 1/2$:

$$\xi = k_\gamma \rho^\gamma \propto k_\gamma \left(\rho_0 t^{-2}\right)^\gamma \approx k_\gamma^2 t^{-1}, \tag{47}$$

$$T = D_\delta \rho^\delta = D_\delta \left(\rho_0 t^{-2}\right)^\delta \quad with \quad \delta = \frac{\omega}{\omega+1}, \tag{48}$$

$$\tau = \xi\rho^{-1} = k_\gamma \left(\rho_0 t^{-2}\right)^{-1/2}, \ i.e. \ \tau = (2K)^{-1} t. \tag{49}$$

We see from $\tau = (2K)^{-1} t$ that this result is in agreement with the theoretical result obtained in [3]. For viscous expansion to be non-thermalizing, we should have $\tau < t$, or otherwise the basic interaction rate for viscous effects should be sufficiently rapid to restore the equilibrium as the fluid expands.

The commoving entropy is

$$\Sigma(t) = -\frac{2\varkappa}{\alpha}\Sigma_0 \int^t x^{2\delta + \frac{2}{\alpha} - 3} dx = (\omega + 1)\Sigma_0 t^{-\frac{\varkappa}{\alpha}}, \tag{50}$$

where $\Sigma_0 = \frac{\rho_0^{1-\delta-1/\alpha} A_\omega^{1/\alpha}}{D_\delta k_B}$ and we find that $\varkappa > -(\omega+1)$ i.e. $\varkappa \in (-2, 0]$. We notice that the parameter $\varkappa$ weakly perturbs the perfect fluid FRW Universe. When $\varkappa = 0$, the commoving entropy assumes a constant value and we recover the perfect fluid case.

Finally, we will use equation (16) to obtain the behaviour of the cosmological "constant" Λ. Since we know the behaviour of the constants G, c and ρ i.e.

$$G = \kappa c^2, \qquad c(t) = K_2 t^{K_1}, \quad and \quad \rho = \rho_0 t^{-2}, \tag{51}$$

then eq. (16) yields

$$\frac{\dot{\Lambda}c^2}{8\pi\kappa\rho} - 2\frac{\dot{c}}{c} = 0, \tag{52}$$

and substituting eq. (51) into eq. (52) it is obtained the following ODE

$$\dot{\Lambda} = 16\pi\kappa\rho_0 \frac{K_1}{K_2^2} t^{-2K_1-3} \Longrightarrow \tag{53}$$

$$\Lambda = -8\pi\kappa \frac{\rho_0}{K_2^2} \frac{K_1}{K_1+1} t^{-2(K_1+1)} \tag{54}$$

with $K_1 > -1$.

We would like to emphasize that for $K_1 > 0$ then $\Lambda < 0$ and for $K_1 < 0$ then $\Lambda > 0$ but unfortunately we do not able to fix a better value for the constant K_1. Finally it is observed that

$$\Lambda \approx \frac{1}{c^2 t^2}. \tag{55}$$

as it is expected in this self-similar solution.

As we have seen, with the followed way, we have not been able to determine a better value for the constant K_1 than the obtained one in eq. (35). for this reason we try a new tentative which consists in considering the effects of a $c-$variable into the scale factor in such a way that when we calculate the entropy such effect may by reflected better than in our previous way.

4.1. A new tentative

In order to take into account the effects of a $c-$variable into the scale factor we will determine it from eq. (14) since we already know the behaviour of G, c, ρ and Λ. Therefore, after a simplification eq. (14) yields.

$$3H^2 = 8\pi\kappa\rho_0 \left(1 - \frac{K_1}{(K_1+1)}\right) t^{-2}, \tag{56}$$

therefore

$$f = K_f t^{\upsilon} \qquad / \qquad \upsilon = \left(\frac{8\pi\kappa\rho_0}{3} \frac{1}{K_1+1}\right)^{1/2}, \tag{57}$$

finding again that $K_1 > -1$.

In this way the entropy formula (12) yields:

$$\Sigma(t) = \Sigma_0 t^{\frac{4\pi\kappa\rho_0}{K_1+1}+2\delta-2}, \tag{58}$$

where $\Sigma_0 = -\varkappa\sqrt{6}\rho_0 \frac{K_f^3}{k_B} \frac{\sqrt{(\pi\kappa\rho_0(K_1+1))}}{2\pi\kappa\rho_0+(K_1+1)(\delta-1)}$. If we make $2\pi\kappa\rho_0 = 1$ (a free hypothesis), $\Sigma(t) \approx \Sigma_0 t^{2\left(\frac{1}{K_1+1} - \frac{1}{\omega+1}\right)}$ we find therefore $K_1 > -\omega$, but we are not able to find a better value (or limit) for K_1.

Or taking into account the field eq. (13)

$$2\dot{H} + 3H^2 - 2\frac{K_1}{t}H = -A\left(\alpha + \frac{K_1}{K_1+1}\right)t^{-2} \tag{59}$$

which is a Riccati ode and which particular solution (scaling solution) is:

$$H = \frac{a}{t} \qquad \Longrightarrow \qquad f = K_f t^a \tag{60}$$

where

$$a = \frac{(K_1+1)}{3} + \\ + \frac{\sqrt{(K_1+1)^4 - 3A\left(\alpha(K_1+1)^2 + K_1^2 + K_1\right)}}{3(K_1+1)} \tag{61}$$

finding that $K_1 > -1$, with $\alpha = (\omega + \varkappa)$, $A = 8\pi\kappa\rho_0$ and imposing the condition.

$$(K_1+1)^4 - 3A\left(\alpha(K_1+1)^2 + K_1^2 + K_1\right) \geq 0 \tag{62}$$

(note that α may take negative values) therefore the entropy behaves as:

$$\Sigma \approx t^{-2+2\delta+\frac{(K_1+1)^2+\sqrt{(K_1+1)^4-3A\left(\alpha(K_1+1)^2+K_1^2+K_1\right)}}{(K_1+1)}}. \tag{63}$$

As we can see following these ways we have only been able to determine that $K_1 > -1$ or that

$$\psi(K_1) > \left|\frac{2}{\omega+1}\right| \tag{64}$$

but as $\psi(K_1)$ depends on the factors like A and α it is very difficult to determine a good value for this constant.

5. Conclusions

In this paper we have studied a flat FRW cosmological model filled with a bulk viscous fluid and where the "constants" G, c and Λ are considered as functions on time t. In order to outline the field equations we have taken into account the possible effects of a $c-$variable into the curvature tensor. In this way we have been able to deduce the general conservation principle from the field equations obtaining an equation that coincides with the obtained one from the divergence of the right hand of the field equation i.e. $div\left(\frac{G}{c^4}T_i^j + \delta_i^j\Lambda\right) = 0$. Using the Lie group tactic we have been able to determine the equation of state for the bulk viscous parameter, $\xi = k_\gamma \rho^\gamma$, as well as the exact form for the "constants" G and c which make integrable the field equations.

We have obtained that our model is self-similar i.e. admits a scaling symmetry iff $\gamma = 1/2$ and c follows a power law solution i.e. $c = c_0 t^{K_1}$, while G and c must verify the relationship $G/c^2 = \kappa$. Under these results we have calculated the behaviour of the energy density finding, in a first approach, that the physical solution is only possible if $K_1 > 0$, that is to say, G and c are growing functions on time t. We have also calculated the rest of the main quantities but under physical considerations we have only been able to determine that $K_1 > -1$. The latter result does not contradict our previous result $K_1 > 0$.

Therefore we conclude that G and c are growing functions while Λ is a negative decreasing function.

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CRITICAL REMARKS TO THE RELATIVITY THEORY

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The article is devoted to a critical analysis of some aspects (logical and experimental) of the relativity theory.

1. Introduction

The "Century of Revolutions" is elapsed. It is the time to judge its "results". It is necessary to accept that in the past century the physics "had obstacle" twice at the same subject – at the electrodynamics (for microobjects and for large velocities). And these "falls" were the essence of the "revolutions". In the first case (the birth of the quantum mechanics), some incomprehensible relations were simply postulated, and appropriate mathematics were selected for this choice (we shall not discuss it). In the second case (the birth of the SRT) a "Great meaning" was "invented" under formal mathematical transformations. Here this topic will be discussed only.

To isolate themselves from "inconvenient" questions, relativists set the following "protective barriers": 1) "But relativistic phenomena really exist and can be explained by the RT"; 2) "Where remove you the Lorentz transformations to?"; 3) "No relativistic paradoxes exist".

To remove the first "barrier", we must remind to relativists that "stars and planets do not fall on the Earth with the refusal of crystal spheres". Therefore, two questions must clearly be separated: 1) whether there exists some phenomenon as such or not? and 2) whether some theory, which ascribes an explanation of this phenomenon to "own" achievements only, is valid or not? There can exist many different interpretations of the same concrete phenomenon, but in a <u>scientific</u> theory net results as well as starting principles and intermediate methods must all themselves be true as such!

The following remark must be made as to the second "barrier". First, the Lorentz transformations reflect the <u>ONE OF</u> mathematical invariants of the Maxwell equations in emptiness only. Second, mathematics does not determine physical principles at all: a property of an invariance is fully defined by the mathematical form of the equation. Third, the light propagation in vacuum is some particular physical phenomenon, and it does not be worth to overstate its generality. You see, the all-universe conclusions do not follow from other particular phenomena (heat conduction, for example). Even the speed of light in real mediums cannot be determined by the single scalar constant c, not to mention the fact that, generally speaking, perturbations in any medium propagate with a speed of sound. The latter speed does not be determined by the single constant also, but it depends on properties of the medium (up to anisotropy). It is obvious that it is impossible to fit all properties of the entire World under the single scheme of invariance. Besides "properties of emptiness", many other items are involved even in the light propagation process: the great variety of properties of mediums, an interaction with devices etc.. Any process becomes specific.

As to the third "barrier" we note the following. Usually arguments of opponents of the relativism are imitated by relativists as naive ones. However, the real situation is not so cheerful even if we shall analyze the professional apologetics of the RT [1] (see the last version and translations into some languages at http://www.antidogma.ru), where the complete lack of logical and experimental groundings for SRT and GRT was proved. This article presents the critical analysis of some relativistic statements.

2. Criticism of Some Aspects of the RT

If the search of relationships of cause and effect is believed to be one of the goal of sciences, then the important positive moment of the classical approach consists in a separation of an object under investigation from the rest of the Universe. For example, in the overwhelming majority of cases "the motion of observer's eyes" does not exert any noticeable influence on a concrete proceeding process and, so all the more, on the rest of the Universe. Certainly, there exist "seeming effects", but to concentrate just upon the process under study, they can be eliminated by the graduating of devices, recalculations etc.. The classical kinematic notions was actually introduced by Newton just for the determina-

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tion of registration points and standards independent of the process under investigation. This founds the grounds for the common description of different phenomena, for the joining of various fields of knowledge and for the simplification of the description. Also the classical notions intuitively coincide with ones given to us in sensations: it is stupid not use they – it equals "to try to go by ears". A centuries-old development of sciences (from ancient Greeks) shows that the classical kinematic concepts lead neither to internal logical contradictions nor to discrepancy with experiments.

The RT tries to bind space and time into some indivisible object; i.e. besides the kinematical notion of "velocity", there occur an additional relation which is not connected with the process under investigation at all. In so doing it is claimed that properties of such a space-time object are firstly connected with the speed of light in the vacuum (why not with all other velocities), and, secondly, are dependent on an observer's motion. The last dependence is claimed as not to be an apparent, but a real effect. It is quite strange that the decision of an observer to change it's velocity leads instantly to change properties of the rest of the Universe, not to mention the fact that there can be many different observers, and for the same space point we shall have absolutely different allegedly real characteristics. To hide the obvious error, the phrase about "one-to-one relation between the Newton and Lorentz coordinates" is to be delivering. However, different mathematical relations can be introduced as many as you like, but no guarantee exists that chosen transformations possess any physical sense.

Attempts look naive when "explanations" of different versions of the classical twins paradox are "made" with artificially fabricated auxiliary diagrams. Physics and mathematics are "slightly" different sciences to put it mildly. Possible, someone could be interested how pure geometric drawings (a rhombus, a parallelogram, a triangle etc.) can be turned or transformed to pseudo-scientifically rescue the SRT. But these recommendations resemble the proud INSTRUCTIONS "how one can scratch the right-hand ear with the left-hand heel, when this leg is twice wound round the neck, and can provoke the same sensations (they must be elucidated beforehand!) as the normal man (which satisfies his requirements in more natural manner). But even for such "a state of affairs", the following fact is remarkable. In classical physics any logically consistent way leads to the same objective result (each observer can imagine reasoning of any other observer and even appropriates they). The matter is quite different for SRT: it is "necessary" to arbitrarily postulate some reasonings from absolutely single-type ones as false (i.e. there occur the fitting the choice of a way to the classical result). The resulting theory is "surprising": "here we read, here we do not read, here we turn over a page by this manner, here we turn inside out by that manner", and, as it is sung in the song: "and in other things, the beautiful marchioness, a nice how-d'ye-do...". It is concocted artfully. Generally speaking, such "the methods of pseudo-scientific exorcisms" can veil problems for study of two points which are moving along the one straight line only. Real problems arise if the number of observers is great than two, or we have a three-dimensional motion. For example, there occurs that the age of an object A is equal to the age of an object B, the age of an object B is equal to the age of an object C, but the ages of objects A and C are different.

Now we consider the following construction. We can offer to inscribe a regular n-gon into a circle of the large R ($n \geq 3$; stationary observers are placed at all angles) and to consider pure rectilinear motions of spacecrafts with astronauts along the sides of the n-gon. The situation is fully symmetrical. Even the same loops for using the same acceletations (to gather the equal large speeds) can be joined to the angles of the n-gon in the identical manner. For example, we choose these accelerations to be equal to the acceleration of free fall on the Earth g. Then, the driving at high relativistic speed requires about one year (but all the distances can be chozen much more: 100 or 1000 light years). It is obvious that neither "accelerated ageing" nor "accelerated rejuvenation" can occur during this year (we can remember the equivalence of accelerated systems and systems in gravitational field from the general relativity theory: just now we have conditions which are analogous to the usual Earth conditions!). The schedule of velocities and accelerations is chosen the same beforehand (all spacecrafts are always "situated" at some sphere with the center of the circle). Because of vector character of quantities, all relative velocities and accelerations will be different in pairs. By the opinion of some selected astronaut, each another astronaut must grow old to a different age (and this takes place from the viewpoint of each astronaut), which is impossible (all astronauts can photograph themselves before each acceleration and after it). Obviously, all these inertial systems of the spacecrafts are absolutely identical for a stationary observer (at the center of the circle, for example). The source of synchronizing signals can be placed at the center of the figure [1]. The course of time is the same for all spacecrafts in spite of different relative motions of the spacecrafts. We can also draw the obvious symmetric scheme of "a flower type" with the possibility of the simultaneous start and finish of astronauts at the center of the circle (see Fig. 1).

Notice that no speed is determined in the Michelson experiment at all, but some remainder of phases of rays is observed (and we can indirectly judge by the speed only). Generally speaking, before using a "device", the latter must be tested and graduated under laboratory conditions – we must know what can be measured by it? (But the present situation was as in the anecdote: -"Test device, Pete", -"Three!", -"What means

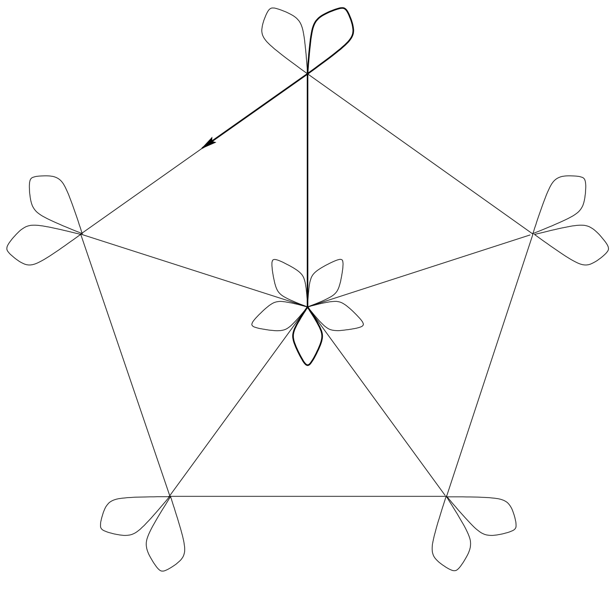

Figure 1: The symmetric model of "a flower".

"three"?", -"But ... what is a device like?") Imagine that somebody were "create" the following "theory": due to the Earth's axial rotation a constant wind with the value of about 400 m/s might be observed along terrestrial parallels. Measuring it by weathercocks with rotators, it would be obtained that the wind is permanently varying within the broad limits both in the direction and in the value depending on time and place. The "conclusion" would be made from this that the atmosphere is absent at the Earth at all. Of course, the theory would be complicated in the case of partial entrainment of the ether (for some local experiments an ether entrainment can practically be complete inside the narrow boundary layer). However, this fact in no way disproves the ether hypothesis (but relativists, like a drunkard under a street lamp, call to seek not there where it can be really found, but simply there where it were easily to look). Even ether were fully entrained by solid and liquid bodies, analysis could not be simple. In this case it is necessary to develop a theory of a transition layer between bodies and a theory of boundary ether layer for gases depending on gas density (for example, we could not dealing with the Earth's orbital speed of 30 km/s as such in Michelson's experiment).

Note that if some mathematical equation is invariant relative the transformations of Lorentz type with some constant c', it means only that among particular solutions of this equation there exist "surfaces" of wave type which can propagate with the velocity c'. However, in this case even the given equation can have other particular solutions with other own invariant transformations, to say nothing of other mathematical equations, i.e. no overall mathematical conclusions do not follow from the fact of invariance. Only relativists try "to blow the big soap-bubble" from the particular phenomenon.

It is obvious also that physical restrictions on the value of speeds cannot be applied by mathematics (by the fact that in some expressions there exists a negative value under the radical sign). It should be remembered that all SRT expressions are introduced with use of a light signal exchange (the method of Einstein's synchronization). But if a body moves faster than light long since, it simply cannot be caught up by signal sent in pursuit. In a similar manner, a synchronization can be made with use of sound (expressions with radicals could be written), but the impossibility of supersonic speeds in no way follows from here at all.

Consider the following mental experiment. Let three observers at points A, B and C be placed at one stright line. Let the distance $|AB|$ be equal to the distance $|BC|$. A periodical synchronizing source O is placed at the middle perpendicular OB. The distance $R = |OB|$ is very great. Note that all points are in the relative rest and this synchronizing procedure (from the remote source) is valid in the SRT also. As the result of such the synchronization, a precision of the synchronization at the all three points A, B, C can be made an arbitrary small value by choosing the appropriate large value of R. Let there be radioactive sources at end points A and C radiating particles at speed $0.9c$. With receiving signal from O, screens at points A and C are simultaneously opened. Particles from the points A and C fly to the central point B towards each other. The observer at the point B will see that the space between the two beams of particles are to be "eating up" with the speed of $0.9c + 0.9c = 1.8c$. With the same speed particles will "get one's teeth into other's body". Just this speed is the speed of the particle's collision. But the relativistic law of the velocity addition bears no relation to the reality at all. In the relativity theory many additional, but really fictive, reaction channel arise as the result of erroneous ascribing reactions at different conditions to the reactions at the same conditions.

Generally speaking, the properties of light, which are intrinsically contradictory and mutually exclusive, are simply postulated in SRT. It is not worth to extol the role of light signals and all "visible things"; otherwise a teaspoon inside a glass with water could be considered as the broken one (pure geometrically, the fallacy in this consideration can easily be tested by the direct location of coordinates of all "teaspoon outlets" at the boundary of the liquid).

The following methodological remark concerns the terminological forgery, frequently committing by relativists (one of "methods" of the self-affirmation by deception). So, terms with a value of c in the denominator (for example, v/c, etc.) came to be called "relativistic" ones, though such the terms frequently appear in the classical case as well, and, at the least, it is necessary to compare analytical expressions for the analogical terms in the classical and relativistic cases. Such the situation of deception takes place in the case of radar observations of the Venus: the rumour was set about an alleged new (?!) confirmation of the SRT, though the pure classical formulae were used (see [2]).

We concentrate our attention on the fact that the energy acquired in a unit time by a particle in its passage through an electromagnetic field region can be described by one and the same formula $(dE_k/dt) = e\mathbf{E}\mathbf{v}$ both in the classical and in the relativistic cases [3]. This fact provide one of causes for the "near-successful" calculation of accelerators. The same "events" and readings of devices are simply related to different scales of energy (more precisely, to different combinations of letter symbols) in the classical and relativistic cases. However, even the situation in relativistic dynamics is not unclouded (though theorists fanatically believe that their written "flourishs" bear a direct relation to the Reality): no one accelerator reachs the rated capacity on "ideal" theoretical calculations. Phenomenological formulae and "fitting" parameters and factors are used in the majority of cases for practical courses and engineering calculations.

