ELEMENTAR OBJECTS OF MATTER: UNIVERSALITY, HIERARCHY, ISOMORPHYSM, DYNAMICAL SPECTRUM

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ABSTRACT

In the frame of Wave Universe Concept (WU Concept) it is presented the alternative approach to the effective description of Elementar Objects of Matter (EOM) of micro and megaworld hierarchy, in particular, of particles in subatomic physics.

According to the Wave Universe Concept (WU Concept), discrete spectrum of EOM is close connected, generate by universal spectrum of physically preferable, elite velocities in the Universe.

The special attantion to analysis and precise description of central set of EOM - stationary states (of EOM) is payed.

In particular, sufficiently precise representations for mass values, cross relations between masses of main important objects of particle physics (proton, pion, main mesons, etc.) are obtained.

Obtained representations for the hierarchy of characteristic dimensional parameters, for instance, for the mass spectrum - mass formula are not contained any divergencies - its are simple, compact, possess clear physical sence and have not any kind of fitting parameters. With this, the competence field of these representations is practically indefinitely - apparently, "all" Wave Universe for wide set EOM of micro and megaworld.

ELEMENTAR OBJECTS OF MATTER

Astohishing diversity of real objects of Universe, observed on different Levels of matter, may be considered as manifestation of nonexhausting creative capacities of Nature.

The most characteristic, wide representable, as possible, the simplest from its with most probability are attracting in some known concepts as candidates to fundamental, *elementary objects of matter (EOM),* representing (and organizing) the observed appearance of Universe.

It is considered evidently, that compositions, combinations such fundamental constituents create and demonstrate all observed variety of complex systems - at all Levels of the Universe hierarchy.

Elementary Objects of Matter (EOM) – As Wave Dynamic System (WDS)

With any way - speculative, dinamical, physical - of attempt to describe, qualify these or another characteristic objects or all its taxanomy, we suppose, that the most frequantly asking question: "From what are consist...?" - don't has the special sense and real perspective.

It is appear as more constructive, fundamental the following conclusion, having far-reaching conseqences [Chechelnitsky, 1980].

Proposition.

Observed in Universe real objects and most fundamental from its - elementary objects of matter (EOM)- represent itself, in conceptual plane - the principal *Wave dynamic systems* (WDS).

Wave (Megawave) aspect of structure of any observed systems of Universe at all Levels of its hierarchy is not external formal supplement, but is deep internal fundamental basis of its dynamical and physical structure.

VELOCITIES HIERARCHY AND UNIVERSALITY

Hierarchy and Spectrum of Elite Velocities.

The *Fundamental wave equation* [Chechelnitsky, 1980], described of Solar system (similarly to the atom system), separates the spectrum of physically distinguished, stationary - *elite* - orbits, corresponding to mean quantum numbers N, including the spectrum of permissible *elite* velocities v_N.

It is the follow representation for the physically distinguished - *elite velocities* $v_N^{[s]}$ in $G^{[s]}$ Shells of *wave dynamical* (in particular, astronomical) *systems* (WDS) [Chechelnitsky, 1986]

$$v_N^{[s]} = C_*^{[s]}(2\pi)^{1/2}/N, \qquad s=...,-2,-1,0,1,2,...$$

$$C_*^{[s]} = (1/\chi^{s-1})\cdot C_*^{[1]}.$$

Here

$C_*^{[1]}$ = 154.3864 km·s^{-1} is the calculated value of *sound velocity* of wave dynamic system (WDS) in the $G^{[1]}$ Shell, that was made valid by observations,

χ = 3.66(6) - the *Fundamental parameter of hierarchy* (Chechelnitsky Number χ = 3.66(6)) [Chechelnitsky, 1980 - 1986],

s - the countable parameter of Shells,

N - (Mega)Quantum numbers of *elite states*,

a) Close to

$$N_{Dom} = 8; 11; 13; (15.5)16; (19,5); (21,5)\ 22,5 -$$

for the *strong elite (dominant) states* (orbits);

b) Close to

$$N - \text{Integer, Semi-Integer} -$$

for the *week elite (recessive)* states (orbits).

In the wave structure of the Solar System for planetary orbits of Mercury (ME), Venus (V), Earth (E), Mars (MA), we have, in particular, $N = (2\pi a/a_*)^{1/2}$ (a - semi-major axes of planetary orbits, $a_*^{[1]} = 8R_\odot$ - semi-major axis of $TR_*^{[1]}$ - *Transsphere*, R - radius of Sun) [Chechelnitsky, 1986]

$$N = 8.083; 11.050; 12.993; 16.038, \text{ close to } integer$$
$$N = 8; \quad 11; \quad 13; \quad 16.$$

Taking into account Ceres (CE) orbit and transponating in $G^{[1]}$ (from $G^{[2]}$) planetary orbits of Uranus - (U), Neptune - (NE), Pluto - (P), it may be received the general representation for observational *dominant* N

	TR_*	ME	TR	V	E	(U)	MA	(NE)	CE	(P)
N=	$(2\pi)^{1/2}$=2.5066	8.083	$(2\pi)^{1/2}\chi$=9.191	11.050	12.993	15.512	16.038	19.431	21.614	22.235

It may be show, that

$$N = N_* = (2\pi)^{1/2} = 2.5066 \text{ (critical - } transspheric \text{ value) and}$$
$$N_{TR} = \chi(2\pi)^{1/2} \cong 9.191$$

also are physically distinguished (*dominant*) N values [Chechelnitsky, 1986].

Extended Representation

It is possible, in principle, examine the following substitution

$$1/N \to \varsigma / N^{\#} \text{ or } N \to N^{\#}/\varsigma$$

and extended formula for elite velocities

$$v_N^{[s]} = C_*^{[s]}(2\pi)^{1/2}(\varsigma / N^{\#}), \qquad s=...,-2,-1,0,1,2,...$$
$$\varsigma\ ,\ N^{\#} - integer.$$

In that case, for instance, the previouns condition N - semi - integer will be indicate (for the set of integer numbers) the condition

$$\varsigma = 2,\ N^{\#} - integer,$$

and thus, - the substitution $N \to N^{\#}/2$.