We will make the following note. On what values can forces be dependent (and, from a conceptual point of view, in what a matter does the distinction of Newton's approach from the Aristotelian one lie)? An interaction of bodies leads to a change of the bodies' state. It is necessary to choose an "indicator" of this change. Aristotel believed the rest as the basis state, and he chose to observe the velocity of body's motion, as an indicator, i.e. $\mathbf{v} = \mathbf{f}(t, \mathbf{r})$ (Aristotel connected the value of $\mathbf{f}(t, \mathbf{r})$ with a force, provoking motion). The choice $\mathbf{v} = \mathbf{f}(t, \mathbf{r})$ is quite sufficient, if we will be satisfied with contemplation. However, if we would try to construct the dynamics of motion, so, after mental Galilean experiment, it became clear that the Aristotelian concept of the force was not conformed to the Reality. Though, strictly speaking, this conclusion is tied to the faith of relativists of "the first wave" - Galilean followers - in existence of empty space (Galilei by itself considered isolated identical systems only and, by contrast to his "pseudo-followers", he not disseminated his principle to mutually penetrating reference systems). If ether exists, the Aristotelian rest is locally tied to the ether, which has no necessity to be "uniformly immovable" as a whole at all, but can participate in complex vortical movements. For example, there exists the theory of vortical dynamics of the solar systems, and a force is only required to maintain motion, which is differ from equilibrium one. However, the analysis of vortical dynamics is not included in our plan, and so, we will use the statements generally accepted in the present state. The Newtonian choice for the description of bodies' interaction is different – an "indicator" of change of body's state is chosen its acceleration. Factually, the Newton second law presents a definition of the notion of "a force", and, from a standpoint of functional dependence, the force coincides with the acceleration within a dimensional factor (mass). Ideally, this way of a motion description (in the habitual form) must be written as $m\mathbf{a} = \mathbf{F}(t, \mathbf{r}, \mathbf{v})$. However, the problem of finding the explicit expression for such the "ideal" forces $\mathbf{F}(t, \mathbf{r}, \mathbf{v})$ is not yet solved for the case of arbitrary configurations and motions of a body, a force source and a medium, for example, based on expressions for statical forces. Nature does not easily unravel its secrets for us: instead of the ideal expression for the force, we are obliged to use an expression that we found $\mathbf{F}(t, \mathbf{r}, \mathbf{v}) = \mathbf{F}_1(t, \mathbf{r}, \mathbf{v}, ...)$. Thus, generally speaking, the real forces should be determined from the experiment. Here we are interested in the fact that the relativistic equation of motion with the Lorentz force $\mathbf{F}(t, \mathbf{r}, \dot{\mathbf{r}})$ can be written as the classical second Newton's law with the force $\mathbf{F}(t, \mathbf{r}, \dot{\mathbf{r}}, \ddot{\mathbf{r}})$. (We note that starting from the Maxwell equations it can strictly be obtained not the Lorentz expression for forces, but the other one [4].)

Though the following methodical remark concerns kinematics first, it touches also upon the GRT and the relativistic dynamics as well. The problem is setted in [3]: to describe the motion of the system under investigation, which is uniformly accelerated relative to the own inertial system (the latter is instantly in the rest relative the system being investigated). A reader can have the natural question: whether the motion, which is uniformly accelerated relative to one inertial system, can really be nonuniformly accelerated ralative to the other inertial systems or not? Unfortunately, in the SRT the situation turns out just the same (we are lucky that the relativity theory practically not use higher derivatives, except the description of radiation, otherwise we could see many new "peculiarities"). However, what will we have with the equivalence principle: in one inertial system there exists an equivalence to some gravitational field (constant), but in the other inertial system in the same space point were we be having the changed gravitational (physical!) field? To "see" the flight of cobble-stones as balloons, with what a speed must the observer fly? But if we will attach the dynamometer to such the uniformly accelerated rocket and hang up a weight to the spring, then, whether differently moving (but with some constant velocities) observers would see that the dynamometer pointer show different Arabic cipher or not?

Some investigators have doubts even on the conventional Lebedev experiments (on the existence of the light pressure): firstly, some comets fly with tail forward to the Sun; secondly, evaluations show a too small effect, but a considerably greater value for the radiometrical effect.

Since modern apologists of relativism abandoned the visualization and the principal necessity of medium's models for the light propagation, the way of generalization of Maxwell's equation becomes not uniquely defined even for the "absolute emptiness" in the case of non-monochromatic light, not to mention the passage to real nonlinear madia (including properties of "intermolecular emptiness", mechanisms of absorption and the light reradiation by moleculs etc.). From pure mathematical considerations and without physical principles, such generalizations can be introduced as much as you desire, and all of them are equal in rights.

It should be further mentioned that the Ritz hypothesis predicts for binary systems not only a phase modulation of the signal received, but an amplitude one as well (as the result of the varying speed of light propagation, in a fixed space point there occur a pulsation of an intensity due to superposition of light which was emitted at different time instants). As this takes place, the ralative intensity of pulsation increases with the distance to the binary system. The frequency of pulsations also increases (to some limits). Some authors [5] believe that the "existence" of quasars and pulsars is one of proofs of the Ritz hypothesis. Really, the smallness of their pulsation period (sometimes less than one second) testifies to the compactness of these objects, but the emitted radiant power (taking into account their remoteness) testifies against the first assumption. And either we must thoroughly test the Ritz hypothesis, or it remains to believe in modern fantastical (non-verifiable) versions.

Now we note on the experimental substantiation of the GRT. Usually, even there exists a hundred different data, a theory is constructed not always: the data can simply be tabulated in a table. But in the case of the GRT we see "the Great theory of three and half observations", three of which are the fiction. Concerning the light deflection from rectilinear motion in a gravitational field, we should make the following statements. First, as it was pointed out by many experimentalists, a quantitative verification of an effect essentially depends on the faith of the concrete experimentalist. Second, even from the classical formula $m\mathbf{a} = \gamma mM\mathbf{r}/r^3$ it follows that any "object" (even of zero or negative mass) will "fall down" in the gravitational field. Just this value was firstly be derived by Einstein (the result was corrected at coefficient of "2" later). Third, with which a value does the effect be compared? With a value in empty space? As early as 1962, a group of Royal astronomers declares that the light deflection near the Sun cannot be considered as confirmation of GRT, because the Sun has an atmosphere stretching for a great distance. We would remind that the effect of refraction is long taken into account by astronomers for the terrestrial atmosphere. Lomonosov discovers the deflection of a light beam in the atmosphere of the Venus long ago. For explanation, imagine a glass sphere. Naturally, parallel rays (from distant stars) will be deflected to the center in it. Such a system is well known as an optical lens. The similar situation will take place for a gas sphere (the Sun's atmosphere in a central symmetric gravitational field).

The displacement of the perihelion of Mercury is, of course, a remarkable effect, but whether the sole example is insufficient "to attract" a scientific theory, or not (see [1])? Calculating the perihelion displacement in GRT (from the rigorous solution for a single attractive point), the impression is given that we know astronomical masses exactly. If we use GRT as a correction to Newton's theory, the situation is in fact opposite: there exists a problem knowing visible planet motions to reestablish the exact planet masses (to substitute the latters and to check GRT thereafter). Since the GRT-corrections are much less than the perturbation planet actions and the influence of a non-sphericity, the reestablishment of exact masses can essentially change the description of a picture of the motion for this complex many-body problem. No such detailed analysis was carried out.

Generally speaking, the situation with description of the displacement of the Mercury's perihelion is typical for relativist's behaviour. First, it was declared that the effect was predicted, but Einstein compares it with the well known results of approximate calculations, which was produced by Laplace long before origin of the GRT. Hope, each man understands a great difference between "predict" and "explain after the event" (remember the appropriate anecdote of Feynman). Second, there exists the most part of precession already in classical physics: the data of 19th century was found with taking into account influences of some planets. The result obtained was the value of 588", whereas a deficiency in the calculated value make up about 43" only, that is a small correction. (Note, that some data of 20th century indicate the total value of precession to be about 10 times higher than mentioned one, but the "deficiency for GRT" in 43" is maintained - "taboo"; nevetheless, it could be a misprint and we will not cavil to 1/3 of "the great experimental base of GRT"). Third, the exact calculation for a many-body problem cannot yet be made even by the modern mathematics. In classical case the calculation was made as a sum of independent corrections from influences of separate planets (the Sun and planets were considered as material points). Naturally, the classical net result (more than 90 % from observable one!) can some more be improved with taking into account the solar non-sphericity, influences of all planets (including small bodies) of the solar system, the fact that the Sun is not a solid object (a material point) and its local density in different layers must "follow" influences of other moving planets. Most probably, this way of using real physical mechanisms can lead to obtaining the deficient small effect. But the relativist's declaration is inconceivable speculation! They "found" an effect (the small procent only) considering motions of two material points only - the Sun and the Mercury. Sorry, and what will a correction be made with the GRT for the most part of the effect obtained classically? Do you fear to

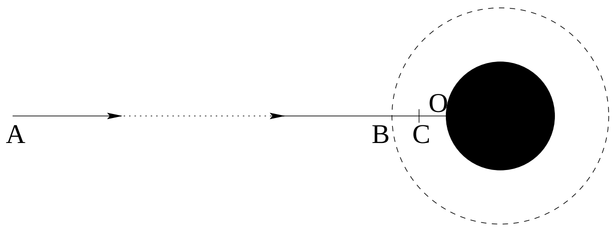

Figure 2: The fall on a "black hole".

calculate? Then on what "a brilliant coincidence" do you repeat? It is the pure machination to a desired result!

We are reminded that in finite moving (periodic, for example) different resonance phenomena can be observed for a coupled many-body system. The effect is manifested in a conforming correction of orbital parameters (especially taking into account a finite size of bodies: non-sphericalness of their form and/or of the mass distribution).

The prototype of the "black hole" in Laplac's solution, where the light, moving parallel to the surface, begins to move over a circle like the artificial satellite of the Earth, differs from the GRT ideas. Nothing prohibits the light with a rather high energy to escape the body in the direction perpendicular to its surface. There is no doubt, that such beams will exist (both by internal and external reasons): for example, the beams falling from outside will be able to accumulate energy, in accordance with the energy conservation law, and to leave such a "black hole" after reflecting. Instead of invoking contradictory properties of light, we simply consider the "fall" of an elementary particle – an electron, for example. Whether the possibility of the elastic reflection is maintained for it, or such the possibility must postulatively be forbidden (to rescue the GRT)? And if such the possibility is not forbidden, then we consider the following process. Let an electron be coming into fall with the zero start velocity from a distant point A (at the distance 100 a.u., for example) to a very massive body (Fig. 2).

The body absorbs "last surplus nearest molecules" and becomes the "black hole" in a matter of an instant before the electron crosses the Schwarzschild sphere (which is marked as B on the picture). To be visual, the distance $|OB|$ is shown comparatively large. In a matter of an instant before the collision of the electron with the surface of the "black hole" the latter object was stable, and since neither velocity nor acceleration of this surface can instantly become very large (besides, the collision can take place with a particle flying to meet), then at the elastic collision the electron will fly to the point A with just the same speed as it acquires before the collision. Relativists claim that it cannot get over the Schwarzschild sphere B. Let it come to a stop at the point C (at the distance 10 km from the body center, for example). If the energy conservation law is obeyed, and since the electron's velocity equals to zero at the points A and C, then the potential energy of the electron at the point A is equal to the potential energy at the point C. Therefore, the gravitational field (attractive forces) is absent between the points A and C, or else the potential might be monotonically decreasing. However, the consideration of the situation from the pure GRT positions leads to the still worse result [1]. The "black holes" in GRT is a real mysticism. Even from the GRT viewpoint follows the impossibility of observation of "black holes": the time of the "black hole" formation will be infinite for us as remote observers. Even if we were waited till "the End of the World", no one "black hole" could have time to form. And since the collapse cannot be completed, the solutions, which consider all things as though they have already happened, have no sense. The separation of events by infinite time for internal and external observers is not "an extreme example of the relativity of the time course", but the elementary manifestation of the inconsistency of Schwarzschild's solution. The same fact follows from the "incompleteness" of systems of solutions. Thus, such the GRT objects as the "black holes" cannot exist and they must be transfered from the realm of sciences to the province of the non-scientific fiction. All the Universe is evidence of the wonderful (frequently dynamical) stability: there do not exist infinite collapses (an explosion can happen sooner). All this does not cancel a possibility of the existence of superheavy (but dynamically stable) objects which can really be manifested by several effects (for example, by accretion, radiation etc.). No the GRT fabrications are required for these purposes at all. We have no need to seek ways for the artificial rescue of the GRT, such as the "evaporation of the black holes", since such a possibility is strictly absent in the GRT (the speed of light cannot be overcome). On the contrary, in classical physics no problems exist at all.

On the new relativistic interpretation [6] of the gravitational displacement of optical lines we note the following (see also [1]). It is easy to take refuge in resonance effects (the presence of radiation lines), but if do we consider transitions to the continuous spectrum? Where does the continuous spectrum know the path passed by the photon from? And we must take into account that not each photon "falling" on an atom will be absorbed, but some photons always fly past just the same place "become blue" which waited for them. And if is any medium absent at all? Let a photon leave the "black hole", for example. It fly itself with the same energy, and places, which it flies by on the way, "become more and more blue" all the time. A fine poetry!

The situation with the red shift in spectra of astronomical objects does not be finally clarified. In the Universe there exists a considerable number of objects with quite different shifts in different spectral regions.

Generally speaking, since distances to remote objects do not directly measured (the calculated result is connected with some hypotheses), then their relation with the red shift is hypothesis also (for which it is unknown what the matter could be verified).

It seems rather strange that some relativists declare a possibility and necessity of the experimental verification of an "allegedly existing" space curvature (for our sole Universe!): but relative what could this curvature be measured? Experiments can note happening variations with physical values only (the method of comparison with the standards).

There exist hypotheses of gravitational influence on the inert mass (and, therefore, on inertial forces, which arise in a rotating whipping top, for example). There arises a question (as some manifestation of relativistic cliches inculcated us): relative what must the rotation be determined? There exists a practical method principally to verify an inertial system. Since we can define the **variation** of a state (an extension of a spring between two rotating balls, for example) relative some other previous state only, it can be affirmed that the extension (due to an action of the centrifugal force) will be minimal for some frequency of rotation (naturally, considering the possible change in the direction of rotation). If this state of minimal extension is maintained independently on orientation of rotation axis, then we have some inertial system. The question, whether it will be the heliocentric system or other one, cannot be solved from pure theoretical considerations for our sole Universe (it is no sense to abstract theorize: it is practically impossible to remove almost all bodies from the Universe). It is obvious that inertial forces have the same mathematical form, and we can discuss a dependence of the inert mass itself on gravitation only. Probably, any detectable dependence of the inert mass on the direction of the resulting gravitational vector is impossible (alternatively, rotating liquids in the state of weightlessness could not be observed as ellipsoid of rotation, for example). Any noticeable dependence on the absolute value of the resulting gravitational vector is also improbable: in the opposite case calculations of motion of comets, asteroids and meteorites were differ from accepted data by exponents (but it is not the case). At first, to discuss a dependence of the inert mass on the value of the total gravitational potential (for small variations in motion at great distances), it is necessary to define, from the all-physical and general-philosophical viewpoints, what meaning of the zero level of this potential, and what the method of its determination in our sole Universe (to make some quantitative evaluations). It seems reasonable to say that this dependence of the inert mass cannot also be appreciable (see the discussion on the Mach principle in [1]). But, in the general case the problem can principally be solved by experiments only.

3. Conclusions

The ultimate conclusion of the article consists in the necessity of returning to classical notions of space and time, to the classical meaning for all derivative values, in the necessity of returning to the classical interpretation of all dynamical concepts.

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NON–NEUMANNIAN REPRESENTATIONS OF ROTATION GROUP (TO THE ETHER THEORY). 2

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Here we continue to consider the infinite dimensional irreducible multivalued non-unitary representations of the rotation group $SO(3)$ behind which a new physical reality called pre-matter (bi-Hamiltonian matter or ether) stands. Here non-Neumannian representations of the $GL(2,C)$ group and connected with it monoid $M(2,C)$ are considered in details.

6. Non-Neumannian Representations of Rotation Group (Effective Construction)

Further we use concrete realization of $U(2)$ representations and its complexification $GL(2,C)$ connected with formulas (2)-(4) (see [1] further called as Part 1[2]).

i) First of all every regular element $g = \begin{pmatrix} \alpha & \beta \\ \gamma & \delta \end{pmatrix} \in GL(2,C)$ $(\delta \neq 0)$ may be written in the form of Gaussian decomposition $g = n_+ h_\Delta n_-$ where $n_+ = \begin{pmatrix} 1 & \beta/\delta \\ 0 & 1 \end{pmatrix} = e^{(\beta/\delta)\sigma_+}$, $h_\Delta = \begin{pmatrix} \Delta/\delta & 0 \\ 0 & \delta \end{pmatrix} = e_\Delta h$, $e_\Delta = \begin{pmatrix} \Delta & 0 \\ 0 & 1 \end{pmatrix} = e^{(\sigma_0+\sigma_3)\theta/2}$, $h = \begin{pmatrix} \delta^{-1} & 0 \\ 0 & \delta \end{pmatrix} = e^{-\sigma_3 \ln\delta}$, $n_- = \begin{pmatrix} 1 & 0 \\ \gamma/\delta & 1 \end{pmatrix} = e^{(\gamma/\delta)\sigma_-}$ and $\Delta = det g = \alpha\delta - \beta\gamma = e^\theta$ (here θ is a complex number).

Here the following matrix notations are used: $\sigma_+ = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$, $\sigma_- = \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}$, $\sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$, $\sigma_0 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$,

Due to the local isimorphism between $T_\lambda(g)$ and g[3] we may write $T_\lambda(g) = T_\lambda(n_+)T_\lambda(e_\Delta)T_\lambda(h)T_\lambda(n_-)$, where

$$T_\lambda(n_+) = e^{(\beta/\delta)T_\lambda(\sigma_+)} = e^{(\beta/\delta)L_+^{(\lambda)}}, T_\lambda(e_\Delta) =$$
$$= e^{(T_\lambda(\sigma_0)+T_\lambda(\sigma_3))\theta/2} = e^{(L_0^{(\lambda)}+2L_3^{(\lambda)})\theta/2}, \tag{1}$$

$$T_\lambda(h) = e^{-T_\lambda(\sigma_3)\ln\delta} = e^{-2L_3^{(\lambda)}\ln\delta}, T_\lambda(n_-) =$$
$$= e^{(\gamma/\delta)T_\lambda(\sigma_-)} = e^{(\gamma/\delta)L_-^{(\lambda)}} \tag{2}$$

are 1-parametric subgroups.

We have (see Part 1 and footnote 1):

$$L_+^{(\lambda)} = \zeta, \quad L_-^{(\lambda)} = -\zeta\frac{d^2}{d\zeta^2} + 2\lambda\frac{d}{d\zeta},$$
$$L_3^{(\lambda)} = \zeta\frac{d}{d\zeta} - \lambda, \quad L_0^{(\lambda)} = 2\lambda. \tag{3}$$

Of course we have to distinguish the group unity $e = g^0$ from the σ_0 because $T_\lambda(e) = 1 \neq T_\lambda(\sigma_0) = 2\lambda$.

Let us act on the junior Cartan vector $f_0^{(\lambda)}(\zeta) = 1$ by operator $T_\lambda(g)$. As $L_-^{(\lambda)} f_0^{(\lambda)} = 0$ so we may write $T_\lambda(g)1 = \delta^{2\lambda}e^{(\beta/\delta)\zeta} = \kappa_\lambda(\zeta; g)$. The latter as a function on the group is the orbit of element $f_0^{(\lambda)}$. For regular g $(\delta \neq 0)$ it is wholly situated in the space of generalized functions of exponential type $F_\lambda^{'}$ which includes (in our realization) all entire analytical functions of complex variable ζ of order $\rho \leq 1$ and type $0 \leq \tau < \infty$, see [2].

In fact let us decompose the function $e^{(\beta/\delta)\zeta}$ into series over functions of canonical basis $f_n^{(\lambda)}$ (see [2]): $e^{(\beta/\delta)\zeta} = \Sigma_{n=0}^{\infty}(-i\frac{\beta}{\delta})^n \sqrt{\frac{\Gamma(n-\lambda)}{n!}} f_n^{(\lambda)}(\zeta)$. Decomposition coefficients $a_n = (-i\frac{\beta}{\delta})^n \sqrt{\frac{\Gamma(n-\lambda)}{n!}}$ at $n \to \infty$ satisfy the condition $|a_n| \leq \left|\frac{\beta}{\delta}\right|^n < K^n$ where $0 \leq K < \infty$. Elements from $F_\lambda^{'}$ obey just such a condition (see Part 1).

ii)As is known if the representation $g \to T_\lambda(g)$ is irreducible so the orbit $T_\lambda(g)f$ of any element f is dense in carrier space F_λ'. Concerning to the junior vector 1 it means that linear envelope of infinite countable set of functions $e^{\tau_n\zeta}$ at any collection of in pairs

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[3]The isomorphism is setting by formula (σ_μ are the Pauli matrices): $T_\lambda(\sigma_\mu) =^{(\lambda)} \overline{\varphi}\sigma_\mu\varphi$, where φ, $\overline{\varphi}$ are determined in [2]: $\varphi = \begin{pmatrix} d/d\zeta \\ 1 \end{pmatrix}$, ${}^{(\lambda)}\overline{\varphi} = (\zeta, -\zeta d/d\zeta + 2\lambda)$.

inequaled complex numbers τ_n is dense in F'_λ. To convince of this we have to show that some function $f(\zeta) \in F'_\lambda$ may be approximated (in topology of F'_λ) by the series $\Sigma_n A_n e^{\tau_n \zeta}$, i.e. we can choose coefficients A_n so that difference $f(\zeta) - \Sigma_n A_n e^{\tau_n \zeta} = \varphi(\zeta) \in U_p(\epsilon)$, where $U_p(\epsilon)$ is a weak neighborhood of zero in F'_λ which is setting by vectors φ satisfying the condition $|< f_m, \varphi >_\lambda| < \varepsilon$. Here $\{f_m\}$ $(m < p)$ is any finite set of vectors in F'_λ and $< \cdot, \cdot >_\lambda$ is the form (4) (see Part 1). In particular as $\{f_m\}$ we can take $\{f_m^{(\lambda)}\}$, then weak neighborhood of zero is determined by seminorms $\left|< f_m^{(\overline{\lambda})}, \varphi >_\lambda\right| < \varepsilon$.

Let us denote $\left|< f_m^{(\overline{\lambda})}, f >_\lambda\right| = a_m (-1)^m \eta_m^{(\lambda)}$ where $\eta_m^{(\lambda)} = \frac{\overline{(\Gamma(m-2\overline{\lambda}))^{1/2}}}{(\Gamma(m-2\lambda))^{1/2}}$. By choice of A_n we may achieve that $< f_m^{(\overline{\lambda})}, \varphi >_\lambda = 0$ at $m = 1, 2, 3, ...p$. From the latter condition the equations for determining of A_n follow:

$$\Sigma_{n=0}^p A_n \tau_n^m = i^m \sqrt{\frac{m!}{\Gamma(m-2\lambda)}} a_m, \; m = 0, 1, 2, ...p. \tag{4}$$

Determinant of the system is the Vandermonde one

$$V_{p+1}(\tau_0, \tau_1, ..., \tau_p) = det \begin{vmatrix} 1 & 1 & . & . & . & 1 \\ \tau_0 & \tau_1 & . & . & . & \tau_p \\ \tau_0^2 & \tau_1^2 & . & . & . & \tau_p^2 \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ \tau_0^p & \tau_1^p & . & . & . & \tau_p^p \end{vmatrix} =$$

$$= \Pi_{n>m}(\tau_n - \tau_m), \tag{5}$$

which is not equal to zero because all τ_n are in pairs different. Therefore our system is solvable concerning A_n.

With A_n got by such a way the series $\Sigma_n A_n e^{\tau_n \zeta}$ approximates the function $f(\zeta) = \Sigma_{m=0}^\infty a_m f_m^{(\lambda)}(\zeta)$ in the sense of weak convergence in F'_λ.

iii) We define now the action of operator $T_\lambda(g)$ on the function $e^{\tau\zeta}$. As we can write $e^{\tau\zeta} = T_\lambda(n_+(\tau)) \cdot 1$, where $n_+(\tau) = \begin{pmatrix} 1 & \tau \\ 0 & 1 \end{pmatrix}$ so we have $T_\lambda(g)e^{\tau\zeta} = T_\lambda(gn_+(\tau)) \cdot 1$. As $gn_+(\tau) = n_+(g,\tau)h_\Delta(g,\tau)n_-(g,\tau)$ where

$$n_+(g,\tau) = \begin{pmatrix} 1 & \frac{\alpha\tau+\beta}{\gamma\tau+\delta} \\ 0 & 1 \end{pmatrix}, \; h_\Delta = \begin{pmatrix} \frac{\Delta}{\gamma\tau+\delta} & 0 \\ 0 & \gamma\tau+\delta \end{pmatrix},$$

$$n_-(g,\tau) = \begin{pmatrix} 1 & 0 \\ \frac{\gamma}{\gamma\tau+\delta} & 1 \end{pmatrix}, \; T_\lambda(n_-(g,\tau)) \cdot 1 = 1,$$

so we obviously obtain [2]:

$$T_\lambda(g)e^{\tau\zeta} = (\gamma\tau+\delta)^{2\lambda} exp(\frac{\alpha\tau+\beta}{\gamma\tau+\delta}\zeta) \tag{6}$$

iv) Define else the result of action of $T_\lambda(g)$ on arbitrary element of canonical basis $f_n^\lambda(\zeta)$ (see formula (3), Part 1). As $\zeta = L_+^{(\lambda)} = T_\lambda(\sigma_+)$ so we may write (for arbitrary function $f(\zeta)$) the formula $T_\lambda(g)f(\zeta) = f(T_\lambda(g)\zeta T_\lambda(g^{-1}))T_\lambda(g) \cdot 1 = f(T_\lambda(g\sigma_+ g^{-1}))\kappa_\lambda(\zeta; g)$ (κ_λ is above defined function). Here matrix $g\sigma_+ g^{-1}$ is $\frac{1}{\Delta}\begin{pmatrix} -\alpha\gamma & \alpha^2 \\ -\gamma^2 & \alpha\gamma \end{pmatrix} = \frac{1}{\Delta}(\alpha^2\sigma_+ - \gamma^2\sigma_- - \alpha\gamma\sigma_3)$.

As $T_\lambda(\frac{1}{2}\vec{\sigma}) = \overrightarrow{L^{(\lambda)}}$ (see (2), Part 1), so we have

$$T_\lambda(g\sigma_+ g^{-1}) = \frac{1}{\Delta}(\alpha^2 L_+^{(\lambda)} - \gamma^2 L_-^{(\lambda)} - 2\alpha\gamma L_3^{(\lambda)}) = \frac{1}{\Delta}[\alpha^2\zeta + \gamma^2(\zeta\frac{d^2}{d\zeta^2} - 2\lambda\frac{d}{d\zeta}) - 2\alpha\gamma(\zeta\frac{d}{d\zeta} - \lambda)].$$

Let us denote $\Phi = \frac{\beta}{\delta}\zeta$. Then we may write

$$T_\lambda(g\sigma_+ g^{-1}) =$$

$$= \frac{\beta\gamma^2}{\Delta\delta}[\Phi(\frac{\alpha\delta}{\beta\gamma} - \frac{d}{d\Phi}) + 2\lambda](\frac{\alpha\delta}{\beta\gamma} - \frac{d}{d\Phi}) = D. \tag{7}$$

Now it is not difficult to define the action of $T_\lambda(g)$ on ζ^n. We have

$$T_\lambda(g)\zeta^n = D^n \kappa_\lambda(\zeta, g) =$$

$$= \delta^{2\lambda}(\frac{\beta\gamma^2}{\Delta\delta})^n\{[\Phi(\frac{\alpha\delta}{\beta\gamma} - \frac{d}{d\Phi}) + 2\lambda](\frac{\alpha\delta}{\beta\gamma} - \frac{d}{d\Phi})\}^n e^\Phi. \tag{8}$$

Here right hand side may be represented in the form of $\delta^{2\lambda}P_n^{(\lambda)}(\frac{\Delta\Phi}{\beta\gamma})e^\Phi$, where $P_n^{(\lambda)}(x)$ is a polynomial about $x = \Delta\Phi/\beta\gamma$ of degree n. As on definition we have $D(P_n^{(\lambda)}(\frac{\Delta\Phi}{\beta\gamma})e^\Phi) = P_{n+1}^{(\lambda)}(\frac{\Delta\Phi}{\beta\gamma})e^\Phi$ so we come to the following relation between polynomials $P_n^{(\lambda)}(x)$:

$$\frac{\gamma}{\delta}[x\frac{d^2}{dx^2} - 2(x+\lambda)\frac{d}{dx} + x + 2\lambda]P_n^{(\lambda)}(x) = P_{n+1}^{(\lambda)}(x).$$

If to put $P_n^{(\lambda)}(x) = (-\frac{\gamma}{\delta})^n n! Q_n^{(\lambda)}(x)$, so the above obtained relation may be written in the form:

$$[x\frac{d^2}{dx^2} - 2(x+\lambda)\frac{d}{dx} + x + 2\lambda]Q_n^{(\lambda)}(x) = -(n+1)Q_{n+1}^{(\lambda)}(x).$$

The same relation takes place for the Laggere polynomials $L_n^{(-2\lambda-1)}(x)$.

In fact from the equation for $L_n^{(\alpha)}(x)$:

$$[x\frac{d^2}{dx^2} + (n+\alpha+1-x)\frac{d}{dx} + n]L_n^{(\alpha)}(x) = 0$$

and recurrent relation

$$[x\frac{d}{dx} + (n+\alpha+1-x)]L_n^{(\alpha)}(x) = (n+1)L_{n+1}^{(\alpha)}(x)$$

(see [3]) we get

$$[x\frac{d^2}{dx^2} - 2(x - \frac{\alpha+1}{2})\frac{d}{dx} + x - \alpha - 1]L_n^{(\alpha)}(x) = -(n+1)L_{n+1}^{(\alpha)}(x).$$

Comparizing this relation with the previous (for $Q_n^{(\lambda)}$) one we see that it must be $-\alpha - 1 = 2\lambda$ and hence $Q_n^{(\lambda)}(x) = L_n^{(-2\lambda-1)}(x)$. Therefore we can write $T_\lambda(g)\zeta^n =$

$\delta^{2\lambda}(-\frac{\gamma}{\delta})^n n! L_n^{(-2\lambda-1)}(\frac{\Delta\zeta}{\gamma\delta})e^{\frac{\beta}{\delta}\zeta}$. As a result we come to the formula

$$T_\lambda(g)f_n^{(\lambda)}(\zeta) = \\ = \sqrt{\frac{n!}{\Gamma(n-2\lambda)}}\delta^{2\lambda}(-i\frac{\gamma}{\delta})^n L_n^{(-2\lambda-1)}(\frac{\Delta\zeta}{\gamma\delta})e^{\frac{\beta}{\delta}\zeta}. \quad (9)$$

Now for arbitrary function $f(\zeta) = \Sigma_n f_n \zeta^n$ we may write

$$T_\lambda(g)f(\zeta) = \\ = \delta^{2\lambda}e^{\frac{\beta}{\delta}\zeta}\Sigma_n f_n n!(-\frac{\gamma}{\delta})^n L_n^{(-2\lambda-1)}(\frac{\Delta\zeta}{\gamma\delta}). \quad (10)$$

v) It follows from formula (6) that at a fixed g operator $T_\lambda(g)$ is not defined on function $e^{\tau\zeta}$ when $\tau = -\delta/\gamma$, i.e. on the function $exp(-\frac{\gamma}{\delta}\zeta)$. It means that $D_{T_\lambda(g)} \neq F_\lambda^{'}$, so that $T_\lambda(g)$ are in general case unbounded operators on $F_\lambda^{'}$.

From all rest functions $e^{\tau\zeta}$ $(\tau \neq -\frac{\delta}{\gamma})$ an infinite countable function system $\{e^{\tau_n\zeta}\}$ dense in $F_\lambda^{'}$ may be chosen. Linear envelope $U[\{e^{\tau_n\zeta}\}]$ is included in the subspace of definition $D_{T_\lambda(g)}$ of operator $T_\lambda(g)$, i.e. $T_\lambda(g)$ at every g is dense defined operator on $F_\lambda^{'}$.

Complex plane $C \ni \tau$ (the point $\tau = \infty$ is considered to be always pricked out) without point $-\frac{\delta}{\gamma}$ is denoted $C(-\frac{\delta}{\gamma})$. Instead of δ we may use the parameter τ from $\tau = -\delta/\gamma$. Then we can say that the manifold $C(\tau)$ is associated with the set of elements $g_\tau = \begin{pmatrix} \alpha & \beta \\ -\frac{\Delta}{\alpha\tau+\beta} & \frac{\tau\Delta}{\alpha\tau+\beta} \end{pmatrix} \in GL(2,C)$ with arbitrary α and β.

vi) It follows from formula (7) that operator $T_\lambda(g_0)$ corresponding to the singular elements $g_0 = \begin{pmatrix} \alpha & \beta \\ \gamma & 0 \end{pmatrix}$ $\in \Delta^{'}$ are not defined on the functions of canonical basis $\{f_n^\lambda\}$. Therefore linear envelope $U[\{f_n^\lambda\}] \notin D_{T_\lambda(g_0)}$. More over such operators are not defined on the subspace of fit functions of exponential type F_λ which contains functions of order $\rho < 1$ and type $0 \leq \tau < \infty$. Hence, $F_\lambda \notin D_{T_\lambda(g_0)}$. However every operator $T_\lambda(g)$ corresponding to the regular element g $(\delta \neq 0)$ is defined on F_λ.

It is remarkable that none from more narrow subspace than $F_\lambda^{'}$ may be considered to be a carrier space for group $GL(2,C)$ in whole. For example, considering the Hilbert space $H_\lambda \subset F_\lambda^{'}$ including side by side with F_λ also the functions of order $\rho = 1$ and type $0 \leq \tau < 1$ we may define only that operators $T_\lambda(g)$ which correspond to the elements g satisfying the condition $\left|\frac{\alpha\tau+\beta}{\gamma\tau+\delta}\right| < 1$ and, of course, $|\tau| < 1$.

vii) Further when g runs the Gaussian area N_+HN_- $= GL(2,C) - \Delta'$ (i.e. $\delta \neq 0$) number β/δ runs the complex plane C (wuthout infinite far point), see above. In the formula (9) number β/δ determines the type of function $e^{\frac{\beta}{\delta}\zeta}$. It follows from here that none function from analytical functions about ζ of the order $\rho = 1$ includes in common subspace of definition $D(N_+HN_-) = \cap_{g\in N_+HN_-} D_{T_\lambda(g)}$ of operator $T_\lambda(g)$ corresponding to the Gaussian region. From (9) it follows also that $D(N_+HN_-)$ coinsides with F_λ. From other hand it follows from vi) that F_λ is not included in common region of definition $D(\Delta') = \cap_{g_0\in\Delta'} D_{T_\lambda(g_0)}$ of operators $T_\lambda(g_0)$, corresponding to the singular elements $g_0 \in \Delta'$. [4] Therefore we have $D(N_+HN_-) \cap D(\Delta') = \cap_{g\in GL(2,C)} D_{T_\lambda(g)} = 0$. Hence representations we considered are non-Neumannian ones.

viii) So far we have considered elements g taking their values from Gaussian area of the $GL(2,C)$ group. It turns out all our formulae may be continued to the Gaussian area of the monoid $M(2,C)$.

Under the multiplication law the set of all 2x2-matrices g forms monoid denoted $M(2,C)$. Here we consider only the subset of matrices g with $\Delta \geq 0$ which form the submonoid denoted $M^+(2,C)$. The latter contains the group $GL^+(2,C)$ of matrices g with $\Delta > 0$.

Subset in $GL^+(2,C)$ with $\Delta = 1$ is the special $SL(2,C)$ group. Special submonoid $J = \{g \in M^+(2,C) \mid detg = \Delta = 0\}$ possesses the property $JM \subset J$ and $MJ \subset J$. We call it the attractive submanifold [5] (see below). Hereby we have $M^+(2,C) = GL^+(2,C) \cup J$. Further elements of J are denoted j.

Contraction $GL(2,C) \to J$ arises under the condition when the space-time is too little (or there is not at all; such a situation takes place when the speceuscle , i.e. ether quanta or field $f(x)$ is pressed into the point, see [4]). Submanifold J plays very important role in the ether dynamics: at the contraction $GL(2,C) \to J$ ether field $f(x)$ (first component of the bi-Hamiltonian system belonging to the space F' more exactly to the subspace F) transmutes into the second one - field $\dot{f}(x)$ belonging to the space F' too (see below). Only after this quantum transition takes place (it is indeed the

[4] "Ideal" elements (vectors, functions) of the type $e^{\infty\zeta}$ are non-proper functions. Such functions as non-existing ones ($\notin F_\lambda'$) we have so far excluded from the rate domain $R_{T_\lambda(g)}$ of the operator $T_\lambda(g)$: usually one considers that operator may not remake the existing (true) vector into non-existing (false) one (namely it is a reason why the function $e^{-\frac{\delta}{\gamma}\zeta}$ does not enter into definition domain $D_{T_\lambda(g)}$ of operator $T_\lambda(g)$ where $g = \begin{pmatrix} \alpha & \beta \\ \gamma & \delta \end{pmatrix}$). However *material implication law* it seems permits to ramake false (non-existing) vector into true (existing) one. Then "ideal" elements of the type $e^{\infty\zeta}$ may be added to the definition domain D and function $e^{\frac{\alpha}{\gamma}\zeta}$ is not exclude from rate domain R (i.e. we have to connect D with $\overline{C} = C \cup \{\infty\}$ and R with C; hereby $\overline{C}$ and D become of course non-linear manifolds). The space with "ideal" elements is denoted $\widetilde{F_\lambda'}$ (it is the Frechet space still).

[5] In the ring theory (structures with two composition laws) subrings with this property are named ideals.

jump of $\dot{f}$ from the space F' into the complex conjugated space $\dot{F}'$).

If to prick out the submanifold Δ' described by equation $\delta = 0$ we get the Gaussian area $N_+H_\Delta N_-$ of $M^+(2,C)$ at $\delta \neq 0$. Hereby monoid $M^+(2,C)$ (and also submonoid J and groups $GL(2,C)$, $SL(2,C)$) decays into two open submonoid (subgroups) $B_+(\Delta)$ and $B_-(\Delta)$ called Borelean ones. Elements j from Gaussian area are written as $j = \begin{pmatrix} \frac{\beta\gamma}{\delta} & \beta \\ \gamma & \delta \end{pmatrix}$. Such j's form 3-dimensional complex manifold. Intersection $J \cap \Delta'$ is obviously 2-complex matrices $\begin{pmatrix} \alpha & \beta \\ 0 & 0 \end{pmatrix}$, or $\begin{pmatrix} \alpha & 0 \\ \gamma & 0 \end{pmatrix}$.

It is very important to notice that *symmetry properties* of observed (Lagrangian) forms of matter (fundamental particles) are described by the group $SL(2,C)$ (the condition $\Delta = 1$ means that there exist invariants of symmetry). Symmetry properties of space-time are described, hereby, by the factor-group $SL(2,C)/Z_2$ - by the Lorentz group $SO(3,1)$ (the Poincare-Minkowski metric is invariant under the latter). (Note that being connected with covering group, matter is more refined structure than the space-time continuum).

It is remarkable, that the *dynamical properties* of spinor fiber (dynamical structure of particle constituents or bi-Hamiltonian matter) are described by the group $GL(2,C)$ which permits the closure to the monoid $M^+(2,C)$. Hereby if submanifold J ($\Delta = 0$) is added to the group $GL(2,C)$ (by means of topological closure of the latter) so the manifold Δ' ($\delta = 0$) of so called singular elements must considered to be pricked out, i.e. in this case monoid $M^+(2,C)$ indeed decays into two open Borelean submonoid B_+ and B_-. Further we will consider representations of all these substructures in order to clear the situation.

ix) We begin to consider the simplest manifold - the Cartan subgroup H_Δ of diagonal matrices $h_\Delta = \begin{pmatrix} \Delta/\delta & 0 \\ 0 & \delta \end{pmatrix}$. It follows from (10) at $\gamma = 0$ that $T_\lambda(h_\Delta)f(\zeta) = \delta^{2\lambda} f(\Delta\zeta/\delta^2)$ where $f(\zeta)$ is an arbitrary function from the space F'_λ. We see that representation of H_Δ in F'_λ is reduced onto one dinemsional representations realized in one dimensional subspaces (see [2]).

At $\Delta = 0$ we have ($h_0 = \begin{pmatrix} 0 & 0 \\ 0 & \delta \end{pmatrix}$): $T_\lambda(h_0)f(\zeta) = \delta^{2\lambda} f(0)$, i.e. any function $f(\zeta)$ is projected onto one and the same function - the junior Cartan vector $f_0^{(\lambda)}$ with projection equaled $f(0)$. It is remarkable that (as $2\lambda \neq 0,1,2,....$) we can not put here $\delta = 0$ although $T_\lambda(0) = 0$ (singular elements are sources of branching).

x) Now we consider the more complicated structure - the Borel submonoid $B_-(\Delta)$ of matrices $b_-(\Delta) = \begin{pmatrix} \Delta/\delta & 0 \\ \gamma & \delta \end{pmatrix}$. Proceeding from (9) we have:

$$T_\lambda(b_-(\Delta))\zeta^n = \delta^{2\lambda}(-\frac{\gamma}{\delta})^n n! L_n^{(-2\lambda-1)}(\frac{\Delta\zeta}{\gamma\delta}). \tag{11}$$

It follows from here that both linear envelope $U[\{f_n^{(\lambda)}\}]$ and space F_λ are invariant under the operators $T_\lambda(b_-(\Delta))$. Hereby representation of $B_-(\Delta)$ in F_λ is a not completely reducible (see [2]).