General Dichotomy

Very close (to discussed above) variant of description of physically distinguished states may be possible with using of effective approximation, proposing by *the General Dichotomy Law* [Chechelnitsky, 1992]. Connected with it compact representation for the N quantum number has the explicit form

$$N_\nu = N_{\nu=0} \cdot 2^{\nu/2}, \qquad N_{\nu=0} = 6.5037$$

that depends from countable parameter

$$\nu = k/2, \quad k=0,1,2,3,...$$

It follows, in perticular, to exponential, (power) dependence for a semi-major axes

$$a_\nu^{[s]} = a_{\nu=0}^{[s]} 2^\nu,$$
$$a_{\nu=0}^{[s]} = a_*^{[s]} (N_{\nu=0})^2/2\pi,$$

In the some sense - this is expansion and generalization to all WDS of Universe of the well-known Titius-Bode Law for the planetary orbits.

Such idealazing model representation - the General Dychotomy Law (GDL) - gives approximate, but easy observed description of the set of distinguished (*dominant*) orbits.

Universal Spectrum of Elite Velocities in the Universe.
Megaworld and Microworld (Quasars and Particles).

Proposition.

The spectrum of physically distinguished *elite* (*dominant*) velocities $v_N[s]$ and quantum numbers N of arbitrary

wave dynamic systems (WDS) have the some *universal* peculiarity. It practically is identical - *universal (invariant)* for all known observed systems of Universe (of *megaworld and microworld*).

In particular, velocities spectrum of experimentally well investigated Solar and satellite systems practically coincide for observed planetary and satellite - *dominant* orbits, corresponding to some (dominant) values of quantum numbers N_{Dom}. Thus it may be expected, that spectrum of *elite (dominant* - planetary) velosities of the Solar system (well identificated by observations) may be effectivelly used as quite representive - *internal (endogenic)* - spectrum of physically distinguished, well observed - *elite (dominant)* velocities, for example, *of far* astronomical systems of Universe [Chechelnitsky, 1986, 1997] and of wave dynamic systems (WDS) - *elementary objects* of subatomic physics.

Quantization of Circulation and Velocity.

We once more repit in the compact form the important conclusion which was obtained in the monograph (Chechelnitsky, 1980) and repeatedly underlined afterwards.

Proposition (Quantization of Velocities).

In the frames of Wave Universe Concept and Universal wave dynamics

The fundamental properties of discreteness, quantization of *wave dynamic systems (WDS)* - objects both *mega* and *microworld* - are connected not only with discreteness, quantization of

i) Kinetic momentum (angular momentum) $K_m = mva$,

ii) And momentum (impuls) $P = mv$ (as that is discrabed in well known formalism of quantum mechanics),

But - on the fundamental level - are connected with discreteness, quantization of

v) *Sectorial velocity* (circulation)

$$L = K_m/m = va, \quad (L_* = \xi\text{đ} = \xi\hbar/m),$$

ξ - nondimensial coefficient,

vv) And *(Keplerian) velocity* $v = P/m$.

vvv) Together with the relating to its sizes (lengths) - a - semi-major axes of orbits and T - periods (frequencies).

Universality of Observed,
Physically Distinguished Velocities

From the point of view of experimental investigations of real systems of Universe the Law of Universality of Elite (Dominant) velocities may be briefly formulated as follows

Proposition (Universality of Elite –
(Dominant) Velocities in Universe).

Detectable in *experiments and observations* velocities of real systems of Universe - from objects of microworld (subatomic physics) to objects of megaworld - astronomical systems - with the *most probability belong to the Universal Spectrum of elite (dominant) velocities* of Universe.

This Universal Spectrum of Velocities in the sufficient approximation may be represented in the form:

$$v_N^{[s]} = C_*^{[s]}(2\pi)^{1/2}/N, \qquad s=...,-2,-1,0,1,2,...$$
$$C_*^{[s]} = (1/\chi^{s-1})\cdot C_*^{[1]}.$$

General Homological Series of Sound Velocities

Once more let pay our attention to the hierarchy of *sound velocities*, that is definded by the recurrence relation

$$C_*^{[s]} = (1/\chi^{s-1})\cdot C_*^{[1]} \qquad s=...,-2,-1,0,1,2,...$$

In view of its special important significance and possibility of following generalizations we will to name it "The General Homological Series (GHS) of sound velocities". By the quality of generative member in that series essentially it is used, for instance, the

$$C_*^{[1]}=154.3864 \text{ km}\cdot\text{s}^{-1}$$

- value of sound velocity in $G^{[1]}$ Shell of WDS.

As a matter of fact, that is *primary source (eponim)* of that series.

Of course, as the capacity of primary source may be used any member of that series.

Testimony (Evidence) for that is only most knowlege reliability of that value - its experimental definiteness (determination).

Fundamental Parameter of Hierarchy.

At 70-th in investigation of wave structure of Solar system [Chechelnitsky, 1980] it have been discovered significent arguments for existance of *Shell structure, hierarchy and similarity - dynamical isomorphysm* - of Solar system Shells.

First of all, that concerned to dynamical isomorphysm of clearly observed $G^{[1]}$ and $G^{[2]}$ Shells, connecting

respectively with I (Earth's) and II (Jovian) groups of planets.

It was determined that arrangement of physically distinguished - *elite* (particularly powerful, strong -*dominant*) orbits of Mercury in $G^{[1]}$ (and Jupiter in $G^{[2]}$), Venus in $G^{[1]}$ (and Saturn in $G^{[2]}$) Shells brightly underline the similarity of geometry and dynamics of processes, flowing in these Shells, with accuracy up to the some scale factor.

As the quantitative characteristics of that isomorphysm, the recalculation coefficient χ - *Fundamental parameter of hierarchy (FPH)* - may be used the ratio, for instance, of

(Keplerian) orbital velocities v

$$v_{ME}/v_J=47.8721\ km\cdot s^{-1}/13.0581\ km\cdot s^{-1}=3.66608 \Rightarrow \chi,$$
$$v_V/v_{SA}=35.0206\ km\cdot s^{-1}/9.6519\ km\cdot s^{-1}=3.62836 \Rightarrow \chi,$$

Sectorial velocities L

$$L_J/L_{ME}=1.01632\cdot 10^{10} km^2\cdot s^{-1}/0.27722\cdot 10^{10}\ km^2\cdot s^{-1}=3.66608 \Rightarrow \chi,$$
$$L_{SA}/L_V=1.37498\cdot 10^{10}\ km^2\cdot s^{-1}/0.37895\ km^2\cdot s^{-1}=3.628357 \Rightarrow \chi,$$

Semi-major axes a

$$a_J/a_{ME}=5.202655\ AU/0.387097\ AU =$$
$$= 13.440164=(3.666082)^2 \Rightarrow \chi^2,$$
$$a_{SA}/a_V= 9.522688\ AU/0.723335\ AU =$$
$$= 13.164975 = (3.628357)^2 \Rightarrow \chi^2,$$

Orbital periods T (d - days)

$$T_J/T_{ME}=4334.47015d/87.96892d=49.272744=(3.666082)^3 \Rightarrow \chi^3,$$
$$T_{SA}/T_V=10733.41227d/224.70246d = 47.76722=(3.6283568)^3 \Rightarrow \chi^3.$$

In the published at 1980 monograph [Chechelnitsky,1980] (date of manuscript acception - 11 May 1978) this dynamical isomorphysm, similarity of geometry and dynamics of physically distinguished orbits of I (Earth's) and II (Jovian) groups were analized.

According to the content of "Heuristic Analysis" division [Chechelnitsky, 1980, pp.258-263, Fig.17,18] similarity coefficient - recalculation scale coefficient of megaquants

$$\Delta^{I}=L_{ME}/3=0.924\cdot 10^9\ km^2\cdot s^{-1}$$
$$\Delta^{II}=L_J/3=3.388\cdot 10^9\ km^2\cdot s^{-1}$$

of L - sectorial velocities (actions, circulations) of I and II groups of planets is equal

$$\Delta^{II}/\Delta^{I}=L_J/L_{ME}=3.66(6) \Rightarrow \chi$$

It was not surprise, that transition to another Shells of Solar (planetary) system (to Trans-Pluto and Intra-Mercurian Shells) would be characterized with the same χ – *Fundamental parameter of hierarchy* (FPH) χ=3,66(6).

Universality of FPH

Analysis of (mega)wave structure of physically autonomous satellite systems of Jupiter, Saturn, etc., indicated, that discovered χ Fundamental parameter of hierarchy (FPH) plays in its the similar essential role, as in the Solar (planetary) system, characterizing the hierarchy, recursion and isomorphysm of Shells.

Thus, it takes shape the essentially *universal* character of (FPH) - its validity for the analysis of (mega)wave structure *of any WDS.*

That corresponds to representations, connected with *co-dimension principle* [Chechelnitsky, 1980, p.245]:

"...fundanental fact is that when we pass on to another WDS, the value of đ [character value of sectorial velocity (action, circulation)] doesn't remain constant, but varies according scales of these systems. This fact is the consequence of *co-dimension principle* ..."

"Magic Number"("Chechelnitsky Number", FPH) χ=3,66(6).
Role and Status of Fundamental Parameter of Hierarchy in Universe.

Previous after primary publications [Chechelnitsky, 1980-1985] time and new investigations to the full extent *convince* the theory expectations, in particular, connected with the $G^{[s]}$ Shells hierarchy in each of such WDS, with the hierarchy of Levels of matter (and WDS) in Universe, with the exceptional role of the *introduced in the theory* χ FPH [Chechelnitsky, (1978) 1980-1986].

The very brief resume of some aspects of these investigations may be formulated in frame of following short suggestion.

Proposition (Role and Status of χ FPH in Universe) [Chechelnitsky, (1978) 1980-1986]

The central parameter, which organizes and orders the dynamical and physycal structure, geometry, hierarchy of Universe

∗ "*Wave Universe (WU) Staircase*" of matter Levels,

∗ *Internal* structure each of real systems - wave dynamic systems (WDS) at *any Levels* of matter, is (manifested oneself) χ - the *Fundamental Parameter Hierarchy (FPH)* - nondimensional number χ =3,66(6).

It may be expected, that investigations, can show in the full scale, that χ - FPH, generally speeking, presents and appeares *everywhere* - in any case, - in an extremely wide circle of dynamical relations, which reflect the geometry, dynamical structure, hierarchy of real systems of Universe.

We aren't be able now and at once to appear all well-known to us relations and multiple links, in which oneself the [Chechelnitsky] χ=3.66(6) *"Magic Number"* manifests.

We hope that all this stands (becomes) possible in due time and with new opening opportunities for the publications and communications.

STATIONARY STATES.

Spectrum of Masses (of EOM). Mass Formulae.

In the frame of Wave Universe Concept even for extent time (for the own perspective investigations of WDS of various hierarchy Levels of Universe) we use the following representation for the spectrum of mass of *stationary states*.

We cite it with hope in potentially wide employment in various, occasionally, far (distant) extending domain of knowledge (for instance, - in particle physics, astrophysics, cosmology).

$$M_N^{[s]}=M_*^{[s]}N^2/2\pi, \quad s=...,-2,-1,0,1,2,...$$
$$M_*^{[s]}=(\chi^2)^s M_*[0]=(\chi^2)^{s-1}M_*^{[1]}$$

More detail representation is possible.

Spectrum of Masses. Mass Formulae.

The description of mass of stationary states is possible in the frame of following assertion.