At $\Delta = 0$ we have $T_\lambda(b_-(0))\zeta^n = \delta^{2\lambda}(-\frac{\gamma}{\delta})^n \frac{\Gamma(n-2\lambda)}{\Gamma(-2\lambda)}$. Again after putting $\Delta = 0$ we can not put further (in ζ-realization) $\delta = 0$, although at $\delta = 0$ for matrices we have $\begin{pmatrix} 0 & 0 \\ \gamma & 0 \end{pmatrix} = \gamma\sigma_-$ and hence due to the local isomorphism we must have $T_\lambda(\gamma\sigma_-) = \gamma L_-^{(\lambda)}$. According to the known formula (see(3), Part 1) we have $T_\lambda(\gamma\sigma_-)\zeta^n = \gamma L_-^{(\lambda)}\zeta^n = \gamma(\alpha_n^{\lambda)})^2\zeta^{n-1}$.

We already know that on the space F'_λ operators $T_\lambda(b_-(\Delta))$ are undounded. In fact this follows, for example, from the formula (6) at $\beta = 0$ (hereby $\alpha = \frac{\Delta}{\delta}$)

$$T_\lambda(b_-(\Delta))e^{\tau\zeta} = (\gamma\tau + \delta)^{2\lambda} exp(\frac{\Delta\tau\zeta}{\delta(\gamma\tau+\delta)}). \tag{12}$$

At $\Delta = 0$ we have $T_\lambda(b_-(0))e^{\tau\zeta} = (\gamma\tau + \delta)^{2\lambda}$.

If to put here $\delta = 0$ we get $(\gamma\tau)^{2\lambda}$. But $\gamma L_-^{(\lambda)} e^{\tau\zeta} = \gamma\tau(-\tau\zeta + 2\lambda)e^{\tau\zeta}$, i.e quite another result. [6]

xi) Consider further another Borel submanifold $B_+(\Delta)$ of matrices $b_+(\Delta) = \begin{pmatrix} \Delta/\delta & \beta \\ 0 & \delta \end{pmatrix}$. We have (see (10))

$$T_\lambda(b_+(\Delta))f(\zeta) = \delta^{2\lambda} e^{\frac{\beta}{\delta}\zeta} f(\frac{\Delta\zeta}{\delta^2}). \tag{13}$$

It follows from here that F'_λ is invariant space under the action of operators $T_\lambda(b_+(\Delta))$. The representation is not completely reducible (see [2]).

At $\Delta = 0$ we obviously have

$T_\lambda(b_+(0))f(\zeta) = \delta^{2\lambda} e^{\frac{\beta}{\delta}\zeta} f(0)$. We can not take here $\delta = 0$. But at $\Delta = 0$ and $\delta = 0$ for $b_+(0)$ we have $\beta\sigma_+$ and therefore $T_\lambda(\beta\sigma_+)f(\zeta) = \beta L_+^{(\lambda)} f(\zeta) = \beta\zeta f(\zeta)$ (see previous footnote).

All these observations are summed up the following general

Statement 3. The most dangerous submanifold in $M(2,C)$ is the intersection $J \cap \Delta'$ (elements of the latter are denoted j_0). Hereby in the framwork of space F'_λ we have $lim_{j\to j_0} T_\lambda(j) \neq T_\lambda(lim_{j\to j_0} j) = T_\lambda(j_0)$.

[6] This property of $T_\lambda(g)$ is a consequence of the common situation in the theory of non-Neumannian representations of topological groups: mapping exp is not surjection. Here is the simplest example of it. For matrices we have $e^{\tau\sigma_+} = 1 + \tau\sigma_+$. Taking T_λ from the right hand side we obtain $T_\lambda(1 + \tau\sigma_+) = 1 + \tau L_+^{(\lambda)} = 1 + \tau\zeta$. But T_λ from the left hand side gives (see before) $T_\lambda(e^{\tau\sigma_+}) = e^{\tau L_+^{(\lambda)}} = e^{\tau\zeta} \neq 1 + \tau\zeta$.

This means that in the framework of space F'_λ we can not close Gaussian area of monoid $M(2,C)$ to get the monoid in whole. In [4] such a situation is called polarization of the relativistic bi-Hamiltonian dynamical system. In connection with this we would like to emphasize that the existence of Gaussian decomposition of semisimple Lie groups has always been a puzzle.

We may even say that if $\Delta = 0$ so $\delta \neq 0$. On the contrary, if $\delta = 0$ so $\Delta \neq 0$, i.e. subsets J and Δ' are in complimentary condition one to other.

Further it is worth while to consider the realization of $GL(2,C)$ on complex plane $\tau \in C$. In this case we have $\tau \to \tau' = \frac{\alpha\tau+\beta}{\gamma\tau+\delta}$, where $\alpha = (\Delta + \beta\gamma)/\delta$. We see that at $\Delta = 0$ complex plane is projected into one and the same fixed complex number β/δ.

Let be $f(\tau)$ a function of complex variable τ belonging to the representation $T_\lambda(g)$. Then we have $T_\lambda(g)f(\tau) = (\gamma\tau+\delta)^{2\lambda} f(\frac{\alpha\tau+\beta}{\gamma\tau+\delta})$. At $\Delta = 0$ the right hand side is $(\gamma\tau+\delta)^{2\lambda} f(\frac{\beta}{\delta})$, i.e. arbitraty function is projected onto one and the same function $(\gamma\tau+\delta)^{2\lambda}$ with projection $f(\frac{\beta}{\delta})$.

In τ-realization canonical Cartan-Weyl basis is formed by functions

$$f_n^{(\lambda)}(\tau) = (i\tau)^n \sqrt{\frac{\Gamma(n-2\lambda)}{n!}}.$$

Hereby we have

$$\Sigma_{n=0}^{\infty} f_n^{(\lambda)}(\zeta)\eta_n^{(\lambda)}\overline{f_n^{(\overline{\lambda})}(\overline{\tau})} = e^{\tau\zeta},$$

where $\eta_n^{(\lambda)}$ is the metric in space representation T_λ (see above).

Returning to the ζ-realization we remark that for arbitrary function $f(\zeta) = \Sigma_n f_n \zeta^n$ of ζ we have at $\Delta = 0$: $T_\lambda(j)f(\zeta) = C_f(j) e^{\frac{\beta}{\delta}\zeta}$, where $C_f(j) = \delta^{2\lambda}\Sigma_n(-\frac{\gamma}{\delta})^n \frac{\Gamma(n-2\lambda)}{\Gamma(-2\lambda)} f_n$ and $j = \begin{pmatrix} \frac{\beta\gamma}{\delta} & \beta \\ \gamma & \delta \end{pmatrix}$.

So, we formulate the

Theorem 1. At contraction $GL(2,C) \to J$ every vector $f \in F'_\lambda$ is projected onto one and the same vector $e^{\frac{\beta}{\delta}\zeta}$ with projection $C_f(j)$, see [4].

Vector $e^{\frac{\beta}{\delta}\zeta}$ is the ground state of the relativistic bi-Hamiltonian dynamical system $\dot{f}$. So, the ground state $\dot{f}$ of this system arises as a result of evolution of states f described by contraction $GL(2,C) \to J$ (the latter is analog of the Schroedinger evolution equation). We may say that the ground state $\dot{f}$ is associated with attractive submonoid J.

Of course this evolution process (in general case reversible) may not be mixed with quantum (irreversible) transition $f \to \dot{f}$ described by transition matrix element $< \dot{f}, f >$ containing complex conjugated state $\dot{f}$.

xii) Further we come back to the group representations namely to the $SL(2,C)$. Its subgroups ($SU(1,1)$ and especially $SU(2)$) will be considered also.

Because of multiplier $(\gamma\tau+\delta)^{2\lambda}$ in (6) elements $T_\lambda(v)f$ ($v \in SL(2,C)$, $\lambda \neq p/2$) as the functions on group $SL(2,C)$ are multivalued (it is not difficult to be convinced that at $\lambda = p/2$ in $F'_{p/2}$ there are vectors f orbits of which $T_{p/2}(v)f$ are multivalued functions on $SL(2,C)$ too). We write this property of $T_\lambda(v)$ so: $v \to \{T_\lambda(v)\}$, where $\{T_\lambda(v)\}$ is the set of operators corresponding to the group element v. For uniformization of our mapping $T_\lambda(v)$ and functions $T_\lambda(v)f$ the space of 1-chains over linearly one-connected group $SL(2,C)$ is very adopted (see earlier). Hereby concrete representative from $\{T_\lambda(v)\}$ is determined by chain $\widetilde{v}$ beginning in unity $e \in SL(2,C)$ and ending in $v \in SL(2,C)$. Mapping we considered is exact mapping of 1-chain group $\widetilde{SL}(2,C)$ determined in Part 1: $\widetilde{v} \to \widetilde{SL}(2,C)$. In fact let us act on element $T_\lambda(\widetilde{v}_1)f$ by operator $T_\lambda(\widetilde{v}_2)$ (hereby it is supposed that f belongs to the definition subspace of $T_\lambda(\widetilde{v}_1)$ and $T_\lambda(\widetilde{v}_1)f$ belongs to the definition subspace of operator $T_\lambda(\widetilde{v}_2)$; such subspaces exist, see further). Element $T_\lambda(\widetilde{v}_2)(T_\lambda(\widetilde{v}_1)f)$ may be obtained as a result of growing of chain $\widetilde{v}_1$ by chain $\widetilde{v}_2$: from the end of chain $\widetilde{v}_1$ as from unity of group $\widetilde{SL}(2,C)$ the chain $\widetilde{v}_2$ outgoes (namely this circumstence permits to consider group $\widetilde{SL}(2,C)$ to be *free* group over $SL(2,C)$). Chain obtained by such a way is the chain $\widetilde{v}_2 \circ \widetilde{v}_1$ composed from $\widetilde{v}_1$ and $\widetilde{v}_2$ (it is very important to emphasize because another chain multiplication laws are possible, see for example [5]). Therefore we have $T_\lambda(\widetilde{v}_2)T_\lambda(\widetilde{v}_1)f = T_\lambda(\widetilde{v}_2 \circ \widetilde{v}_1)f$, i.e. $\widetilde{v} \to T_\lambda(\widetilde{v})$ is homomorphism.

When a chain (beginning in e and ending in v) is drawn on the group $SL(2,C)$ then simultaneously on the $\overline{C} \ni \tau$ a chain $\widetilde{\tau}$ (beginning in $\tau = \infty$ and ending in τ) is drawn too. To establish the connection between of both these chains it is wirth while to consider the fibration $(\overline{C}, M)$ of $SL(2,C)$ where $\overline{C}$ is the base (Riemannian sphere) to every point of which τ the matrix $\widehat{\tau} = \frac{1}{\sqrt{1+|\tau|^2}}\begin{pmatrix} \overline{\tau} & 1 \\ -1 & \tau \end{pmatrix}$ corresponds and M_τ is a fiber over τ elements of which are described by matrices $m_\tau = \frac{1}{\sqrt{1+|\tau|^2}}\begin{pmatrix} \alpha\tau+\beta & \beta\overline{\tau}-\alpha \\ 0 & \frac{1+|\tau|^2}{\alpha\tau+\beta} \end{pmatrix}$ (α, β are arbitrary complex variables). In parametrization connected with this fibration element v (denoted v_τ) is written in the form of $v_\tau = m_\tau\widehat{\tau}$. At fixed τ elements v_τ (at arbitrary α, β) are thous which may not be defined on the functions of the type $e^{\tau\zeta}$.

It follows from here that if in $\overline{C}$ the chain $\widetilde{v}_0$ is pricked out so the functions $e^{\tau\zeta}$ corresponding to the rest of τ's form a dense definition domain of all operators $T_\lambda(\widetilde{v}_0)$ where $\widetilde{v}_0$ is a lifting of $\widetilde{\tau}_0$ (another words $\widetilde{\tau}_0$ is projection of $\widetilde{v}_0$ onto $\overline{C}$). If chain $\widetilde{\tau}$ in $\overline{C}$ ($\widetilde{v}$ in $SL(2,C)$) is dense in $\overline{C}$ (in $SL(2,C)$) (so called fractal curve) nevertheless there are very many points in $\overline{C}$ and corresponding them set of functions $e^{\tau\zeta}$ dense in F'_λ (see Part 1).

xiii) It follows from (10) that all vectors from F'_λ are analytical ones for the representation $b_+ \to T_\lambda(b_+)$ (first in representation theory such vectors were considered in [6]). Differentiating (10) over β and δ (putting then $\beta = 0$ and $\delta = 1$) we get the generators ζ and $\zeta d/d\zeta - \lambda$ coinsiding with $L_+^{(\lambda)}$ and $L_3^{(\lambda)}$ in (2) (Part 1).

It follows from (10) that all vectors from linear envelope $U[\{f_n^{(\lambda)}\}]$ are analytical for representation $b_- \to T_\lambda(b_-)$. Differentiating (10) over γ (putting then $\gamma = 0$ and $\delta = 1$) we get the generators $(2\lambda - \zeta d/d\zeta)d/d\zeta$ coinsiding with $L_-^{(\lambda)}$ in (2) (Part 1).

xiv) As is seen in the space F'_λ there is a dense set of analytical vectors for representation $T_\lambda(v)$ where $v \in N_+HN_-$. It turns out every function $f \in F'_\lambda$ is analytical vector for $T_\lambda(v)$ at v belonging to the enough small neighbourhood $\epsilon_f(e) \subset SL(2,C)$. In fact every function of order $\rho < 1$ is analytical vector for Gaussian area. Let us consider now functions of order $\rho = 1$ and of the type $0 \le \tau < \infty$. From (10) it follows that as in $e^{\tau\zeta}$ ($\tau \in C$ all points of C are inner) $|\tau| < \infty$ (only such functions belong to F'_λ) so there is a neighbourhood of unity $\epsilon(e)$ with δ/γ obeying the condition $|\tau| < |\delta/\gamma| < \infty$ in which $T_\lambda(v)e^{\tau\zeta}$ is analytical function about v. It means that for every $f \in F'_\lambda$ there is a neighbourhood of unity $\epsilon_f(e) \subset SL(2,C)$ and a chain $\widetilde{v}$ disposed in whole in this neighbourhood so that equality $T_\lambda(\widetilde{v}) = T_\lambda(v)$ takes place where v is the end of chain $\widetilde{v}$: $v = p(\widetilde{v})$.

The condition may be written in the form: if $\widetilde{\omega}$ is a cycle (loop) disposed in whole in $\epsilon_f(e)$ so $T_\lambda(\widetilde{\omega})f = f$. Besides it follows from (10) that on dense subset of the form $U[\{f_n^{(\lambda)}\}]$ for every pair of cycles $\widetilde{\omega}_1, \widetilde{\omega}_2 \in \widetilde{\Omega}$ we have $T_\lambda(\widetilde{\omega}_2 \circ \widetilde{\omega}_1)f = T_\lambda(\widetilde{\omega}_1 \circ \widetilde{\omega}_2)f$. It means that subgroup $\widetilde{\Omega}$ may be considered to be Abelian one. Hereby if $\widetilde{v}_2^{-1} \circ \widetilde{v}_1 \in \widetilde{\Omega}$ so $T_\lambda(\widetilde{v}_2^{-1} \circ \widetilde{\omega} \circ \widetilde{v}_2)f = T_\lambda(\widetilde{v}_1^{-1} \circ \omega \circ \widetilde{v}_1)f$. Commutativity of the group $\widetilde{\Omega}$ plays very important role at topology introducing in group $\widetilde{SL}(2,C)$.

xv) Because $T_\lambda(\widetilde{v})f = T_\lambda(v)f$ (see above) we may differentiate the right hand side over parameters of $v \in \epsilon(e)$ and get algebra Lie representation, realized by operators (2) (Part 1). Inversely at very small $|\overrightarrow{\theta}| << 1$ process $exp(iT_\lambda(\frac{1}{2}\overrightarrow{\sigma}\overrightarrow{\theta})f = T_\lambda(v)f$ converges for every vector $f \in F'_\lambda$ and determines an analytical function in neighbourhood $\epsilon_f(e) \ni v$. Hereby product $T_\lambda(v^N)...T_\lambda(v^1)f$ (here all $v^i \in \epsilon(e)$ determines an element $T_\lambda(\widetilde{v})f$ depending on discrete chain $\widetilde{v}$. Hereat it is necessary to look after the fulfilment of condition $T_\lambda(v^{i-1})...T_\lambda(v^1)f \in D_{T_\lambda(v^i)}$, i.e. $f \in D_{T_\lambda(\widetilde{v})}$. For this purpose enough to prick out the chain $\widetilde{\tau}(\widetilde{v})$ in C, and rest τ's to connect with $f \in D_{T_\lambda(\widetilde{v})}$.

xvi) The property $T_\lambda(\widetilde{v})f = T_\lambda(p(\widetilde{v}))f$ where all points of $\widetilde{v}$ are situated in $\epsilon_f(e) \subset SL(2,C)$ tells that space F'_λ guaranties the existence of neighbourhood of unity $\widetilde{\epsilon}(\widetilde{e}) \subset \widetilde{SL}(2,C)$ free from small subgroups. Such a neighbourhood exists for every $\widetilde{v}$ (it follows from the homogenity of group). Another words from existence of differentiable representations $T_\lambda(\widetilde{v})$ in F'_λ the existence of the kernal $Y_{F'_\lambda}$ follows that $\widetilde{SL}(2,C)/Y_{F'_\lambda}$ is a locally Euclidean group locally isomorphic to the Lie group $SL(2,C)$, i.e. it is a Lie group denoted $\widetilde{SL}'(2,C)$. It means that the Fifth Hilbertian Problem has positive solution for 1-chain groups considered over classical groups.

Of course $\widetilde{SL}'(2,C)$ is only locally (im small) Lie group. In whole $\widetilde{SL}'(2,C)$ is neither analytical group nor (finite dimensional) manifold at all. As a topological structure it possesses the property that dimensionality of neighbourhood of every its element depends on size of this neighbourhood. Idea about existence of such structures takes its rise in Riemann's dissertation [7].

xvii) In the case of $SU(1,1)$-subgroup of matrices $v = \begin{pmatrix} \alpha & \beta \\ \overline{\beta} & \overline{\alpha} \end{pmatrix}$ we have $|\alpha|^2 - |\beta|^2 = 1$ and hence $|\frac{\beta}{\alpha}| < 1$. At transformation $\tau \to \frac{\alpha\tau+\beta}{\overline{\beta}\tau+\overline{\alpha}}$ interior of circle $|\tau| < 1$ is mapped into itself so that $|\frac{\alpha\tau+\beta}{\overline{\beta}\tau+\overline{\alpha}}| < 1$.The Hilbert space H_λ earlier considered is invariant under the operators $T_\lambda(v)$, $v \in SU(1.1)$. In particular if $e^{\tau\zeta} \in H_\lambda$, so $T_\lambda(v)e^{\tau\zeta} = (\widetilde{\beta}\tau + \widetilde{\alpha})^{2\lambda} exp\frac{\alpha\tau+\beta}{\overline{\beta}\tau+\overline{\alpha}} \in H_\lambda$. Hence on H_λ operators $T_\lambda(v)$ are bounded and we have there usual Neumannian irreducible representation $D^+(\lambda)$ of $SU(1,1)$. At $\lambda \ne p/2$ $D^+(\lambda)$ is multivalued representation of $SU(1,1)$ (this group is infinitelly linearly connected). At $\lambda < 0$ representations are unitary. The group $SU(1,1)$ is used in usual (unitary) quantum mechanics.

xviii) Let us consider else subgroup $SU(2)$. Here situation is quite another. In τ-realization group elements are written in the form $u_\tau = \begin{pmatrix} \frac{1-|\beta|^2}{\tau\overline{\beta}} & \beta \\ -\overline{\beta} & \tau\overline{\beta} \end{pmatrix}$, hereby $|\beta| = \frac{1}{\sqrt{1+|\tau|^2}}$. In this parametrization elements are written in the splitted form $u_\tau = m\hat{\tau}$, where now $m = h = \begin{pmatrix} e^{i\varphi} & 0 \\ 0 & e^{-i\varphi} \end{pmatrix}$ and $\varphi = arg\beta$. In this case our fibration is isomorphic to the well known Hopf fibration (S^2, S^1) so that 1-chain group $\widetilde{SU}(2)$ may be understood to be $\widetilde{S^2}\overline{S^1}$ where $\overline{S^1}$ is the universel covering of Cartan subgroup H (1-circle) and $\widetilde{S^2}$ is 1-chain space over sphere S^2. $\widetilde{SU}(2)$ is used in the ether theory (see [8]).

7. Conclusion

Now we know three several Lie groups with one and the same Lie algebra $so(3,1)$ behind of which very different physical entities stand. They are 1) the Lorentz group $SO(3,1)$ (symmetry group of the Poincare-Minkowski space) with which integer angular momenta are connected, 2) its covering manifold $SL(2,C)$ (symmetry group of the Dirac fiber) with which halfinteger spins are connected, and 3) 1-chain Lie group $\widetilde{SL}(2,C)$ (symmetry group of ether) with which arbitrary spins are connected.

We have considered here only hidden physical medium (ether) connected with special covering of rotation group $SO(3)$ - 1-chain Lie group $\widetilde{SU}(2)$ and described by linear representations of the latter. Dependence on chains says about multivalued turbulent character of motion of the medium, see [8]. As is known usage linear representations is a sign of quantum theory. From this point of view ether is quantum system.