Proposition

Characteristic spectrum of masses of certain $U^{(k)}$ matter Level may be represented in form

$$M_N^{(k)}=M_*^{(k)}N^2/2\pi, \quad k=...,-2,-1,0,1,2,...$$

Here k - contable parameter, that determines $U^{(k)}$ Level of matter, N - main quantum number.

Preferable values of N belong to set physically distinguished

∗ *Elite states;*

and among them - to the more restricted subset of elite states -

∗ *Dominant states* - *strong elite* states.

Generative ("Transspheric", critical, *General*) $M_*^{(k)}$ mass, which formes the mass spectrum of examined $U^{(k)}$ local Level of matter, itself belong to the *General Homological series* (GHS) of masses

$$M_*^{(k)}=\chi^k M_*^{(0)}, \qquad k = ...,-2,-1,0,1,2,...,$$

$M_*^{(0)}$ - physically distinguished, certain existing, real observed *generative mass*, will be say, *primary-image (eponim)* mass (it may be any the well-known from $M_*^{(k)}$),

χ - Fundamental Parameter of Hierarchy (FPH) (Chechelnitsky Number χ = 3.66(6)).

Matter Levels and Shells.

By special, preferable - more rare - set of matter Leveles $U^{(k)}$ it may be considered the sequence - hierarchy of matter Levels, when generative mass $M_*^{[s]}$ belongs to the General Homological Series (GHS) of mass

$$M_*^{[s]}=(\chi^2)^s M_*^{[0]}, \qquad s = ...,-2,-1,0,1,2,...$$

In other words - this is Even subset of matter Levels $U^{(k)}$ at k = 2s, $M_*^{(0)} = M_*^{[0]}$

Such hierarchy of $U^{(2s)} = U^{[s]}$ matter Levels corresponds (in some sense equivalent) to $G^{[s]}$ Shells hierarchy, that is wide analysed in structure of WDS.

So, the mass spectrum, close connected with G[s] Shell structure, may be represented at following compact form

$$M_N^{[s]}=M_*^{[s]}N^2/2\pi, \quad s=...,-2,-1,0,1,2,...$$
$$M_*^{[s]}=(\chi^2)^s M_*^{[0]}$$

General Homological Series of Masses

What value must be choosed (selected) as $M_*^{[0]}$ - generative ("transspheric", critical) - General value of mass?

It must be comprehend also, that sampling of only one value of the primary - image (eponim) $M_*^{(0)} = M_*^{[0]}$ (or, for instance, $M_*^{[2]}$), essentially, signifies also sampling of the whole of General Homological Series (GHS) of masses (or General Homology of masses)

$$M_*^{(k)}=\chi^k M_*^{(0)}, \qquad k = ...,-2,-1,0,1,2,....$$

Such choosing is not only formal, only mathematical operation. It must be dictated by physics, objective reality,

observations.

It may be show by "appearance order" (i.e. by justified, convincing consequences), that such mass is m_π (the mass of $\pi^{\pm}$-meson) or $M_{2p}=2m_p$ mass of Di-proton (or Deuteron). In terms of unique Homological series - that is, essentially, the same.

Di-proton (Deuteron) and pion ($\pi^{\pm}$ - meson) belong to the same *(General) Homological series (GHS)*, in other words, its generate the same *General Homology* of masses.

Each of its may be considered as *primary-image (eponim)* of Homological series.

This affirmation may be convinced to true immediately.

We have, according to [RPP], for Di - proton mass

$$M_{2p} = 2m_p = 2\cdot\ 938.27231 = 1876.5446\ \text{Mev/c}^2$$

and for $\pi^{\pm}$ - meson (pion) mass

$$m_\pi = 139.56995\ \text{Mev/c}^2$$

the ratio

$$M_{2p}/m_\pi = 13.44519 = \chi^2.$$

The following from that quantity value χ = 3.666(7684) coinsides with standard, accepted value of χ = 3.66(6) - Fundamental parameter of hierarchy (FPH).

This result may be also considered as one of possible experimental determination of χ - FPH (in microworld).

Pion, Di-proton and χ constant.

Once more we point importance of the following observation.

Proposition

Masses of m_π pion, m_{2p} Di-proton and value of χ FPH are connected (group together) by the following relation

$$M_{2p}/m_\pi = 2m_p/m_\pi = 13.44519 = \chi^2.$$

That relation in some specific sense may be considering as experimental definition of χ FPH .

It will be good for consequent calculations the following relation between m_p and m_e.

Proposition

By using equation

$$m_\pi/m_e = \beta 2\alpha^{-1}$$

The relation between fundamental masses m_p and m_e may be express by the formula

$$m_p/m_e = \beta\chi^2/\alpha = 1836.1527,$$

where β=0.996623 is approximating coefficient ($\beta \sim 1$).

Thus, the following assertions open possibilities of the wide using of mass spectrum representation in various ranges (spans) of masses.

Proposition

The General Homological series (GHS) of masses

$$M_*^{(k)} = \chi^k M_*^{(0)}, \qquad k = ...,-2, -1, 0, 1, 2,...,$$

and

$$M_*^{[s]} = (\chi^2)^s M_*^{[0]}, \quad M_*^{(0)} = M_*^{[0]} \qquad s = ...,-2, -1, 0, 1, 2,...,$$

are is completely represented by the *$\pi^{\pm}$ - meson - Di - proton GHS (or π - D Homology*) of masses.