In classical approach there is only configuration space and its symmetry group. We can see that such an approach is not always sufficient for description of physical phenomena (see [8]): 1-chain fibration over space and its symmetry group - 1-chain group - are needed also. At classical approach this mathematical tool we consider may be transferred onto real media - gases and liquides. We hope that by means of this tool turbulence regime of real media may be described.

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NO GW IS EMITTED BY B PSR1913+16

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In the *exact* (non-linear) formulation of general relativity (GR) *no* motion of bodies can give origin to gravitational waves (GW's) – as it has been proved. Accordingly, the measured rate of change of the orbital period of binary pulsar B PSR1913+16 must have *other* causes, different from the emission of GW's; maybe the viscous losses of the unseen pulsar companion, if it were e.g. a helium star.

Summary. The paper is structured as follows.

Sect. **1**. contains some passages of a recent report by Weisberg and Taylor (see [1*g*)] regarding thirty years of observations of binary radiopulsar B PSR1913+16.

Sect. **2**.: a straightforward criticism of the relativistic approach which is employed in papers cited in [1].

Sect. **2bis**.: a possible alternative explanation of the shrinkage of the orbit of the above radiopulsar.

Sect. **3**.: the linear approximation of GR is *inadequate* to give an existence theorem of physical GW's.

Sect. **4**.: *system B PSR1913+16 cannot emit GW's*.

Sect. **5**.: the analogy between Maxwell-Lorentz e.m. theory and the linearized version of GR is a *false* analogy.

Sect. **6**.: erroneousness of a surmise concerning the behaviour of B PSR1913+16.

1. Nobody has ever found a ***direct*** experimental proof of the *real* existence of the gravitational waves (GW's). According to some authors [1], an ***indirect*** experimental evidence could be given by the time decrease of the orbital period P_b of the binary pulsar B PSR1913+16 [1bis].

The abstract of paper [1*g*)] runs as follows: "We describe results derived from thirty years of observations of PSR B1913+16. Together with the Keplerian orbital parameters, measurements of the relativistic periastron advance and a combination of gravitational redshift and time dilation yield the stellar masses with high accuracy. The measured rate of change of orbital period agrees with that expected from the emission of gravitational radiation, according to general relativity, to within about 0.2 percent. Systematic effects depending on the pulsar distance and on poorly known galactic constants now dominate the error budget, so tighter bounds will be difficult to obtain. [...].". And in sect. **3.1** of the same paper [1*g*)] the authors claim that: "According to general relativity, a binary star system should emit energy in the form of gravitational waves. The loss of orbital energy results in shrinkage of the orbit, which is most easily observed as a decrease in orbital period. Peters and Mathews (1963) (see [2]) showed that in general relativity the rate of period decrease is given by

$$\dot{P}_{b,GR} = \frac{192\pi G^{5/3}}{5c^5}\left(\frac{P_b}{2\pi}\right)^{-5/3}\left(1-e^2\right)^{-7/2}\times \left(1+\frac{73e^2}{24}+\frac{37e^4}{96}\right) m_p m_c \left(m_p+m_c\right)^{-1/3}.'' \quad (1)$$

Here: G is the gravitational constant; c the speed of light *in vacuo*; e the orbital eccentricity ($e = 0.6171338(4)$); m_p the mass of the pulsar ($m_p = 1.4414 \pm 0.0002$ solar masses), m_c the mass of the companion ($m_c = 1.3867 \pm 0.0002$ solar masses).

Then, Weisberg and Taylor [1*g*)] write: "Comparison of the measured $\dot{P}_b$ with the theoretical value requires a small correction, $\dot{P}_{b,Gal}$, for relative acceleration between the solar system and binary pulsar system, projected onto the line of sight (Damour and Taylor 1991) [*see*[1*e*)]]. This correction is applied to the measured $\dot{P}_b$ to form a "corrected value" $\dot{P}_{b,corrected} = \dot{P}_b - \dot{P}_{b,Gal}$. The correction term depends on several rather poorly known quantities, including the distance [$\approx 16,000$ light-years] and proper motion of the pulsar and the radius of the Sun's galactic orbit. The best currently available values yield $\dot{P}_{b,Gal} = -(0.0128 \pm 0.0050) \times 10^{-12}$ s/s, so that $\dot{P}_{b,corrected} = 2.4056 \pm 0.0051) \times 10^{-12}$ s/s. Hence

$$\frac{\dot{P}_{b,corrected}}{\dot{P}_{b,GR}} = 1.0013 \pm 0.0021, \quad (2)$$

and we conclude that the measured orbital decay is consistent at the (0.13 ± 0.21) % level with the general relativistic prediction for the emission of gravitational radiation. [...]."

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2. The good agreement between the measured $\dot{P}_b$ and the computed $\dot{P}_b$ is suspect – as I have already emphasized [3] –, because the relativistic perturbative approximation, of which eq.(1) is a consequence, is quite unreliable from the point of view of the ***exact*** (non-linear) formulation of GR, as it was pointed out by several relativists [3bis].

Further, I remark that in GR the hypothetic GW's do not have a *true* energy. Therefore the *true* mechanical energy which is lost during the orbital motion should transform itself into the *pseudo* (i.e. false) energy of the hypothetic GW's: the energy balance would be violated. ***Objection***: if we *suppose* that the *linearized* version of GR has an unconditioned, approximate validity – as the experimentalists, and some (simple) theoreticians [4], do – the physical existence of GW's seems a theoretical possibility, and it seems – by exploiting the analogy with Maxwell-Lorentz e.m. theory – that the *acceleration* of a body can generate GW's. ***Answer***: the energy-momentum of such GW's has a tensor character only under Lorentz transformations of co-ordinates, but *not* under general transformations. Now, this is contrary to the basic tenet of GR.

2bis. The authors of papers [1] have *assumed* that *both* stars of the considered binary system are neutron stars, and thus act dynamically as *point* masses. But if the companion star were a helium star or a white dwarf, tides and viscous actions might mimic the relativistic (as the periastron advance) and pseudorelativistic effects. In particular, the viscous losses of the companion could give a time decrease of the pulsar revolution period of the same order of magnitude of that given by the hypothesized emission of gravitational radiation – as it is well known to many observational astrophysicists.

Finally, the empirical success of a theory – or of a given computation – is not an absolute guaranty for its conceptual adequacy. Consider for instance the Ptolemaic theory of cycles and epicycles, which explained rather well the planetary orbits (with the only exception of Mercury's).

3. It can be proved that the linear approximation of GR is quite *inadequate* to a proper study of the hypothetic GW's, see [5], [6]. And if we continue the approximation beyond the linear stage (see [7], [8]), we find that the radiation terms of the gravitational field can be *destroyed* by convenient co-ordinate transformations: this proves that the GW's are *only a product of a special choice of the reference system*, i.e. that they do not possess a *physical* reality (see further [9], [10], [11]): the undulatory solutions of Einstein field equations have a mere *formal* (*non*-physical) character.

4. If the two stars of B PSR1913+16 are dynamically treated as two (gravitationally interacting) *point* masses [1], the ***exact*** formulation of GR tells us that their orbits are ***geodetic*** lines [9], i.e. their motions are "natural", "free" motions, quite analogous to a rectilinear and uniform motion of a point charge in the customary Maxwell-Lorentz theory. Accordingly, no GW is sent forth by our stars! [10], [11].

In my paper [3β)] I have given another elegant proof of this fact, resting on a fundamental proposition by Hermann Weyl [12], according to which for any relative motion of two bodies it is always possible (in GR) to choose a co-ordinate system in which *both* bodies are *at rest*. (Remark that in GR the expression *at rest* must be defined precisely by specifying the *interested spacetime manifold.*)

Let us apply the above proposition to system B PSR1913+16, i.e. let us choose a co-ordinate frame for which both stars are at rest. Evidently, an observer Ω who "resides" in this frame does not record any emission of GW's. Now, any observer Ω' – very far, in particular, from Ω –, for whom B PSR1913+16 is in motion, does not possess (in GR!) any physical privilege with respect to Ω. Accordingly, both observers, Ω and Ω', do not register any GW sent forth by our binary system. (See Weyl [13] for the Riemann-Einstein manifold of two point masses at rest.)

5. The ***false*** formal analogy between the e.m. Maxwell-Lorentz theory and the linearized version of GR is the responsible for the publication of countless and senseless papers. In particular, it has generated the conviction that, in GR, the *acceleration* of a body must give origin to GW's; many people have forgotten that, in the *exact* (non-linear) formulation of GR, the concept "acceleration" does not possess an absolute character. (The above conviction was also extended to perturbative approximations of higher order.)

We observe finally that the exact theory does not admit any class of physically privileged reference frames for which, in particular, the undulatory character of a given gravitational field is an invariant property.

6. A last remark. Some authors have conjectured that a coexistence of effects due to emission of GW's by B PSR1913+16 and to tides and viscous actions of the companion star could be possible.

Now, this is pure nonsense, because – as it can be proved – even motions that are *not* purely gravitational cannot generate GW's [14].

Πῦρ σοι προσοίσω.
(I will bring fire to thee.)
EURIPIDES, *Andromache.*

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A CASE FOR NUCLEOSYNTHESIS IN SLOWLY EVOLVING MODELS

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We present a case for Cosmological Nucleosynthesis in an FRW universe in which the scale factor expands linearly with time: $a(t) \sim t$. It is demonstrated that adequate amount of ^4He requires a baryon density that saturates mass bounds from galactic clusters. There is a collatal metallicity production that is quite close to the lowest metallicity observed in metal poor Pop II stars and clouds. On the other hand, sites for incipient low metallicity (Pop II) star formation can support environments conducive to Deuterium production up to levels observed in the universe. A profile of a revised "Standard Cosmology" is outlined.

1. Introduction

Early universe (standard big-bang) nucleosynthesis [SBBN] is regarded as a major success for the Standard Big Bang [SBB] Model. As presented, SBBN results look rather good indeed. The observed light element abundances are taken to severely constrain cosmological and particle physics parameters. Deuterium, in particular, is regarded as an ideal "baryometer" for determining the baryon content of the universe [1]. This follows from the fact that deuterium is burned away whenever it is cycled through stars, and a belief, that there are no astrophysical sites (other than SBBN), capable of producing it in its observed abundance [2]. The purpose of this article is to admit caution in adhering to this belief and to explore nucleosynthesis in an environment radically different from the Standard.

What would be the point of such an exercise ?

Indeed, at the outset, drastic variations from SBBN may sound preposterous at this time. Confidence in SBBN stems primarily from D, ^7Li and ^4He measurements. D abundance is measured in the solar wind, in interstellar clouds and, more recently, in the intergalactic medium [3, 4]. The belief that no realistic astrophysical process other than the Big Bang can produce sufficient D lends support to its primordial origin. Further, ^7Li measurement [$^7Li/H \sim 10^{-10}$] in Pop II stars [5] and the consensus [6] over the primordial value for the ^4He ratio $Y_p \geq 23.4\%$ (by mass) suggest that light element abundances are consistent with SBBN over nine orders of magnitude. This is achieved by adjusting just one parameter, the baryon entropy ratio η. Alternative mechanisms for ^7Li production that are accompanied by a co-production of ^6Li with a later depletion of ^7Li have fallen out of favour. The debate on depletion of ^7Li has been put to rest by the observation of ^6Li in a Pop II star [7]. Any depletion of ^7Li would have to be accompanied by a complete destruction of the much more fragile ^6Li. Within the SBBN scenario therefore, one seeks to account for the abundances of ^4He, D, ^3He and ^7Li cosmologically, while Be, B and ^6Li are generated by spallation processes [8].

These results, however, do meet with occasional skepticism [see eg. [25] for problems with BBN]. Observation of ^6Li, for example, requires unreasonable suppression of astrophysical destruction of ^7Li. On the other hand, the production of ^6Li would be accompanied by a simultaneous production of ^7Li comparable to observed levels [9]. This raises doubts about using observed ^7Li levels as a benchmark to evaluate SBBN.

Further the best value of ^4He mass fraction, statistically averaged and extrapolated to zero heavy element abundances, hovers around $.216 \pm .006$ for Pop II objects [10]. Such low ^4He levels have also been reported in several metal poor HII galaxies [11]. For example for SBS 0335-052 the reported value is $Y_p = 0.21 \pm 0.01$ [12]. Such small values for ^4He would not lead to any concordant value for η consistent with bounds on ^7Li and D. Of course, one could still explore a multi-parameter non-minimal SBBN instead of the minimal model that just uses η for a single parameter fit. Non-vanishing neutrino chemical potentials have been proposed to be "natural" parameters for such a venture. These conclusions have been criticized in [6, 12] on grounds of reliance on statistical over-emphasis on a few metal-poor objects with a high enough ^4He abun-

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dance to save minimal SBBN. On the other hand, there are objects reported with abysmally low ^4He levels. This is alarming for minimal SBBN. For example, levels of ^4He inferred for μ Cassiopeiae A [12] and from the emission lines of several quasars [13] are as low as 5% and 10 - 15% respectively. Such low levels would most definitely rule out SBBN. At present one excludes such objects from SBBN considerations on grounds of "our lack of understanding"of the environments local to these objects. As a matter of fact, one has to resort to specially contrived explanations to account for low Y_p values in quasars. Considering that a host of mechanisms for light element synthesis are discarded on grounds of requirement of special "unnatural" circumstances [2], it does not augur to have to resort to special explanations to contend with low ^4He emission spectra. This comment ought to be considered in the light of much emphasis that is laid on emission lines from nebulae with low metal content [6]. Quasars most certainly qualify for such candidates. Instead, one merely seems to concentrate on classes of Pop II objects and HII galaxies that would oblige SBBN. Until the dependence of light element abundance on sample and statistics is gotten rid of and / or fully understood, one must not close one's eyes to alternatives.

We end our overview of the status of SBBN with a few comments. Firstly the low metallicity that one sees in type II stars and interstellar clouds poses a problem in SBBN. There is no object in the universe that has low abundance [metallicity] of heavier elements as is produced in SBB. One relies on some kind of reprocessing, much later in the history of the universe, to get the low observed metallicity in, for example, old clusters and inter-stellar clouds. This could be in the form of a generation of very short-lived type III stars. Such a generation of stars may also be necessary to ionize the intergalactic medium. The extrapolation of ^4He abundance in type II objects and low metal (HII) galaxies, to its zero heavy metal abundance limit, presupposes that reprocessing and production of heavy elements in type III stars is not accompanied by a significant change in the ^4He levels. A violation of this assumption, i.e. a minute increase in ^4He during reprocessing (even as low as 1 - 2 %) would rule out the minimal SBBN. As a matter of fact, it is possible to account for the entire pre-galactic ^4He by such objects [14].

Finally, of late [15], the need for a careful scrutiny and a possible revision of the status of SBBN has also been suggested from the reported high abundance of D in several Ly_α systems. It may be difficult to accommodate such high abundances within the minimal SBBN. Though the status of these observations is still a matter of debate, and (assuming their confirmation) attempts to reconcile the cosmological abundance of deuterium and the number of neutrino generations within the framework of SBB are still on, a reconsideration of alternate routes to deuterium in a slow expanding universe as described in this article could well be worth the effort. This is specially in consideration of the stranglehold that Deuterium has on SBB in constraining the baryon density upper limit to not more than some 3 to 4 % . This constraint has been used in SBB to make out a strong case for non - baryonic dark matter to make up the mass estimates at galactic and cluster scales. Relying on Deuterium that is so local environment sensitive, to predict the nature of CDM runs the risk of "building a colossus on a few feet of clay"[16].

This article reports our study of nucleosynthesis in a universe in which the scale factor evolves linearly with time independent of the equation of state of matter. A strictly linear evolution of the cosmological scale factor is surprisingly an excellent fit to a host of cosmological observations. Any model that can support such a coasting presents itself as a falsifiable model as far as classical cosmological tests are concerned as it exhibits distinguishable and verifiable features.

Large scale homogeneity and isotropy observed in the universe is incorporated in the Friedman-Robertson-Walker (FRW) metric:

$$ds^2 = dt^2 - a(t)^2[\frac{dr^2}{1-Kr^2} + r^2(d\theta^2 + sin^2\theta d\phi^2)]. (1)$$

Here $K = \pm 1, 0$ is the curvature constant. In the following section, we summarize the concordance of observations in a $K = -1$ FRW cosmology in which the scale factor evolves linearly with time: $a(t) \propto t$, right from the creation event itself. The motivation for such an endeavor has been discussed at length in a series of earlier articles [31, 23]. For the purpose of this article, we shall take as a conjecture that a strictly homogeneous background FRW model coasts linearly with time. This can be achieved in a large class of non-minimally coupled theories of gravity. However, perturbations around the homogeneous background are asumed to satisfy the perturbed Einstein equations. Section 3 describes concordant nucleosynthesis in such a model.

2. Concordance of a linear coasting cosmology:

Classical Cosmology tests

- **n(z), a(z):** Data on Galaxy number counts as a function of red-shift along with data angular diameter distance as a function of red-shift do not rule out a linearly coasting cosmology [28]. However, as these tests are marred by evolutionary effects (and mergers), they have fallen into disfavour as reliable tests of a viable model.

- **Hubble Diagram:** With the discovery of Supernovae type Ia [SNe Ia] as reliable standard candles, the status of the Hubble test has been elevated to that of a precision measurement. The Hubble plot relates the magnitude of a standard candle to its redshift in an expanding FRW universe. In [31] we demonstrated how linear coasting is as accommodating for high red-shift objects as the standard non–minimal model with a small cosmological constant. The concordance of linear coasting with SNe1a data finds a passing mention in the analysis of Perlmutter [26] who noted that the Hubble plot for $\Omega_\Lambda = \Omega_M = 0$ (for which the scale factor would have a linear evolution in standard cosmology) is "practically identical to the **bestfit** plot for an unconstrained cosmology". The concordance of this Hubble plot continues even for the more recent data on SNe1a with redshifts $z \geq 1$. The plot almost coincides with the Hubble plot for $\Omega_\Lambda \approx 0.72$, $\Omega_M = 0.28$.

- **Age of the Universe** The age estimate of an ($a(t) \propto t$) universe, deduced from a measurement of the Hubble parameter, is given by $t_o = (H_o)^{-1}$. The low red-shift SNe1a give the best value of 65 km $\sec^{-1}$ Mpc^{-1} for the Hubble parameter. The age of the universe turns out to be 15×10^9 years. Such an age estimate is comfortably concordant with age estimates of old clusters.

- **Lensing Statistics:** Consistency and concordance of linear coasting with gravitational lensing statistics was reported in [32].

- **Density Perturbations**

  In [27] we explored a conjecture that the background universe coasts linearly with perturbations around this background being described by

$$-8\pi G\delta T^M_{\mu\nu} = \delta G_{\mu\nu}. \tag{2}$$

It turns out that small perturbations can evolve to a non-linear regime and therefore be expected to lead to structures at large scales. This can be seen by expressing the metric as $g_{\mu\nu} ={}^{(o)} g_{\mu\nu} + \delta g_{\mu\nu}$, the $\delta g_{\mu\nu}$ being the perturbations. Scalar perturbations can be decomposed in terms of eigenmodes of the laplacian on the constant $\bar{\eta}$ surface (here $d\bar{\eta} = a^{-1}dt$) with eigenvalues $-k^2$ In terms of matter gauge invariant variable D_g (see eg. [29, 30]) and a density parameter

$$C \equiv 4\pi G\rho^o_b a_0^2 = \frac{3}{2}\frac{8\pi G}{3H_o^2}\rho^o_b = \frac{3}{2}\Omega_b$$

the density perturbation equation simply reduces to [27]:

$$[(k^2+3)\frac{e^{\bar{\eta}}}{C} + 3]\ddot{D}_g +$$

$$+[(k^2+3)\frac{e^{\bar{\eta}}}{C} + 2]\dot{D}_g - D_g k^2 = 0. \tag{3}$$

$k = 1$ corresponds to the Hubble scale which is the same as the curvature scale in this model. At a redshift ≈ 1000, a sphere of Hubble radius subtends an angle roughly .25 degrees. Using constraints from microwave background anisotropy at these angles gives $D_g \approx 10^{-5}$ at these scales at the last scattering surface. It is easy to see that modes $k \leq 1$ do not grow. At smaller angular scales ($k >> 1$), the observed anisotropy is expected to fall to much lower values [34]. Photon diffusion dampens anisotropies at angular scales smaller than about one minute. However, for such large values of k, D_g has rapidly growing solutions. The perturbation equation becomes

$$\ddot{D}_g + \dot{D}_g - Ce^{-\bar{\eta}}D_g = 0. \tag{4}$$

This has exact solutions in terms of modified first and second type bessel functions I_1, K_1:

$$D_g = C_1(Ce^{-\bar{\eta}})^{\frac{1}{2}} I_1((4Ce^{-\bar{\eta}})^{\frac{1}{2}}) +$$

$$+C_2(Ce^{-\bar{\eta}})^{\frac{1}{2}} K_1((4Ce^{-\bar{\eta}})^{\frac{1}{2}}). \tag{5}$$

For large arguments, these functions have their asymptotic forms:

$$I_1 \longrightarrow \frac{(Ce^{-\bar{\eta}})^{-\frac{1}{4}}}{2\sqrt{\pi}} exp[2(Ce^{-\bar{\eta}})^{\frac{1}{2}}];$$

$$K_1 \longrightarrow \frac{(Ce^{-\bar{\eta}})^{-\frac{1}{4}}}{2\sqrt{\pi}} exp[-2(Ce^{-\bar{\eta}})^{\frac{1}{2}}]. \tag{6}$$

Even if diffusion damping were to reduce the baryon density contrast to values as low as some 10^{-15}, a straight forward numerical integration of eqn(4) demonstrates that for $k \geq 3000$ the density contrast becomes non linear around redshift of the order 50.