For the definiteness (and there have specific physical sense) it may be considered, that for GHS of masses

$$M_*^{[s]} = (\chi^2)^s M_*^{[0]} \qquad s = ...,-2, -1, 0, 1, 2,...$$

valid $M_*^{[1]} = m_\pi$, $M_*^{[2]} = M_{2p} = 2m_p = 1876.5446\ \text{Mev/c}^2$

and then $M_*^{[2]} = \chi^2 M_*^{[1]} = M_{2p} = 2m_p$

In this circumstances GHS of masses

$$M_*^{[s]} = (\chi^2)^{s-1} M_*^{[1]}] = (\chi^2)^{s-2} M_*^{[2]}, \qquad s = ...,-2, -1, 0, 1, 2,...$$

become fully definite (by Chechelnitsky Number χ=3,66(6)) and containing following set - hierarchy of masses

(fragment) $M_*^{[s]} \Rightarrow ..., M_*^{[0]}=10.3816,\ M_*^{[1]}=139.575,\ M_*^{[2]}=1876.5446,\ M_*^{[3]}=25228.6\ \text{Mev/c}^2,...$

Even Homology.

It is interesting to point, that discussed above $U^{(k)}=U^{(2s)}$ subset of matter Levels may qualified as *Even (k=2s) subset*, and GHS - as *Even Homology* of mass related to $M_*^{[0]}$ prime image (eponim).

Odd Homology.

It is clear, that (residual) remaining (in $U^{(k)}$ set) the $U^{(k)}=U^{(2q+1)}$ subset of matter Levels, may consider as *Odd subset*, and in $M_*^{(k)}$ Homological series ($M_*^{(k)}$ HS) of mass the remaining set - special series

$$M_*^{[q]} = \chi(\chi^2)^q M_*^{[0]} = \chi^{2q+1} M_*^{[0]}$$

is *Odd (k=2q+1) Homology* of mass.

It may be shown, that this *Odd Homological* series (Odd HS) have the nontrivial physical sense.

MICROWORLD (SUBATOMIC WORLD). STATIONARY STATES — MASS SPECTRUM. THEORY AND EXPERIMENTS.

Calculations that use the discussed above representations for the mass hierarchy discover, essentially, new world of dynamical accordances, propose possibilities for constructive interpretations of dynamical structure of known from experiments stationary states and resonances of subatomic world.

Stationary States of $G^{[1]}$ Shell: Population of Pion ($\pi^{\pm}$ meson).

Presentation of stationary states dynamical spectrum we shall from, it will be say, population of $\pi^{\pm}$ meson.

This is matter Level, that corresponds to the $G^{[1]}$ Shell (s=1), matter Level $G^{[1]}$ (or k=2s=2, $U^{(k)}=U^{(2)}$).

Mass spectrum is generated by one of components ($\pi^{\pm}$ meson mass)

$$M_*^{[1]} = m_\pi \cong 139.575 \text{ Mev/c}^2$$

that belongs to π–D General Homological Series (π–D GHS).

Mass spectrum of stationary states seems stonishingly saturated [Table 1].

The Υ Family.

It is interesting to point, that spectrum of Υ states, that is detected in experiments (see RPP), also belongs to periphery of $G^{[1]}$ Shell - with large (periphery) values of N quantum number.

Stationary States of $G^{[2]}$ Shell: Population of Di-proton.

The corresponding to $G^{[2]}$ Shell (s=2, k=2s=4, $U^{(k)}=U^{(4)}$) matter Level is generated by physically distinguished state of Di-proton (Deuteron).

In the Table 2 it is use mass value $M_*^{[2]}=2m_p=1876.51$ Mev/c^2 that belongs to π–D GHS (π–D Homology).

It is presented the comparision of theoretically calculated masses of stationary states (also is presented the theoretical calculation by General Dichotomy) with collected data of experiments (estimations also, etc.) from [RPP] (Table 2).

At initial stage of search investigations it is hardly advisible to develop too rigid selection, based on customary preferences of the past. So, to the comparison with the theory it is attracted, as it possible, most wide material.

Stationary States of $G^{[3]}$ Shell.

Mass spectrum of stationary states, connected with $G^{[3]}$ Shell, is represented in Table 3.

It is generated by the mass $M_*^{[3]} = \chi^2 2m_p = 25.2286$ Gev/c^2 that belongs to π–D GHS (π–D Homology) [Table 3].

Stationary States of $G^{[4]}$ Shell.

Mass spectrum of stationary states, connected with $G^{[4]}$ Shell, is represented in Table 4.

It is generated by the mass $M_*^{[4]} = \chi^4 2m_p = 0.339$ Tev/c^2 that belongs to π–D GHS (π– D Homology).

It is possible that modern and future HEP in high degree will be connected with manifestation of stationary states of $G^{[3]}$, $G^{[4]}$ and later Shells.

Another Levels of Matter.

Stationary States of $G^{[-2]}$ Shell.

Mass spectrum of stationary states of $G^{[-2]}$ Shell is generated by mass

$$M_*^{[-2]} = \chi^{-8} 2m_p = 0.05743 \text{ Mev/c}^2$$

that belongs to π–D GHS. The state ME (N=8.083) of $G^{[-2]}$ Shell

$$M = 0.5973 \text{ Mev/c}^2,$$

that is close to electron mass $m_e = 0{,}51099906$ Mev/c^2 draws the most attention..

In frame of this $G^{[-2]}$ Shell to the *experimental value* of electron quantum number N the value

$$N = (2\pi M^{\wedge})^{1/2} = 7.477054, \quad M^{\wedge} = m_e/M_*^{[-2]} = 8.89777,$$

$$P^{\wedge} = 2\pi M^{\wedge} = 55.9053$$

corresponds.

It lies at the interval permissible, often observing N values, for instance, of elite states in Solar (planetary) system and satellite systems of planets. Observed in the system of Saturn S1 (Mimas) satellite has N=7.380, in the

system of Jupiter J2 (Europe) satellite - N=7.680.

It is interesting to point that $M^{\wedge}$, $P^{\wedge}$ close to integer and (N) - to semi-integer (that is patterns of wave stability).

Stationary States of $G^{[0]}$ Shell.

The mass spectrum of $G^{[0]}$ Shell also demonstrates the physical significantness of description of mass spectrum. Physically preferable mass, that belongs to π–D GHS (π–D Homology)

$$M_*^{[0]} = 10.3816 \text{ Mev/c}^2$$

generates the mass spectrum of stationary states, that corresponds to (elite) dominant N_{Dom} values (see Table 5).

First of all, it may be pointed, that in mass spectrum the stationary states are discovered, that correspond to ones detected in experiments π-meson and ρ–meson.

It may be waited that many of other mesons correspond also to periphery elite (may be, not so strong, as dominant) values of N quantum number. For instance, for the η' (958) meson with m = 957.77 Mev/c^2 we have quantum number

$$N = (2\pi m/M_*^{[0]})^{1/2} = 24.0762$$

that is close to integer.

Subset of Neutrino.

It is possible, that with increasing of mass precision it may be stated, that part of neutrino ν_τ (for which now only up limits of masses is indicated) indeed belongs to stationary states of $G^{[0]}$ Shell (see Table 5, TR state).

Stationary state - muon.

Finally, the last but not least, in the population of dominant - stationary states of $G^{[0]}$ Shell (Table 5) it is discovered the state with M = 107.97 Mev/c^2 mass, evidently close to indeed corresponding (as indicate analysis) muon state. Even for concidered only for first main approximation, the achieved precision must be concidered in sufficient degree acceptable, especially at background of low accuracies of few known in particle physics mass formulae (as Gell-Mann-Okubo, etc.) Nevertheless, problem of more precise corresponding of theoretical and experimental masses of muon must be specially considered.

Mistery of muon.

The physical nature of muon, latent sense of it existence, it's true status in theoretical physics lies in the center of attention at even many decades. That is how this that problem is sounded by Nobel Prizer M.Perl [Perl, 1995(1996)]: "There are two puzzles, connected with electron and muon. The first puzzle: ... properties of these particles relate to interactions the same, but the muon at 206,8 times more heavy. Why?

The second puzzle was connected with that muon is not stable and desintegrate (decay) by the time $2{,}2\cdot10^{-6}$ sec...

To the end of 1950 electron-muon problem (e–μ problem) consisted from two parts:

1. Why the muon at 206,8 times more heavy then electron?

2.Why the muon is not desintegrated by the way

$$\mu^- \to e^- + \gamma \text{ ?"}$$

In reality that expression is continued the tradition which exist (before) him. In the frame of discussed approach it may be discovered, that "experimental" value of N quantum number in the G[0] Shell for the observed mass of muon

$$m_\mu = 105.658389 \text{ Mev/c}^2 \text{ is equal to}$$

$$N = (2\pi m_\mu /M_*^{[0]})^{1/2} = 7{,}9966806,$$

that is close to integer.

In that case the $P^{\wedge} = 2\pi m_\mu /M_*^{[0]} = 63.9469$ is the value of azimutal quantization, that is also close to integer. These kind of properties in the Wave Universe Concept are patterns, the indicators of increased stability of wave configurations.

The e - μ Similarity

Our answer to questions, connected with pointed by more investigatores similarity of electron and muon properties, in the limited brief form may be stated as follows.

Proposition.

The electron and muon similarity is close connected with that both belong (close to) ME dominant level (in the N = 7.6 - 8 region).

The difference of electron and muon properties is connected with that its belong to ME dominant levels of *different* $G^{[-2]}$ and $G^{[0]}$ Shells.

With that distinction, evidently, the known difficult in $\mu^- \to e^- + \gamma$ - decay is connected, becouse that is decay

in the e stay, that belongs to comparatively far distant $G^{[-2]}$ Shell.

In general it may be stated, that the muon is neighboring (in the sense of ME dominant level) recurrention of electron in the another distant $G^{[0]}$ Shell.

Stationary States of $G^{[-7]}$ Shell. Set of Neutrino.

As the information for the following analysis it may be shown the mass spectrum of stationary states, that belongs to some (decade) ev/c^2 range.

This is the region (of $G^{[-7]}$ Shell, Table 6), that with most probability corresponds to ν_e electron neutrino states [see RPP].

It may be waited, that with increasing of experiments precision it will be discovered the more correspondence of experimental values not of only one, but all spectrum of electron neutrino, to the theoretically predicted mass spectrum of $G^{[-7]}$ Shell (and lieing down by masses $G^{[s]}$ Shells).

Hierarchy, Recurrences, Isomorphysm.
Transponation - As Effective Tool of Analysis and Extrapolation.

Wide potential possibilities of EOM investigations in the frame of Wave Universe Concept are close connected

∗ With - constructing by theory and observing in reality - *WDS Hierarchy* at each discrete Level of matter,

∗ With *dynamical isomorphism* of real objects - as similar (in structure) WDS,

∗ With *recurrent appearence* of analogous properties at different Levels of matter.

That open possibility of wide use of the effective tool of analysis and extrapolation - it will be say, *(Tool of) Transponation*.

Shortly saying, all this is signify the possibility of *constructive carry - resonable* (controlled by experiments and observations) *extrapolation* - of clearly observed properties of WDS, its stationary states at some $U^{(k)}$ Level of matter (at some $G^{[s]}$ Shell) - to another $U^{(k+p)}$ Level of matter (to another $G^{[s+r]}$ Shell).

For instance, values of N_{NE}, N_P quantum numbers, corresponding to dominant (planetary) orbits of Neptune and Pluto, definited in $G^{[2]}$ Shell of the Solar system may be transponate in it $G^{[1]}$ Shell as $N_{(NE)}$, $N_{(P)}$.

In general case, some properties of components of Homological (by χ - FPH) series (HS) may in some sense be considered as similar. The carry-over - Transponation of knowledge about this - at large "distances" by "Wave Universe (WU) Staircase" (by different scales) can give "board" for special examinations for initiative, euristical searches.

Alternative Aspect of Z^0 Gauge Boson

According to RPP, Z^0 gauge boson has the mass

$$m(Z^0)= 91.187\pm 0.007\ \text{Gev/c}^2$$

Its charge is equal to zero.