In contrast to the above, in the radiation dominated epoch, the adiabatic approximation perturbation equations imply [27]:

$$[(k^2+3)\frac{3}{4k^2} + \frac{3\tilde{C}}{2k^2e^{2\bar{\eta}}}]\ddot{D}_g +$$

$$+\frac{3\tilde{C}}{k^2e^{2\bar{\eta}}}\dot{D}_g + [\frac{k^2+3}{8} - \frac{\tilde{C}}{2e^{2\bar{\eta}}}]D_g = 0. \tag{7}$$

For $\bar{\eta}$ large and negative, small k pertubation equation reduces to

$$3\ddot{D}_g + 6\dot{D}_g - k^2 D_g = 0. \tag{8}$$

Eqns(7–8) imply that perturbations bounded for large negative η damp out for small k while large k modes are oscillatory.

We conclude that fluctuations do not grow in the radiation dominated era, small k (large scale) fluctuations do not grow in the matter dominated era as well. However, even tiny residual baryonic fluctuations $O(10^{-15})$ at the last scattering surface for large values of $k \geq 3000$ in the matter dominated era, grow to the non linear regime. Such a growth would be a necessary condition for structure formation and is not satisfied in the standard model. In the standard model, cold dark matter is absolutely essential for structure formation.

- **The recombination epoch**

Salient features of the plasma era in a linear coasting cosmology have been described in [36, 33, 34]. Here we reproduce some of the peculiarities of the recombination epoch. These are deduced by making a simplifying assumption of thermodynamic equilibrium just before recombination.

The probability that a photon was last scattered in the interval $(z, z + dz)$ can be expressed in terms of optical depth,and turns out to be:

$$P(z) = e^{-\tau_\gamma}\frac{d\tau_\gamma}{dz} \approx$$

$$7.85 \times 10^{-3}(\frac{z}{1000})^{13.25} exp[-0.55(\frac{z}{1000})^{14.25}]. (9)$$

This $P(z)$ is sharply peaked and well fitted by a gaussian of mean redshift $z \approx 1037$ and standard deviation in redshift $\Delta z \approx 67.88$. Thus in a linearly coasting cosmology, the last scattering surface locates at redshift $z^* = 1037$ with thickness $\Delta z \approx 68$. Corresponding values in standard cosmology are $z = 1065$ and $\Delta z \approx 80$.

An important scale that determines the nature of CMBR anisotropy is the Hubble scale which is the same as the curvature scale for linear coasting. The angle subtended today, by a sphere of Hubble radius at $z^* = 1037$, turns out to be $\theta_H \approx 15.5$ minutes. The Hubble length determines the scale over which physical processes can occur coherently. Thus one expects all acoustic signals to be contained within an angle $\theta_H \approx 15.5$ minutes.

We expect the nature of CMB anisotropy to follow from the above results. The details are still under study and shall be reported separately.

- **Summary**

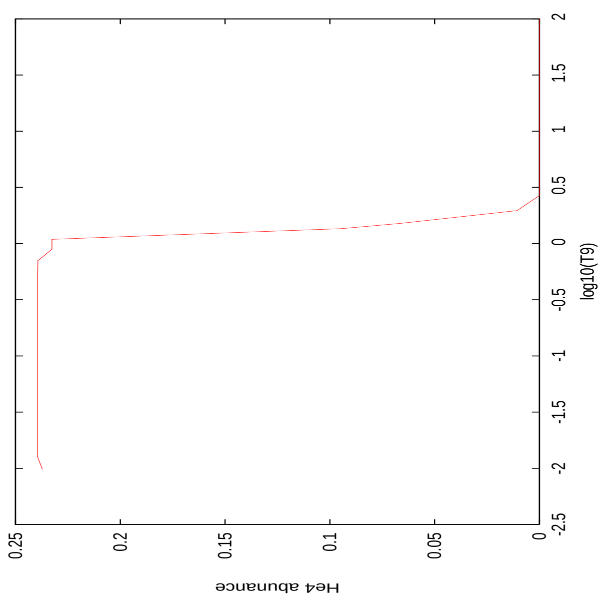

Figure 1: The figure shows abundance of He4 as a function of temperature for $\eta \approx 7.8 \times 10^{-9}$. The final abundance of He4 is approximately 23 %. It reaches this value around $T \approx T_9$ and stays same thereafter.

In spite of a significantly different evolution, a linear coasting cosmology can not be ruled out by all the tests we have subjected it to so far. Linear coasting being extremely falsifiable, it is encouraging to observe its concordance !! In standard cosmology, falsifiability has taken a backstage - one just constrains the values of cosmological parameters subjecting the data to Bayesian statistics. Ideally, one would have been very content with a cosmology based on physics tested in the laboratory. Clearly, standard cosmology does not pass such a test. One needs a mixture of hot and cold dark matter, together with (now) some form of *dark energy* to act as a cosmological constant, to find any concordance with observations. In other words, one uses observations to parametrize theory in Standard Cosmology. In contrast, a universe that is born and evolves as a curvature dominated model has a tremendous concordance, it does not need any form of dark matter and there are sufficient grounds to explore models that support such a coasting.

3. The Nucleosynthesis Constraint:

What makes linear coasting particularly appealing is a straightforward adaptation of standard nucleosynthesis codes to demonstrate that primordial nucleosynthesis is not an impediment for a linear coasting cosmology [22, 23]. A linear evolution of the scale factor radically effects nucleosynthesis in the early universe. With the present age of the universe some 15×10^9 years and the *effective* CMB temperature 2.73 K, the universe turns out to be some 45 years old at 10^9 K. With the universe expanding at such low rates, weak interactions remain in equillibrium for temperature as low as $\approx 10^8$ K. The neutron to proton ratio is determined by the n-p mass difference and is approximately $n/p \sim exp[-15/T_9]$. This falls to abysmally low values at temperatures below 10^9 K. Significant nucleosynthesis leading to helium formation commences only near temperatures below $\sim 5\times10^9$K. The low n/p ratio is not an impediment to adequate helium production. This is because once nucleosynthesis commences, inverse beta decay replenishes neutrons by converting protons into neutrons and pumping them into the nucleosynthesis network. For baryon entropy ratio $\eta \approx 7.8\times10^{-9}$, the standard nucleosynthesis network can be modified for linear coasting and gives $\approx 23.9\%$ Helium. The temperatures are high enough to cause helium to burn. Even in SBBN the temperatures are high enough for helium to burn. However, the universe expands very rapidly in SBBN. In comparison, the linear evolution gives enough time for successive burning of helium, carbon and oxygen. The metallicity yield is some 10^8 times the metallicity produced in the early universe in the SBBN. The metallicity is expected to get distributed amongst nucleii with maximum binding energies per nucleon. These are nuclei with atomic masses between 50 and 60. This metallicity is close to that seen in lowest metallicity objects. Fig. 1–4 describe nuclesynthesis as a function of the Baryon entropy ratio. The metallicity concommitantly produced with $\approx 23.9\%$ Helium is roughly 10^{-5} solar.

The only problem that one has to contend with is the significantly low residual deuterium in such an evolution. The desired amount would have to be produced by the spallation processes much later in the history of the universe as described below.

Interestingly, the baryon entropy ratio required for the right amount of helium corresponds to $\Omega_b \equiv \rho_b/\rho_c = 8\pi G\rho_b/3H_o^2 \approx 0.69$. This closes dynamic mass estimates of large galaxies and clusters [see eg [35]]. In standard cosmology this closure is sought by taking recourse to non-baryonic cold dark matter. There is hardly any budget for non - baryonic CDM in linear coasting cosmology.

Deuterium Production:

To get the observed abundances of light elements besides ${}^4He$, we recall spallation mechanisms that were explored in the pre - 1976 days [2]. Deuterium can indeed be produced by the following spallation reactions:

$$p +^4 He \longrightarrow D +^3 He; \quad 2p \longrightarrow D + \pi^+;$$

$$2p \longrightarrow 2p + \pi^o, \ \pi^o \longrightarrow 2\gamma, \ \gamma +^4 He \longrightarrow 2D.$$

There is no problem in producing Deuterium all the way to observed levels. The trouble is that under most

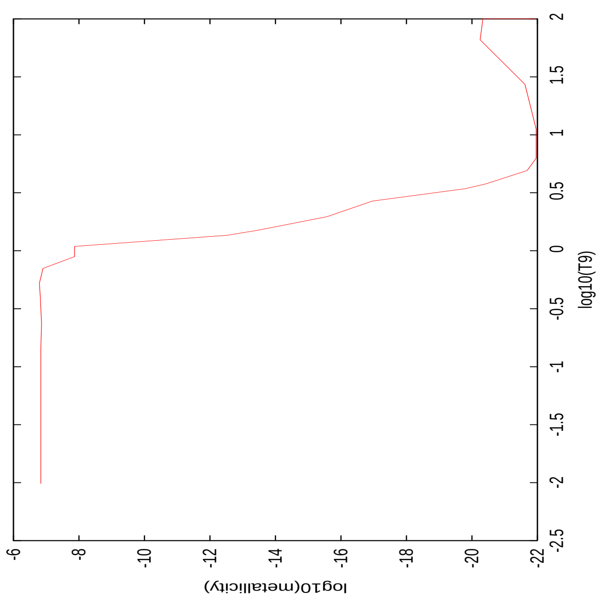

Figure 2: The figure shows metalicity as a function of temperature for $\eta \approx 7.8\times10^{-9}$. The metallicity for a linaer coasting model is nearly equal to 10^{-5} times solar metallicity.

conditions there is a concomitant over - production of Li nuclei and γ rays at unacceptable levels. Any later destruction of lithium in turn completely destroys D. As described in [2], Fig. 5 exhibits relative production of ${}^7Li$ and D by spallation. It is apparent that the production of these nuclei to observed levels and without a collateral gamma ray flux is possible only if the incident (cosmic ray or any other) beam is energized to an almost mono energetic value of around 400 MeV. A model that requires nearly mono energetic particles would be rightly considered *ad hoc* and would be hard to physically justify.

However, lithium production occurs by spallation of protons over heavy nuclei as well as spallation of helium over helium:

$$p,\alpha \ + \ C,N,O \longrightarrow Li \ + \ X;$$

$$p,\alpha \ + \ Mg,Si,Fe \longrightarrow Li \ + \ X;$$

$$2\alpha \longrightarrow^7 Li \ + \ p; \quad \alpha \ + \ D \longrightarrow p \ + \ {}^6Li;$$

$${}^7Be + \gamma \longrightarrow p +^6 Li; \quad {}^9Be + p \longrightarrow \alpha +^6 Li.$$

The absence or deficiency of heavy nuclei in a target cloud and deficiency of alpha particles in the incident beam would clearly suppress lithium production. Such conditions could well have existed in the environments of incipient Pop II stars.

Essential aspects of evolution of a collapsing cloud to form a low mass Pop II star is believed to be fairly well understood [17, 18]. The formation and early evolution of such stars can be discussed in terms of gravitational and hydrodynamical processes. A protostar would emerge from the collapse of a molecular cloud core and would be surrounded by high angular momentum material forming a circumstellar accretion disk with bipolar outflows. Such a star contracts slowly while the magnetic fields play a very important role in regulating collapse of the accretion disk and transferring the disk orbital angular motion to collimated outflows. A substantial fraction of the accreting matter is ejected out to contribute to the inter - stellar medium.

Empirical studies of star forming regions over the last twenty years have now provided direct and ample evidence for MeV particles produced within protostellar and T Tauri systems [19, 20]. The source of such accelerated particle beaming is understood to be violent magnetohydrodynamic (MHD) reconnection events. These are analogous to solar magnetic flaring but elevated by factors of 10^1 to 10^6 above levels seen on the contemporary sun besides being up to some 100 times more frequent. Accounting for characteristics in the meteoritic record of solar nebula from integrated effects of particle irradiation of the incipient sun's flaring has assumed the status of an industry. Protons are the primary component of particles beaming out from the sun in gradual flares while ^4He are suppressed by factors of ten in rapid flares to factors of a hundred in gradual flares[19, 20]. Models of young sun visualizes it as a much larger protostar with a cooler surface temperature and with a very highly elevated level of magnetic activity in comparison to the contemporary sun. It is reasonable to suppose that magnetic reconnection events would lead to abundant release of MeV nuclei and strong shocks that propagate into the circumstellar matter. Considerable evidence for such processes in the early solar nebula has been found in the meteoric record. It would be fair to say that the hydrodynamical paradigms for understanding the earliest stages of stellar evolution is still not complete. However, it seems reasonable to conjecture that several features of collapse of a central core and its subsequent growth from acreting material would hold for low metallicity Pop II stars. Strong magnetic fields may well provide for a link between a central star, its circumstellar envelope and the acreting disk. Acceleration of jets of charged particles from the surface of such stars could well have suppressed levels of ^4He. Such a suppression could be naturally expected if the particles are picked up from an environment cool enough to suppress ionized ^4He in comparison to ionized hydrogen. Ionized helium to hydrogen number ratio in a cool sunspot temperature of $\approx 3000\ K$ can be calculated by the Saha's ionization formula and the ionization energies of helium and hydrogen. This turns out to be $\approx\ exp(-40)$ and increases rapidly with temperature. Any electrodynamic process that accelerates charged particles from such a cool environment would yield a beam deficient in alpha particles. With ^4He content in an accelerated particle beam suppressed in the incident beam and with the incipient cloud forming a Pop II star having low metallicity in the target, the "no - go" concern of (Epstein et.al. [2]) is effectively circumvented. The "no-go" used $Y_\alpha/Y_p \approx .07$ in both the energetic particle flux as well as the ambient medium besides the canonical solar heavy element mass fraction. Incipient Pop II environments may typically have heavy element fraction suppressed by more than five orders of magnitude while, as described above, magnetic field acceleration could accelerate beams of particles deficient in ^4He.

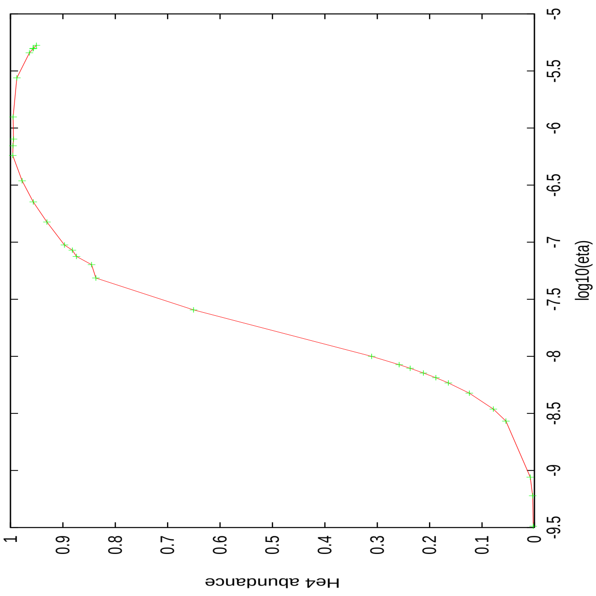

Figure 3: The figure shows He4 abundance as a function of η.

One can thus have a broad energy band - all the way from a few MeV up to some 500 MeV per nucleon as described in the Fig. 5, in which acceptable levels of deuterium could be "naturally" produced. The higher energy end of the band may also not be an impediment. There are several astrophysical processes associated with gamma ray bursts that could produce D at high beam energies with the surplus gamma ray flux a natural by product.

Circumventing the "no-go" concern of Epstein et al would be of interest for any cosmology having an early universe expansion rate significantly lower than corresponding rates for the same temperatures in early universe SBB.

4. Conclusions:

Our understanding of star formation has considerably evolved since 1976. SBBN constraints need to be reconsidered in view of empirical evidence from young star forming regions. These models clearly imply that

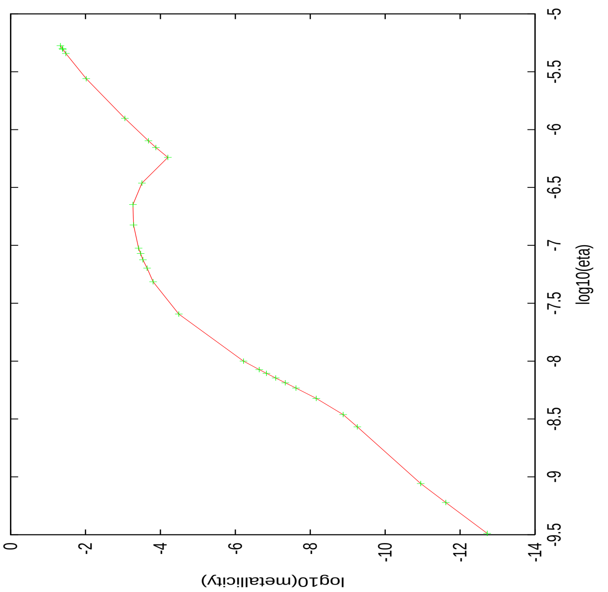

Figure 4: The figure shows metallicity as a function of η.

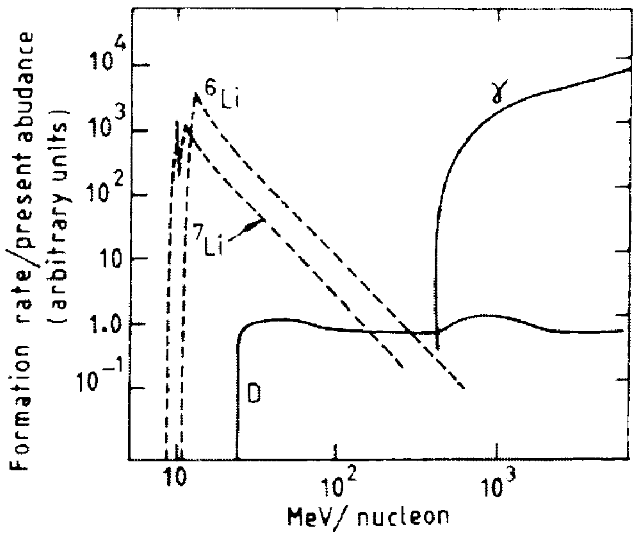

Figure 5: The rates at which abundances approach their present values as a function of the energy per nucleon of the incident particle.

spallation mechanism can lead to viable and natural production of Deuterium and Lithium in the incipient environment of Pop II stars. One can conceive of cosmological models in which early universe nucleosynthesis produces the desired primordial levels of ^4He but virtually no D. Such a situation can arise in SBBN itself with a high baryon entropy ratio η. In such a universe, in principle, Deuterium and Lithium can be synthesized up to acceptable levels in the environment of incipient Pop II stars.

In SBB, hardly any metallicity is produced in the very early universe. Metal enrichment is supposed to be facilitated by a generation of Pop III stars. Pop III star formation from a pristine material is not well understood till date in spite of a lot of effort that has been expanded to that effect recently [21]. It is believed that with metallicity below a critical transition metallicity ($Z_{cr} \approx 10^{-4} Z_{\odot}$), masses of Pop III stars would be biased towards very high masses. Metal content higher than Z_{cr} facilitates cooling and a formation of lower mass Pop II stars. In SBB, the route to Deuterium by spallation discussed in this article would have to follow a low metal contamination by a generation of Pop III stars.

Deuterium production by spallation discussed in this article would be good news for a host of slowly evolving cosmological models [22, 23]. An FRW model with a linearly evolving scale factor enjoys concordance with constraints on age of the universe and with the Hubble data on SNe1A. Such a linear coasting is consistent with the right amount of helium observed in the universe and metallicity yields close to the lowest observed metallicities. The only problem that one has to contend with is the significantly low yields of deuterium in such a cosmology. In such a model, the first generation of stars would be the low mass Pop II stars and the above analysis would facilitate the desired deuterium yields.

In SBB, large-scale production and recycling of metals through exploding early generation Pop III stars leads to verifiable observational constraints. Such stars would be visible as 27–29 magnitude stars appearing any time in every square arc-minute of the sky. Serious doubts have been expressed on the existence and detection of such signals [24]. The linear coasting cosmology would do away with the requirement of such Pop III stars altogether.

[2]

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SLAV-ARYAN VEDAS ABOUT THE UNIVERSE STRUCTURE AND HUMANITY HISTORY

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There is given the unique information about Slav-Aryan Veda, written on golden plates more than 40 thousand years ago that contain the description of the Universe structure and properties, Galaxy beginning and evolution, Solar System structure and its change during the last 153 thousand years, history of settlement and the Earth greatest cataclysms, knowledge about nature and society, race origin and migration ways of the Ukraine inhabitants ancestors, precepts of our far ancestors and event forecast until 2172.

1. Slav-Aryan Vedas

Slav-Aryan Vedas (further — simply "Vedas") in a broad sense represent a set of ancient documents of Slav and Aryan peoples non-outlined precisely, including the precisely dated and having authorship works as well as national legends, tales, bylinas, etc., told and written down recently.