From the point of view of discussed here approach WU Concept it is not difficult to prove in validity of following relations

$$M = \chi^5 m(\pi^0) = 3.6666^5\cdot 134.9764 = 89457.136\ \text{Mev/c}^2$$
$$M = \chi^5 m(\pi^{\pm}) = 3.6666^5\cdot 139.56995 = 92501.56\ \text{Mev/c}^2$$

As it is easily seen, Z^0 boson mass lies in the interval (range) between these calculated values.

So, it may be concluded follow

Proposition.

In the principal aproximation the mass of Z^0 heavy boson is represented in form

$$M = \chi^5 m_\pi = \chi^3\, 2m_p = 92506.67\text{Mev/c}^2 = 92.506\text{Gev/c}^2$$

It belongs to Odd (k=2q+1) subset of $M^{(k)}$ mass General Homological series of Di-proton

$$M^{(k)} = \chi^k M_*^{(0)},\ k=2q+1,\ q = -2,-1,0,1,2,3,...$$

at q=3 (k=7), if $M_*^{(4)} = M_*^{[2]} = 2m_p$,

That is coinside also with fact, that heavy Z^0 boson is the *elite state* of $G^{[2]}$ Shell ($M_*^{[2]}=2m_p=1.8765\ \text{Gev/c}^2$) with N quantum number close to N≅17.5.

Heavy $W^{\pm}$ boson is also *elite state* the same $G^{[2]}$ Shell with N close to and N≅16.5 (see Table 2).

Universal Invariant of Energy – Temperature.

It is interesting to point the following nontrivial fact.

Proposition

Universal Hierarchies of

- physically distinguished, elite (dominant) $v_N^{[s]}$ *velocities*
- and $M_N^{[s]}$ *masses*

in Universe are *not independent*,

but are generated by some, with its connected, *Universal Invariant* (UI)

$$E = 2T_{Kin} = 2(1/2)M_N^{[s]}(v_N^{[s]})^2 = M_N^{[s]}(v_N^{[s]})^2 = \text{const} \Rightarrow \text{Invar}$$

It is essentially, that Universal Invariant (UI) of E Energy (H Hamiltonian)

$$|H| = E = 2T_{Kin}$$

also may be considered

- and as Universal Invariant of T Temperature

$$T = (1/3k)E = const,$$

where $k = 1.3807 \cdot 10^{-16}$ erg·K^{-1} - Boltzmann constant.

Numerical value (of right part - const) of that Energy UI is equal to

$$E = const = E_*^{[2]} = M_*^{[2]}(C_*^{[2]})^2 = 2m_p(C_*^{[2]})^2 = 0.593066 \cdot 10^{-10} \text{ erg} = 37.016 \text{ ev},$$

where $m_p = 1.672623 \cdot 10^{-24}$g,

$$C_*^{[2]} = 42.10538 \text{ km·s}^{-1} = 0.4210538 \cdot 10^7 \text{cm·s}^{-1},$$

$$1 \text{ erg} = 6.2415 \cdot 10^{11} \text{ ev},$$

and of that Temperature UI is equal to

$$T = const = T_*^{[2]} = (1/3k)E_*^{[2]} = 143180.12 \text{ K°}.$$

Genesis, sense, significance of that astonishing, mysterious Invariant in Universe may be represented as the object of special examination.

There are immence amount of evident and less evident consequances, effects, associations, continuations, that immediately imply or connected with approaches, ideas of WU Concept. By virtue of clear causes, we are not able to present its in all totality, at once, simultaneously. We hope, its will make up the object of consequent publications.

DISCUSSION

Main ideas and results of discussed aproach are obtained by author long ago.

Its for a long time kept lie, subjected to the critical analysis, comprehend, overgrowning by details and by more convinced argumentation - and waited till own hour for a publication.

Previous several decades of intensive investigations, connected with development of basic ideas of the Wave Universe Concept, created the *fundamental base* for break in new, early unexperienced range of knowledge. Value of receiving results is extremely extensive. Majority from its still remain nonpublished.

Suggesting continuations, consequances of WU Concept ideas, often, such natural and evident, that it may be waited in not far future appearences of works and papers of another advanced researchers, where these results will be rediscovered, developed in details.

The alternative character of the aproach too evident, it opens unexpected perspectives and those possible circumstanies and new problems, which, frequently, arise with proposals and appearences of principally new ideas.

Why, as Niels Bohr said, - "Problems are more important, then decisions - solutions can be obsolete, but problems - never".

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TABLE 1

MASS SPECTRUM: STATIONARY STATES - $G^{[1]}$ Shell

States	Quantum Number N	Mass $M = M_*(N^2/2\pi)$ [Mev/c^2]	Mass M (Experiment) [Mev/c^2]
TR_*	2.5066	**M_***=139.575	π, m=139.56995
ME	8.083	1451.64	f (1420), m=1426.8±2.3; $\omega(1420)^{[m]}$, 1419±31; $\rho(1450)^{[0]}$, m=1465±25; η(1440), m=1420±20; NN, 1468±6;
TR	9.191	1876.51	D, m=1869.4±0.4; $D^{[o]}$, m=1864.6±0.5; $\eta_2(1870)$, m=1881 ± 32 ± 40; NN, m=1873 ± 2.5; X, m=1870.0±40
V	11.050	2712.56	NN, m=2710.0±20; X, m=2747±32 $\eta_c(1S)$, m=2978.8±1.9; J/ψ(1S), m=3096.88±0.04
E	12.993	3750.10	ψ(3770), m=3769.9±2.5
(U)	15.512	5345.36	B^+, m=5278.7 ± 2.0; B^o, m=5279.0±2.0; B_s^o, m=5375±6;
MA	16.038	5714.18	
(NE)	19.431	8387.17	(1S), m=9460.37±0.21;
CE	21.614	10378.34	(3S) = (10355), m=(10355.3±0.0005
(P)	22.235	10982.55	(10860), m=10865±0.008; (11020), m=11019±0.008;

TABLE 2

MASS SPECTRUM: STATIONARY STATES - $G^{[2]}$ SHELL

THEORY						EXPERIMENT
Micro – Mega (MM) Analogy			General Dichotomy			Experiment [RPP,1994,p.1367;RPP,2000]
States	Quantum Number N	Mass M= $M_*(N^2/2\pi)$ M_*=1.8675	States ν	Quantum Number $N=N_\nu=N_{\nu=0}2^{\nu/2}$, $N_{\nu=0}$=6.5037	Mass M= $M_*(N^2/2\pi)$ M_*=1.8675	Mass M
		[Gev/c^2]			[Gev/c^2]	[Gev/c^2]
TR_*	2.5066	1.8675		2.5066	1.8675	
			ν=0.0	6.5037	12.6329	Exclude m=0.04 ÷12 Gev/c^2 10_{-8}^{+25} Ellis,93B; 10_{-8}^{+60} Novikov, 93B;
ME	8.083	19.516	0.5	7.734	17.865	
TR	9.191	25.228	1.0	9.197	25.265	25_{-19}^{+275} Ellis, 92E
V	11.050	36.468	1.5	10.938	35.731	35.4 ± 5 Abreu, 92J; 35_{-26}^{+205} Ellis, 94
E	12.992	50.418	2.0	13.007	50.531	50_{-0}^{+353} Renton, 92
(U)	15.512	71.865	2.5	15.468	71.462	73_{-13}^{+178} Blondel, 93
MA	16.038	76.823				
	16.5	80.918				$W^{\pm}$: M = 80.84 ± 0.22 ± 0.83 Alitti N = $(2\pi M/M_*)^{1/2}$ = 16.452 $W^{\pm}$: M=79.91 ± 0.39 Abe N=16.357
	17.5	91.024				Z^0 : M = 91.187 ± 0.007 N=$(2\pi M/M_*)^{1/2}$ = 17.473
	18.5	101.588	3.0	18.395	101.063	103.7 L3 Collaboration [Felcini, 2000]
	19.0	107.297				108.9 L3 Collaboration
(NE)	19.431	112.760				114.5 L3 Collaboration [Felcini, 2000; Tully,2000;Acciarry et al., 2000]
	19.5	113.0186				
CE	21.614		3.5	21.876	142.925	
(P)	22.235	147.654	4.0	26.015	202.126	

TABLE 3

MASS SPECTRUM: STATIONARY STATES - $G^{[3]}$ Shell

T H E O R Y				**E X P E R I M E N T**
		General Dichotomy		
States	**Mass** $M=M_*(N^2/2\pi)$	**States** ν	**Mass** $M=M_*\times(N_\nu^2/2\pi)$, $N_\nu= N_{\nu=0}\,2^{\nu/2}$, $N_{\nu=0}=6.5$	**MASS M**
	$[Tev/c^2]$		$[Tev/c^2]$	$[Tev/c^2]$
TR_*	$M_*=0.025228$		$M_*=0.0252$	L H C
		0.0	0.16984	
ME	0.26238	**0.5**	0.24019	
TR	0.33918	**1.0**	0.33968	
V	0.49030	**1.5**	0.48038	
E	0.67784	**2.0**	0.67936	
(U)	0.96619	**2.5**	0.96077	
MA	1.03285			
		3.0	1.35873	
(NE)	1.516			
CE	1.87591	**3.5**	1.92154	
(P)	1.98512			
		4.0	2.71747	

TABLE 4

MASS SPECTRUM: STATIONARY STATES - $G^{[4]}$ Shell

T H E O R Y				**E X P E R I M E N T S M MASS**
		General Dichotomy		
States	**Mass** $M=M_*(N^2/2\pi)$	**States** ν	**Mass** $M=M_*\times(N_\nu^2/2\pi)$, $N_\nu= N_{\nu=0}\,2^{\nu/2}$, $N_{\nu=0}=6.5$	
	$[Tev/c^2]$		$[Tev/c^2]$	$[Tev/c^2]$
TR_*	$M_*=0.339$		$M_*=0.339$	L H C
		0.0	2.283	
ME	3.527	**0.5**	3.229	
TR	4.560	**1.0**	4.566	
V	6.591	**1.5**	6.458	
E	9.113	**2.0**	9.133	
(U)	12989	**2.5**	12.917	
MA	13.886			
		3.0	18.267	
(NE)	20.381			
CE	25.220	**3.5**	25.834	
(P)	26.688			
		4.0	36.534	

TABLE 5

MASS SPECTRUM: STATIONARY STATES - $G^{[0]}$ Shell

States	Quantum Number N	Mass M= $M_*(N^2/2\pi)$ [Mev/c^2]	Mass M (Experiment) [Mev/c^2]
TR_*	2.5066	M_*=10.3816	
ME	8.083	107.97	μ , m = 105.658398
TR	9.191	139.57	π, m = 139.56995 ν_τ, m <125, m < 143, m < 157
V	11.050	201.76	
E	12.993	278.93	
(U)	15.512	397.58	
MA	16.038	425.02	
(NE)	19.431	623.83	
CE	21.614	771.90	ρ (770), m = 769.9±0.8
(P)	22.235	816.88	ω (782), m = 781.94±0.12 η' (958), m = 957.77±0.14

TABLE 6

MASS SPECTRUM: STATIONARY STATES - $G^{[-7]}$ Shell

States	Quantum Number N	Mass M= $M_*(N^2/2\pi)$ [ev/c^2]	Mass M Experiment [RPP] ν_e Neutrino mass [ev/c^2]
TR_*	2.5066	M_*=0.130757	
ME	8.083	1.3599	
TR	9.191	1.7579	
V	11.050	2.5411	
E	12.993	3.5131	
(U)	15.512	5.0076	
MA	16.038	5.3531	
(NE)	19.431	7.8573	<7.2; <8.0
CE	21.614	9.7226	<9.3
(P)	22.235	10.2887	<11.7 <13.1; <14.0