"Perun's Vedas Santees" are meant only as Vedas in narrow sense (Books of Knowledge or Perun's Wisdom Books), consisting of nine books, dictated by our first ancestor, the god Perun, to our far ancestors while their third arrival to the Earth on the spaceship Waitman in 38004 B.C. (or 40009 years ago). Only the first book of these Vedas was translated into Russian nowadays.

As a whole Vedas contain a profound knowledge about nature and reflect Humanity history in the Earth during last several hundred thousand years, - at least, not less than 600000 years. They also contain Perun's prediction of the future events for 40176 years ahead, i.e. until nowadays and 167 years ahead.

Vedas in its basis, on which they were written originally down, are divided into three basic groups:

— **satees** are the plates of gold or other precious metal, without affect with corrosion on which texts were put by stamping signs and filling them with paint. Then these plates were fastened by three rings like books or made out in the oak framework and framed by a red cloth;

— **charatiys** are the sheets or rolls of high-quality parchment with texts;

— **volchvaries** are wooden plates with the texts written or cut out.

Santees are the most ancient of known documents. Originally "Perun's Vedas Santees" were called as Vedas, but there are mentions of others Vedas in them, which even at that time, i.e. more 40 thousand years ago, named Ancient and which either are lost, or stored in secluded places and not disclosed for any reasons currently. Santees reflect the most secret Ancient Knowledge. It is possible even to tell that they are archive of knowledge. By the way, Indian Vedas is only a part of Slav-Aryan Vedas, transferred by arias about 5000 years ago to India.

As a rule charatiys were santees copies, or, probably, writing out of santees, intended for wider use in the priestly habitat. The most ancient charatiys are "Charatiys of Light" (the Book of Wisdom) which were written down 28736 years ago (or, to be exact, from 20 August till 20 September, 26731 B.C.). As it is easier to write down charatiys than to make santees engraving on gold, so extensive historical data were written down in such a kind.

So, for example, charatiys under the name "Avesta" were written down on 12000 bull's skins 7513 years ago along with the war history of Slav-Aryan peoples with Chinese. The peace conclusion between fighting parties was called as the World Creation in the Star Temple (W.C.S.T.). And a year according to our ancient calendar in which this peace concluded was called as the Star Temple.

It was the first world war in the Earth's history, and this event was so tremendous, and the victory was so significant for White Race that served as a reference point for new chronology introduction. Since then all white peoples counted summers from the World Creation. And this chronology was cancelled only by Peter Romanov I in 1700 who imposed the Byzantine calendar to us as only the Romanovs come to power with the help of the Byzantine Empire. And "Avesta" itself

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was destroyed by Alexander the Great on an instigation of the Egyptian priests so the World Creation in the Star Temple didn't throw the light onto "the world creation", described under their dictation in the Bible.

"Vlesov's book" written down (perhaps, gradually by several authors) on wooden plates and reflecting the history of Southeast Europe peoples during one and a half thousand years till the Kiev Russia christening can be named among volkhvaries. Volkhvaries were intended for the Magi - our ancient clergy of old believers, whence the name of these documents went as well. Volkhvaries were methodically destroyed by Christian church.

Slav-Aryan peoples had four basic letters in antiquity - according to the number of basic White Race Clans. The most ancient of the kept documents, i.e. santees were written down by Ancient 'Aryan Runes or Runic as they are still called. Ancient Runes are neither letters nor hieroglyphs in our modern understanding, but some kind of the secret images transmitting huge volume of Ancient Knowledge. They include tens of signs, which are written down under the common line, named celestial. Signs designate figures, letters and separate things or phenomena - or frequently used, or very important.

X'Aryan Runic served as a basis for creation of the simplified letter forms during ancient times: ancient Sanskrit, Lines and Rezovs, Devanagary, German-Scandinavian Runes and many others. It also became the basis of all modern alphabets together with other Slav-Aryan Clans letters, beginning with old Slav and finishing with Cyrillic and Latin. So Cyril with Mephodiy didn't invent our spelling - they only created one of its convenient variants that was caused by the necessity of Christianity distribution in Slav languages.

It is necessary to add also, that Slav-Aryan Vedas are kept by Priests-keepers or Capen-Engling, i.e. Keepers of Ancient Wisdom, at Slav-Aryan Heathens (temples) of Old Russian Englieest Church of Orthodox Old Believers-Englieests. Exact storage places are not specified anywhere, as the certain forces tried to destroy our Ancient Wisdom during last thousand years. Time of these forces domination comes to an end nowadays, and Vedas keepers started to translate them into Russian and publish. Currently only one of nine books "Perun's Vedas Santees" is translated with reductions. But it is in a narrow sense as for Vedas. And in a broad sense Vedas pieces are stored in different places by all white peoples - descendants of those Slav-Aryan Clans that occupied our Earth the first.

By the way, it is necessary to note also, that Engliya (whence there was a name of old believers church) is a certain stream, more likely, energy in all its kinds which proceeds from uniform and incomprehensible God-creator Ra-M-Hi. This stream arises in the center of matter congestion at galaxy formation and is connected to the stars birth. Except for Ra-M-Hi our far ancestors esteemed their first ancestors and curators, whom they also considered as gods. They also invented special images which allowed to concentrate attention and will of people majority for the nature forces control, for example, the call of a rain (and people — as small gods, therefore they should unite their will and mental energy for great deals). These images also were called as gods. Thus, our ancestors had three kinds of gods headed by the god whom they named as Ra-M-Hi.

2. Our Galaxy

It is necessary to remind for the beginning that the visible part of our Galaxy represents the disk of the diameter 30 kiloparsec, containing approximately 200 billion stars, which are grouped in four bent sleeves. We see the Galaxy on summer nights from an edge like the Milky Way. The word "Galaxy" appeared of the Greek word "galactikos" — milky. Therefore galactic sleeves are practically inaccessible for our observations (even with the help of telescopes and radiotelescopes), and modern science considers, that they are two of them. Actually they are four of them, and our far ancestors knew about it exactly. The swastika sign widely used by them (dishonored by German fascism) is the sign designating our Galaxy. There is a corresponding Rune in Ancient 'Aryan spelling, designating this object of the Universe.

Our Galaxy didn't always exist and won't exist always. Galaxies in the universe are born of the primary great-grandmother (ether) and passing the development cycle, die again to give a life to new galaxies as it is done with grass or trees leaves within a year. In other words, there is a fluctuation of a matter in space and time in the Universe, and the Universe exists always. The development cycle of any galaxy is described in full details in the "Book of Wisdom" mentioned above. The similar description is met in the ancient document from India, which was used by Elena Blavatskaya for writing her book "the Secret doctrine".

The life is initially inherent for all matter forms at all its scale levels and shown at the certain steps of its evolution. It is shown in the same way and as stars and planets at the matter formation in that organic kind that we know. But the reasonable life can distribute itself from one star planets to other star planets in the development process, accumulation of some critical mass and achievement of the technical progress certain level, at which interstellar spacecraft construction is possible. It is obvious that stars started coming out closer to our Galaxy center with the beginning of its formation. Hence, the life was born in its organic kind for the first time (or, more precisely, shown) there. Hence, the people that live closer to the center of the Galaxy reached the greatest level of spiritual and physical development and should seem as gods for us.

3. Solar System

Our Solar system is in Orion's sleeve closer to the Galaxy periphery, on the distance approximately 10 kiloparsec from its center. Therefore the organic life could appear on it in two ways: self-rise or to be brought by more advanced civilizations from stars which are closer to the Galaxy center. Vedas narrate that people appeared on the Earth by their migration on big space vehicles Waitmans from planets of other star systems. And there were only plants and animals on the Earth by that time, as well as monkeys that could not evolutionized up to the reasonable creature level that people are.

Our far ancestors had more exact data not only about the Galaxy, but about our Solar system as well than we are now. In particular, they perfectly knew its history and structure. They knew that 27 planets and the large asteroids called as Earthes were included into our Solar system structure called as the Yaryla-Sun system. Our planet was called as the Midguard-Earth, there is only patrimonial name — the Earth left until nowadays. Other planets also had other names: Khorsa's Earth (Mercury), Mertsany's Earth (Venus), Oreya's Earth (Mars), Perun's Earth (Jupiter), Stryboga's Earth (Saturn), Indra's Earth (Khyron, the asteroid 2060), Varun's Earth (Uranus), Niya's Earth (Neptune), Viya's Earth (Pluto).

Daya's Earth was destroyed more than 153 thousand years ago called, as Phaeton nowadays, where there is the asteroid belt between the Mars and the Jupiter now. There were already the stations of our ancestors' space navigation and communication by the beginning of the Earth settling by people on Mars and Daya. The messages have recently appeared that there were seas on Mars really and, probably, the planet was inhabited.

Other planets of the Solar system haven't been known for our astronomers till now yet (the rotation periods around the Sun are specified in terrestrial years in brackets): Veles' Earth (46.78) — between Khyron and Uranus, Semargla's Earth (485.49), Odina's Earth (689.69), Lada's Earth (883.6), Udrzetsa's Earth (1147.38), Radogost's Earth (1952.41), Torah's Earth (2537.75), Prove's Earth (3556), Kroda's Earth (3888), Polkan's Earth (4752), Zmiya's Earth (5904), Rugiya's Earth (6912), Chura's Earth (9504), Dogoda's Earth (11664), Dayma's Earth (15552).

The Earth system with the satellites, which our ancestors named as Moons, looked in another way. The Midguard-land had two Moons all over again — the Month with a cycle time of 29.3 days existing nowadays and Lelya with a cycle time of 7 days (probably, a seven-day week originated from it). The Moon Fatta from the disappeared Deya was forwarded to our Earth about 143 thousand years ago and placed between orbits of the Month and the Lelya with a cycle time of 13 days. Lelya was destroyed in 109806 B.C., and Fatta — in 11008 B.C. as a result of super-power weapon application by earthmen that led to the world catastrophes and Humanity return to the Stone Age.

The Midguard-land external look 300 thousand years ago was absolutely other according to Runychesky annals. The desert Sahara was like the sea. Indian ocean was like a land. The Gibraltar Strait was not at all. There was the Western sea on the Russian Plain where Moscow is located now. The big continent Daarija was located at the Arctic ocean. There is Daarija's copy-card, which was copied by Merkaterom in 1 595 from the wall of a pyramid in Giza (Egypt). The Western Siberia was filled with the Western sea. The big island Buyan was on the territory of Omsk. Daarija was connected with the continent by the mountain isthmus — Rypeysky (Ural) mountains. The river Volga ran into the Black sea. And, the most important, the planet had no inclination of its axis and possessed warmer and softer climate in northern latitudes than now.

4. Great wars in the Galaxy

The Midguard-land is practically on the Boundary that divides the central part of the Galaxy favorable for life, from its peripheral part in which there's the lack of natural resources and, the most important, energy (Engliya).

All these lacks are exactly traced even within the limits of our planet: on poles — cold and ice, on equator — heat and desert, in middle latitudes — appearing with the period in 25920 years because of the Earth precession — the glaciers, making people and animals migrate. And winter cold, autumn slush, summer heat come even come in the same place within a year. People have to do stocks of meal, fire wood, warm clothes for winter. As a result — the struggle for favorable residing territories, wood, oil, coal, gas, deposits of metals, etc. occurs, finishing with conflicts, wars, including world.

There are several suns near the Galaxy center, all their surface is warmed in regular intervals, including ones from the Galaxy's nucleus side, people do not require heating premises, warm clothes, do not suffer from lack of food and water. All their activity is directed to correct clan prolongation, care of folks, knowledge accumulation and transfer, as well as spirituality development.

Slav-Aryan Vedas narrate that there are a lot of the worlds in the Universe - both at our scale level and others, including ones at very and very thin levels. Transition of an alive reasonable creature from one world into thinner one is possible only with a dense body loss and only with the development of higher and higher spirituality. Therefore there is a so-called Golden Way of Spiritual Development which has the laws connected with knowledge availability, first of all.

Vedas assert that Chernobog decided to bypass the Universal Laws of an ascension along the Golden Way of Spiritual Development in antiquity, to remove Security Seals from Secret Ancient Wisdom of the World for the Worlds of the Lowest in hope that the Security Seals with Secret Ancient Wisdom of all the Worlds of the Highest will be removed for him under the Divine Conformity Law. The noble Belobog united Light Forces for the Divine Laws protection, the Great ss — the war with Dark Forces from the Lowest Worlds began as a result of it.

Light Forces won, but the part of Ancient Knowledge got into the Lowest Worlds nevertheless. Having found Knowledge, these Worlds representatives began an ascension along the Golden Way of Spiritual Development. However they did not learn to distinguish Kindness and Anger and began trying to enter low life forms into frontier ones with the World of Darkness of the area where Heavenly Halls got (Constellations) of Makoshy (the Big-bear), Rady (Orion) and Race (Small and Big Lion). In order that Dark Forces could not penetrate into Light Earthes, Gods-defenders created the protective Boundary, which passed through the Earthes and Stars of the specified Halls, and also through the Show Worlds (our world), Navy (the world of dead) and Pravy (the world of gods). Our planet is on this Boundary as well, and Humanity is the witness and the participant of wars.

5. Our Ancestors

During the most ancient times the Midguard-land was on the eight space Ways crossing, which connected habitable lands in nine Halls of the Light Worlds, including the Hall of Race where the representatives of the Great (White) Race or Rasichy lived only. In those days the representatives of White Humanity were the first who occupied and rendered habitable the Midguard-land.

Ancestral home of our many ancestors is the solar system with the Golden Sun in the Hall of Race. The clans of White people living on the lands in the given solar system, call it as Dazhdbog-sun (the modern name — Beta of the Lion or Danebola). It is called as the Yarogreat Golden Sun, it is brighter as for light stream radiation, size and mass, than the Yarylo-sun.

Inguard-land rotates around the Golden Sun, the cycle time of which is 576 days. The Inguard-land has two Moons: the Big Moon with a cycle time of 36 days and the Small Moon with a cycle time of 9 days. There is the biological life on the Inguard-land similar to the life on the Midguard-land in the Golden Sun system.

In one of the fights of the second Great Assa on the above-stated Boundary the spaceship Waitmara transporting immigrants — including ones from the Inguard-land, was damaged and had to land on the Midguard-land. Waitmara landed on the northern continent, which was called as star travelers Daarija (the Gift of Gods, Gift to Ariyas).

There were representatives of four Clans of the allied Great Race Lands on Waitmara: Aryan Clans - 'Aryan and da'Aryan; Clans of Slavs - Rassens and Swatoruss. They were people with white skin and the growth more than 2 meters, but had distinctions in growth, hair color, iritis color and blood group.

Da'Aryans had silver (gray, steel) color of eyes and light-brown, almost whitish hair. 'Aryans possessed green color of eyes and light-brown hair. Swatoruss had sky-blue (blue, cornflower-blue, lake-blue) color of eyes and hair from whitish to chestnut-colored. Rassens had fiery (brown, light brown, yellow) eyes and chestnut-colored hair. Color of eyes depends on what Sun shined for people of these Clans at their native Lands during their evolution. Aryans differed from Swatoruss and Rassens also by the fact that they were able to distinguish where false information was (Krivda) and where the Truth was. It was connected by the fact that Aryans had the fight experience with Dark Forces, protecting their Lands.

The part of crew departed after Waitmara's repair (i.e. returned "on heavens"), and the part remained on the Midguard-land as they liked the planet, and "terrestrial" children were born at many of them by the moment of flying away. Those, who remained on the Midguard-land, began referring to as Asies. Asies — the descendants of Heavenly Gods living on the Midguard-land. And the territory of their further moving began referring to as Asiya (later — as Asia) since originally it was occupied by Asies. The names "Rasseniya", "Rasychy" appeared after their settling.

Then White Race people resettlement from the Inguard-land to the Midguard-land, Daarija followed. The people moved to the Midguard-land remembered about their ancient ancestral home and called themselves as "Dazhdbog grandsons", i.e. descendants of those Great Race Clans who lived under Dazhdbog-sun aureole. Living people at the Midguard-land were called as Great Race, and the people stayed at the Inguard-land were called as Ancient Race.

6. Different People

The people with various color of skin and the certain territory of residing live at the Midguard-land. Terrestrial humanity has ancestors which arrived to the Midguard-land at different times from various Heavenly Halls and have the following skin color: Great Race — white; Great Dragon — yellow; Fiery Snake — red; Gloomy Heathland — black; Pekelny World — gray.

Allies of White Race in fight with Forces of Darkness were the People from the Hall of the Great Dragon. They were allowed to settle at the Land, having defined a place in the Southeast, at the Yaryla-sun rising. It is modern China.

They defined the place at the land in the Western (Atlantic) ocean to other ally, the people from the Hall of Fiery Snake. Subsequently, with the arrival of the Great Clans Race to them, this Land began referring to as Antlan, i.e. the Land of Antovs. Ancient Greeks called it as Atlantis. Red-skinned people were moved on Waitmaras to the American continent after Antlan destruction 13 thousand years ago.

The Great Country of Black People property covered not only the African continent during ancient times, but also a part of Hindustan. Once Rusichy rescued a part of people with black color of skin, perishing at various Lands in the Gloomy Heathland Halls, destroyed by the forces of Darkness, their resettlement to the African continent and India. Then they rescued a part of Black People from the destroyed planet Daya.

The Indian tribes of dravids and nags belonged to Negro peoples and worshiped to the Goddess Kaly- — the Goddess of Black Mother and Black Dragons. Their rituals were accompanied by bloody human sacrifices. Therefore our Ancestors granted Vedas to them — the Sacred Texts nowadays known as Indian Vedas (Hinduism). Having learned about immemorial Heavenly Laws, such as Karma Law, Incarnations, Reincarnations, RITA and others, they abandoned obscene deals.

All people above-mentioned have one genotype though differ with color of skin.

The enemy of Great Race and other Races at the Midguard-land are the representatives of Pekelny World, secretly penetrated to the Midguard-land, therefore the territory of their residing is not determined. They are called as Strangers in Vedas, and places of their primary dwelling are called as Hell. As Vedas specify, they had gray skin, eyes of the Gloom color, they were bisexual initially (androgens), could be a woman or man (their sexual orientation varied depending on the Moon phases). They created various false religious cults. They coveted ill-gotten. All their ideas were only about power. The purpose of Strangers was to break the harmony reigning in the World of Light and destroy Descendants of the Heavenly Clan and Great Race as only they can give them worthy repulse.

Grey people arrived to the Midguard-land by small amounts at different times. But last time they arrived about 6 thousand years ago in large numbers, as Vedas testify, and resided at the free lands on the island Shri Lanka. Leaders of Strangers are called as Koscheis that explored gray people for their purposes. Strangers have the other genotype, as primarily they are bisexual. But being irinated (mixing up in genic and sexual level) between other people, they gradually turned into unisex ones, but having big enough stratum with genetic and sexual deviations (gays, lesbians, sadists, masochists, mentally retarded, etc.) as they started to dither the steady genetic base of other races. The aspiration for having power over other people also is the result of races mixture and should be considered as a pathology by a society.

7. Gods of our Ancestors

Gods (patrons, curators, the previous ancestors of people) repeatedly arrived to the Midguard-land, communicated with Great Race descendants, transferring them Wisdom (history and precepts of ancestors, knowledge of cereals cultivation, devices of a communal life, clans prolongation, education of children, etc.). 165032 years passed from the time when the Goddess Tara visited the Midguard-land. She was the younger sister of God Tarkh called as Dazhdbog (that gave Ancient Vedas). Slav-Aryan peoples called North Star in honor of this fine Goddess — Tara (and perhaps, on the contrary, if a woman arrived from this star).

Tarkh was the patron (curator) of the Eastern Siberia and Far East, and Tara was the patron of the Western Siberia. The territory name became Tarkhtara commonly, descendants recalled it as Tartariya, and then this name was removed to the name of Tatars people.

The God Perun visited the Midguard-land more than 40 thousand years ago from the Uray-land in the Eagle Hall on Swarozh (heavenly) Circle, he visited it the third time. He was the god-patron of all soldiers and many Great Race Clans. The god-Thundered managing with Lightnings, the son of God Swaroga and Lada-virgin. After first three Heavenly Fights between Light and Darkness when Light Forces won, the God Perun went down onto the Midguard-land to tell people about happened events and what expects Lands in the future, about approach of Dark times. Dark times represent the period of people life when they cease to honor Gods and live under Heavenly Laws and start to live under the laws which the representatives of Pekelny World imposed to them. They teach people to create laws and live according to them, so they aggravate their life, lead to degradations and self-destruction.

There are Legends, that God Perun visited the Midguard-land some more times to tell Secret Wisdom to Priests and Elders of Saint Race Clans, how to prepare for dark, heavy times, when the sleeve of our swastika galaxy will pass through the spaces subjected to the forces from the Hell Dark Worlds. At this time Light Gods cease to visit their peoples, as they do not penetrate into another's spaces, subjected to forces of these Worlds. Light Gods will start to visit Great Races Clans again with our Galaxy sleeve output from the specified spaces. The beginning of Light times starts in Sacred Summer 7521 from W.C.S.T. or in 2012 A.D.

Then Dazhdbog arrived onto the Midguard-land — God Tarkh Perunovich, the God-keeper of ancient

Great Wisdom. He was called as Dazhdbog (the giving God) because he gave people of Great Race and Heavenly Clan descendants Nine Santees (Books). These Santees were written down by ancient Runes and contained Sacred Ancient Vedas, Precepts of Tarkh Perunovich and his preaches. All inhabitants in various Worlds (Galaxies, Star Systems) and Lands, where representatives of the Ancient Clan live, live according to Ancient Wisdom, Patrimonial Principles and Rules that Clan adheres. They began to call themselves as "Dazhdbog grandsons" after visiting our Ancestors by God Tarkh Perunovich.

Our Ancestors were visited by many other Gods as well.

8. Destruction of the Moon Lelya

The First Great Flood happened as a result of the Moon Lelya destruction, one of three Moons rotating around of the Midguard-land.

Here is how ancient sources speak about this event: "Children are mine! Let you know, the Earth goes by the Sun, but my words will not pass by you! And remember about ancient times, people, remember! About the Great flood which exterminated people, about falling fire onto the mother Earth!" ("Songs of the bird Gamayun").

"You live quietly at Midguard for a long time when the peace strengthened: Remembering about Dazhdbog acts from Vedas as it destroyed Koschei's strongholds that were on the nearest Moon... Tarkh did not allow to destroy Midguard by treacherous Koscheis, as they destroyed Daya... These Koscheis, governors of Grey, disappeared together with the Moon in half-participation... But Midguard paid off for freedom with Daarija, latent by the Great Flood... That Flood was created by the Moon Waters, they fell down with a rainbow to the Earth from heavens, because the Moon was broken up into parts and went down with army Swarozhychy into Midguard..." ("Peruns' Vedas Santees").

Not only the Earth's external look changed after waters fell down onto the Midguard-land and splinters of the destroyed Moon Lelya, but also the temperature mode on its surface changed, as its axis began pendulum fluctuations. The Great Cold snap began.

However not all descendants of Great Race Clans and Heavenly Clans perished together with Daarija. People were warned by Great Priest Spas about forthcoming Daarija's destruction as a result of the Great Flood and started to move to the Eurasian continent beforehand. 15 settlements from Daarija were organized. People moved along the Stone Isthmus between Eastern and Western seas to the south within 15 years. These are the names known now as Stone, Stone Belt, the Rypeysky or Ural mountains. There was their full resettlement 111812 years ago (or in 109808 B.C.).

A part of people rescued, having risen on small flying apparatuses Waitman into the low-earth orbit and returned back after the Flood. Others moved (teleported) through the "gates among worlds" at the Bear's Hall to the da'Aryans' ownership.

After the Great Flood our Great Ancestors occupied the big island in the Eastern Sea, called as Buyan. Nowadays this is the territory of the Western and Eastern Siberia. The moving of Sacred (White) Race began from here to nine world sides. The favorable land of Asii or the Sacred Race land is the territory of modern Western and Eastern Siberia from Rypeisky mountains (the Urals) up to 'Aryan sea (the lake Baikal). This territory was called as Belorechye, Pyatirechye, Semirechye.

The name "Belorechye" originated from the river Iriy name (Iriy the Quietest, Iriy -calm, Irtysh) which is considered as the White, Pure, Sacred River and along which our Ancestors settled for the first time. After the Western and Eastern seas recession, Great Races Clans occupied the lands, being earlier as a sea-bottom. Pyatirechye is the land washed by the rivers Irtysh, Ob, Yenisey, Angara and Lena where they were gradually settled. Later, when there was a warming after the First Great Cold snap, and the glacier receded, the Great Races Clans settled along the rivers Ishym and Tobol as well. Since then Pyatirechye turned into Semirechye.

Each of them obtained the corresponding name in the process of land development to the east of the Urals. Siberia was located in the north in the bottom current of the Ob, between the Ob and the Ural mountains. Belovodye is located actually to the south, on the riverside of Irtysh. There is Lukomorye to the east of Siberia, on the other side of the Ob. Yugorye is located to the south of Lukomorye that reaches the mountains Irijsky (Mongolian Altai).

The city of Asgard Irijsky became the capital of our Ancestors at this time (As is the god, Guard is the city, the city of Gods in common), which was founded in the summer 5028 from Great Resettlement from Daarija to Rasseniya, on the holiday of Three Moons, the month Taylet, the ninth day of 102 Krugolet Chislobog year — an ancient calendar (104778 B.C.). Asguard was destroyed in the summer 7038 from W.C.S.T. (1530 A.D.) by Dzhungars — natives of northern provinces Arymiya (China). Old men, children and women hid into caves, and then went to skits. Nowadays there is Omsk at the location of Asguard.

The original ceremony - Paskhet with deep inner meaning, made by all Orthodox people, - appeared in memory of rescue from the Flood and Great Resettlement of the Great Race Clans in 16-th year. This ceremony is well familiar for everybody. Painted eggs are hit by each other being checked, whose egg is stronger on Paskhet. The broken egg was called as Kaschei's egg, i.e. the destroyed one by the Moon Lelya with the bases of Foreigners, and the whole egg was called as

Force Tarkh Dazhdbog. The fairy tale about Koschei Immortal also appeared, whose death was in an egg (on the Moon Lelya) somewhere at high oak top (i.e. actually in heavens).

As a result of the first Great Cold snap the northern hemisphere of the Midguard-land began to become covered with snow during the third part of the year. Great Resettlement of the Heavenly Clans descendants to the Ural mountains began due to the lack of food for people and animals, which protected Sacred Rasseniya at the western borders.

'Aryan Clan, headed by the Great Leader Antom, reached the Western (Atlantic) ocean and forwarded with the help of Waitman to the island in this ocean on which people lived with skin color of Sacred Fire flame (people with red skin) without beards. The Great Leader constructed Heathen (temple) of the Trident of God Morej and Oceans (God Nija) on that land, which patronized people, protecting them from Forces of Evil. The island began to be called as the land of Antas or Antlan (according to Old Greek — Atlantis).

9. The destruction of the Moon Fatta

However the life of our Ancestors on the Midguard-land was undergone to one more trial. As Vedas testify, great prosperity befuddled the heads of leaders and priests. Laziness and desire of other property obscured their mind. They also started to lie to Gods and people, began to live under their laws, breaking Precepts of Wise Ancestors and Laws of the Single God-creator. They started to use the Force of Elements (probably, the gravitational weapon) of the Midguard-land for their purposes achievement.

The Moon Fatta was destroyed 13013 years ago (in 11008 B.C.) in the fight between people of the White Race and priests of Antlany. But thus an enormous splinter of Fatta ran into the Earth therefore the terrestrial axis inclination changed in 23 degrees and continental outlines (from here - there is a modern word "fatal") changed. The Yarilo-sun began to pass through other Heavenly Halls on Swarozhy Circle. The huge wave bypassed the Earth three times that brought to ruin Antlany and other islands. The increased volcanic activity led to atmosphere pollution that was one of the reasons of the Great Cold snap and congelation. Many centuries passed before the atmosphere began to be cleared, and glaciers receded to poles.

Righteous people of the Light Race of Pure Waitman were transferred to the territory of Great Country Ta-Kemy after Antlany's destruction that was in the east from Antlany and in the south from Great Veney (Europe). The tribes with the skin of Gloom color (Negros) and tribes with the skin of the Going down Sun color — ancestors of separate Semitic peoples, in particular, arabs lived there. Ta-Kemy — the ancient country was called in such a way that existed in the north of the African continent, on the territory of modern Egypt. It is known from Ancient Egypt legends that this country was founded by nine White Gods who came from the North. White skin Priests hide themselves as White Gods — devoted to Ancient Knowledge in this case. Undoubtedly, they were Gods for Negro population of Ancient Egypt. Greeks called them as Kymeriyts.

White Gods created the state Egypt and transferred local population sixteen secrets: the skill to build habitation and temples, skill of agriculture technique, cattle breeding, irrigation, craft art, navigation, military art, music, astronomy, poetry medicine, secrets of embalming, secret sciences, priestess institute, pharaoh institute, use of minerals. Egyptians received all this knowledge from the first dynasties. Four Great Race Clans, replacing each other, trained new Priests with Ancient Wisdom. Their knowledge was so extensive, that allowed to be organized quickly in a powerful civilization. The term of the state Egypt formation is known — 12–13 thousand years ago. The route how white Priests appeared in Egypt is known now as Belovodye (Rasseniya) — Antlan (Atlantis) — Ancient Egypt.

10. Antsky Union and Zmiyov Banks

Further the part of Great Race Clans moved to the bottom watercourse of the river Danube because of strong droughts, and then to the middle Podneper. The powerful Antsky union arose on these territories, whose name speaks for itself.

The tribes living in a forest-steppe zone along 50-th parallel from the Western Ukraine up to Don were called as antas on medieval cards of the Kiev Russia. Time of their existence according to the mention in historical sources — since 375 (the first mention about antas) according to 602 (the last mention about antas) A.D. But more objective sources on the basis of the carbon analysis of so-called Zmiyov bank show that Antsky union existed, at least, a millenium.

The length of Zmiyov banks is about 1000 km (according to some estimations their length reached up to 1500 and even 2000 km) which is comparable to the length of the Great Chinese wall. The depth of banks is 200 km. They were under construction since II century B.C. till VII century A.D., i.e. the whole millenium. More than 600 km of banks passed on the Drevljanskaya land (surrounded from the south), the rest — on Polyanskaya land (the length of banks in Kiev region is equal to 800 km). Such an interesting detail: in the beginning banks were constructed by the inhabitants of two lands, perhaps, separately (all the first banks were located in 60 kilometers from Kiev), but methodically both lines of banks moved ahead to the south. And it means that they had the same owner. Moreover, banks were under construction according to the unified plan in both lands, and they were joined since IV century. The bank Fastov-Zhitomir of the length 120 km was constructed in general like straight lines, protecting, thus, two lands at once.

Goons committed excesses on those days in Europe. Goons' Tsar Attyla won emperors of Tsargrad and Rome, the Holy Seat implored mercy hardly before him. He was stopped only in 451 in 200 km from Paris (at that time — Lutetia). Goons subdued tens empires, but Antsky union could not subdue at all!

Thus, the first half of the first millenium was filled with struggle of Antsky union against Sarmatian, Gothic, Goon and Avarian aggression for that purpose, as a matter of fact, Zmiyov banks were constructed. It is possible to conclude also from this that tribes of Antsky union, living in a forest-steppe zone, were settled and peaceful, but always struggling for their independence.

Only Slavs christianization and Christian church division into Orthodox and Catholic splitted Antsky union into two parts. The Kiev Russia was formed of the eastern part after the Rurikoviches arrival from north, and the western - a number of Central European Slavic states. Such countries names as Bulg-Ariya (Bulgaria), Hung-Ariya (Hungary) speak well for themselves for the profit of an antsky-aryan origin. They are considered as Slavic, apparently, from Orthodoxy, which spiritually united both Aryan and Slavic Clans.

Slavic tribes had related languages on the territory of Antsky union that are kept till now. Belarus (84% of lexical concurrences), Polish (70% of lexical concurrences) are the closest languages to Ukrainian one according to the modern linguistic data, Slovak and Czech languages are little bit farther, belonging to one subgroup. Bulgarian (73% of concurrences), Serbian (66%) are the closest languages to the Russian one, a little bit less Croatian, Macedonian and Slovene that make the second subgroup. There are 62% of the general lexicon in Ukrainian and Russian languages (44% of morpheme general and 18% of morpheme similar).

The author of the given report was not too lazy and "shovelled" the Polish-Russian dictionary of 10000 words in full. It appeared, there is 96% of similarity between Ukrainian and Polish words of this dictionary, while there is only 80% of similarity between Ukrainian and Russian. The rest 4% of the Polish language words are either German, English or Old Polish origin.

11. Ukraine is the Atlantis successor

The transitive, i.e. oscillatory process occurred after falling to the Earth a huge Fatta splinter and its axis displacement during several thousand years, at which there were local cold snaps either cold snaps or warmings of the duration for 300–500 years. Droughts were observed during these warmings in Egypt. Antas, living on worse lands, moved to the north, Europe, to their relatives during one of these droughts. They settled in the river basin of the Danube and middle Dneper.

Thus, modern Ukraine is the state successor that was on Atlantis. Many facts speak about it.

1. Slav-Aryan Vedas speak directly about it as it was already above-mentioned.

2. Old Slav name Atlantis testifies about it — Antlan (the Antovs' land) as the Ukrainian word "lane" just designates arable, and in a more comprehensive sense — the favorable, fertile or the dwelling land as people did not settle at the infertile lands.

3. The Byzantine historians called east Slavs as antas.

4. The powerful Antsky union existed in the first half of I millenium A.D. in the Southeastern Europe. Further the eastern part of Antsky union turned to the Kiev Russia, and its basic lands — to the present Ukraine.

5. We have got a lot of names and surnames like Anton and Antonov.

6. Besides the main god of Atlantis (Antlany) was the seas god Niy with a trident (Egyptians had Poseidon, and Greeks had Neptune). Apparently, the trident was on the arms of Atlantis governors. The trident is the main element of the arms of Kiev Russia and the present Ukraine.

7. Further, the Ukrainian language differs by half from Russian on grammar. Such change is necessary from 10 up to 25 thousand years if to take into account, that the grammar varies per 2–5% for a millenium, as could happen with uniform primary language of our ancestors, when their part moved to Atlantis. Thus it should be taken into account, that somewhere 2-3 thousand years have already passed since the time when antas returned to the territory of the present Ukraine, then there was a rapprochement of Russian and Ukrainian languages (i.e. a return process). Russian language was introduced into the basic cities of the Kiev Russia by the Rurikoviches, their team, traders and other immigrants from the north. Therefore it was an official language of the Kiev Russia. And people spoke Ukrainian in villages and remote cities.

8. Then the name of the country "Ukraine" (at edge) does not match in any way with the central position of residents in Europe. Most likely, the name concerns to the settlements of Slavs at the land edge, on the island, i.e. in Atlantis. Therefrom it also removed here, having lost its primary value. Those Slavs were called as Ukrainian from what, apparently, the name of the modern country — Ukraine went.

9. The reality of Atlantis and flood existence (there are already so many proofs that there are no doubts concerning their reality currently).

10. The reality of the big drought occurrence in Egypt (fixed by ancient historians) that led to the population migration.

Thus, that fact can be ascertained quite provable for today, that the significant part of the population in Ukraine is the Atlantis population descendants. Apparently, the Ancient Knowledge can be stored somewhere within this country limits. Then the Strangers' interest to it become clear and significant.

12. Ancient measure units of length and time

Our Ancestors had sacred numbers: 3, 4, 7, 9, 16, 33, 40, 108, 144, 369. We use these numbers till nowadays: we receive passports in 16 years, we remember dead people on 9-th and 40-th days, etc. Our Ancestors had 9 parts of the world. The circle of 360 degrees will be if to divide each of them into 40 parts that we use currently as well.

Every day was divided into 16 hours, each hour contained 144 parts, there were 1296 shares in each part, 72 instants were in each share, 760 moments were in each instant, in each instant — 160 sigs.

It is enough to give one simple example to understand, with what sizes our Ancestors operated: Slav-Aryan peoples called one of the smallest time particles as "sig". It was depicted like a lightning by Rune. The fastest moving from one place to another was estimated in sigs. Old Russian expressions such as "sigat", "siganut" originated from here.

What is 1 sig equal to in modern time units? The answer makes think for anyone: one second contains 300244992 sigs and 1 sig is approximately equal to 30 fluctuations of an electromagnetic wave of caesium atom taken as a basis for modern atomic hours (or about 1/300 billion share of a second). What were such small sizes necessary for our Ancestors? The answer is simple for measurements of superfast processes. Thus, ancient expressions "sigat," "siganut" can mean only "teleport" in the modern language.

And the biggest distance size of the "remote distance" is equal about 1,4 light years. It is obvious that such units of length were necessary only for the description of distances up to other star systems. Similarly the biggest period of time "Swarozhy Circle" was equal to the period of the terrestrial axis precession in 25920 years, which remains unnoticed by the contemporaries for some reason, got used to live in the scales of one human life, instead of time scales of the Humanity existence and glacial ages.

13. The most ancient Slav-Aryan Calendar

The Calendar of our Ancestors originates of the people's calendar living on the Inguard-land. The name of the calendar was obtained from the word-combination "God Koljada's Gift".

The annual way on the Yaryla-sun star sky was called as Swarozhy Circle by Slav peoples. The Swarozhy Circle was divided into 16 parts, and they were called as the Mansions or Halls (constellations) which were divided into 9 Halls each in its turn. Thus, the Swarozhy Circle consisted of 144 parts, and the unique Heavenly Rune corresponded to each part.

The full cycle of Darijsky Round year of Numberbog consisted of 144 years (i.e. years) that corresponded to the divisions of Swarozhy Circle into 180 parts. (Now 137-th year of this Round year began). There were 15 years of them per 365 days, and every 16^{th} year was Sacred and contained 4 days more in honor of the holiday Paskhet. The New year fell to the autumn equinox day, i.e. for September 22.

Every summer had 9 months and consisted of three seasons: spring, autumn and winter. Three months were necessary for each season. Here is a typical example of one year:

1. Ramkhat — September 22 - November1, 2003
2. Ilet — November 2, 2003 - December 11, 2003
3. Beylet — December 12, 2003 - January 21, 2004
4. Gaylet — January 22, 2004 - March 1, 2004
5. Daylet — March 2, 2004 - April 11, 2004
6. Elet — April 12, 2004 - May 21, 2004
7. Veylet — May 22, 2004 - July 1, 2004
8. Kheylet — July 2, 2004 - August 10, 2004
9. Toylet — August 11, 2004 - September 20, 2004.

Months of simple summer had different quantity of days: 41 days in odd months and 40 days in even ones. There were 41 day in each month in Sacred Summer. The expressions such as "forty terms," "it is better forty times one time, than never forty times," etc. appeared from quantity of days in months and the sacred number 40.

The calendar had no negative dates. If the most ancient dates were required to specify, so the most ancient events, from which the readout made, were used. For example, now goes the following:

Summer of 2004 from Christ birth;

Summer 7 513 from World Creation in the Star Temple (5 508 B.C.);

Summer 13 013 from the Great Cold snap (11 008 B.C.);

Summer 40 009 from Perun's Third Visiting of Waitman (38004 B.C.);

Summer 106783 from the basis of Asguard Iriysky (104778 B.C.);

Summer 111812 from the Great Resettlement from Daarija (109806 B.C.);

Summer 142995 from the Period of Three Moons (140990 B.C.);

Summer 153371 from Assy Daya (151336 B.C.);

Summer 165035 from the Time of Tary, Perun's daughter (163030 B.C.);

Summer 604379 from the Time of Three Suns (602374 B.C.).

Slavs week consisted of 9 days at ancient times (apparently, according to the period of the Small Moon rotation around the Inguard-land) in which there was no Wednesday at all, and Sunday appeared only at Russian-speaking Christians. The last day until this day refers to as a "week" at Byelorussian, Ukrainian, Poles, Chekh, Serbs and other slavic peoples. Wednesday was not the last day at ancient Russiches, but Triteynik, and after Friday went the following: Shestytsa, Sedmytsa, Osmytsa and properly Sunday — the day when people had a rest from their deals (they do nothing). It was recommended to go to the relatives on this day, come to see them and be pleased in common. And such walkings were not chaotic (I went to my brother to the next village, and he went to me on another road at this time), apparently, there were some rules. The Ukrainian temple represent these rules.

The mention of ancient names of the week days are kept in national fairy tales "and he went to Hailstones-capital on the first sedmytsa" ("the Horse Gorbunok"), "here osmytsa passed already and a week approached" ("the Stone bowl").

14. Conclusion

Slav-Aryan Vedas contain much more data on the universe structure and history of Humanity, than this rather modest survey report can contain. But it would be desirable to hope that it will be an incitement to all those people who got acquainted with it, to independent search of Ancient Knowledge, renaissance of Ancient Wisdom and their spirituality breeding as well as spirituality of their children, relatives and familiar people to get real human happiness.

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Spacetime & Substance Volume 6, No. 1 (26), 2005

CONTENTS

S.S. Sannikov-Proskuryakov. NON–NEUMANNIAN REPRESENTATIONS OF ROTATION GROUP (TO THE ETHER THEORY). 1 .... **1**

J.A. Belinchón. BULK VISCOUS FRW WITH TIME VARYING CONSTANTS REVISITED **8**

S.N. Arteha. CRITICAL REMARKS TO THE RELATIVITY THEORY **14**

S.S. Sannikov-Proskuryakov. NON–NEUMANNIAN REPRESENTATIONS OF ROTATION GROUP (TO THE ETHER THEORY). 2 .... **21**

Angelo Loinger. NO GW IS EMITTED BY B PSR1913+16 .... **28**

Geetanjali Sethi, Pranav Kumar, Sanjay Pandey & Daksh Lohiya. A CASE FOR NUCLEOSYNTHESIS IN SLOWLY EVOLVING MODELS **31**

N.A. Zhuck. SLAV-ARYAN VEDAS ABOUT THE UNIVERSE STRUCTURE AND HUMANITY HISTORY **39**