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 attention 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.

ELEMEN TAR O BJECTS O F M ATT ER

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, elemental objects of matter (EOM), representating (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 frequently 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, \quad s=...,2,-1,0,1,2,... \]

\[ C[\[s\]] = (1/\chi_s^{-1})C[\[1\]]. \]
Here \( C_s^{[1]} = 154.3864 \text{ km s}^{-1} \) is the calculated value of sound velocity of wave dynamic system (WDS) in the G\(^{[1]}\) Shell, that was made valid by observations,

\[ \chi = 3.66(6) \text{- the Fundamental parameter of hierarchy (Chechelnitsky Number } \chi = 3.66(6) [\text{Chechelnitsky, 1980 - 1986}]. \]

- \( C \) - the countable parameter of Shells,
- \( \chi = 3.66(6) \) - the Fundamental parameter of hierarchy (Chechelnitsky Number \( \chi = 3.66(6) \)) [Chechelnitsky, 1980 - 1986],
- \( s \) - the countable parameter of Shells,
- \( N \) - (Mega)Quantum numbers of elite states,

a) Close to \( N_{\text{Dom}} = 8; 11; 13; (15.5)16; (19,5); (21,5) 22,5 \)

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, \( N = (2\pi a/a_\ast)^{1/2} \) (a - semi-major axes of planetary orbits, \( a_\ast^{[1]} = 8R_\ast \) - semi-major axis of TR\(^{[1]}\) - Transsphere, R - radius of Sun) [Chechelnitsky, 1986]

\[ N = 8.083; 11.050; 12.993; 16.038, \text{ close to } \text{integer} \]

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

\[ N = N_\ast = (2\pi)^{1/2} = 2.5066 \text{ (critical - transspheric value) and} \]

\[ N_{\text{TR}} = \chi(2\pi)^{1/2} \cong 9.191 \]

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

Extended Representation

It is possible, in principle, examine the following substitution

\[ 1/N \rightarrow \zeta / N^\# \text{ or } N \rightarrow N^\#/\zeta \]

and extended formula for elite velocities

\[ v_N^{[s]} = C_s^{[s]}(2\pi)^{1/2} (\zeta / N^\#), \quad s = \ldots,-2,-1,0,1,2,\ldots \]

\[ \zeta , N^\# \text{- integer}. \]

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

\[ \zeta = 2, \text{ } N^\# \text{- integer}, \]

and thus, - the substitution \( N \rightarrow N^\#/2. \)

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 number quantum has the explicit form

\[ N_v = N_{v=0} = 2^{v/2}, \quad N_{v=0} = 6.5037 \]

that depends from countable parameter

\[ v = k/2, \quad k=0,1,2,3,\ldots \]

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

\[ a_v^{[s]} = a_v^{[s]} 2^v, \quad a_v^{[s]} = a_v^{[s]} (N_{v=0})^{1/2}\pi. \]

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 Dychotomty 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 same 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 $N_{\text{Dom}}$. Thus it may be expected, that spectrum of elite (dominant) planetary) 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) $K_{\text{K}}=mv$,
  - ii) And momentum (impuls) $P = mv$ (as that is discrabed in well know n formalism of quantum mechanics),
- But - on the fundamental level - are connected with discreteness, quantization of
  - v) Sectorial velocity (circulation) $L = K_{\text{K}}/m = va$,
  - $\xi -$ 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 experim ental investigations of real systems of Universe the Law of Universality of Elite (Dominant) velocities may be briefly form ulated as follow s

**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 approxim ation m ay be represented in the form:
  $v_{N}^{[s]} = C_{s}^{[s]}(2\pi)^{1/2}/N, \quad s=..., -2, -1, 0, 1, 2, ...
   C_{s}^{[s]} = (1/\xi^{s-1})C_{s}^{[1]}$.

**General Homological Series of Sound Velocities**

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

$C_{s}^{[s]} = (1/\xi^{s-1})C_{s}^{[1]} \quad s=..., -2, -1, 0, 1, 2,...$

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 $C_{s}^{[1]} = 154.3864 \text{ km} \cdot \text{s}^{-1}$ - 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 know lege 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 significant 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[^3]) 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 $\chi$ - Fundamental parameter of hierarchy (FPH) - may be used the ratio, for instance, of

# (Keplerian) orbital velocities $v$

$$ \frac{v_{ME}}{v_{J}} = \frac{47.8721 \text{ km s}^{-1}}{13.0581 \text{ km s}^{-1}} = 3.66608 \Rightarrow \chi. $$

# Sectorial velocities $L$

$$ \frac{L_{J}}{L_{ME}} = \frac{1.01632 \cdot 10^{10} \text{ km}^{2} \text{s}^{-1}}{0.27722 \cdot 10^{10} \text{ km}^{2} \text{s}^{-1}} = 3.66608 \Rightarrow \chi. $$

# Semi-major axes $a$

$$ \frac{a_{J}}{a_{ME}} = \frac{5.202655 \text{ AU}}{0.387097 \text{ AU}} = 13.440164 \Rightarrow \chi^{2}. $$

$\chi$ - nondimensional number

### Universality of FPH

Analysis of (mega)wave structure of physically autonomous satellite systems of Jupiter, Saturn, etc., indicated, that discovered $\chi$. 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]:

"...fundamental fact is that when we pass on to another WDS, the value of $d$ [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) $\chi=3.66(6)$. 

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 GI 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 $\chi$ 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 $\chi$ FPH in Universe) [Chechelnitsky, (1978) 1980-1986]

# The central parameter, which organizes and orders the dynamical and physical 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) $\chi$ - the Fundamental Parameter Hierarchy (FPH) - nondimensional number $\chi =3.66(6)$. 

...
CHECHELNITSKY A. M.  Elementar Objects of Matter: Universality, Hierarchy, Isomorphism, Dynamical Spectrum

# It may be expected, that investigations, can show in the full scale, that $\chi$ - FPH, generally speaking, presents and appears 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 able now and at once to appear all well-known to us relations and multiple links, in which oneself the [Chechelnisky] $\chi=3.66(6)$ "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 Formulæ.

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).

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

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

Matter Levels and Shells.

STATIONARY STATES.

Spectrum of Masses (of EOM). Mass Formulæ.

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$M_{N}^{[s]} = M_{s}^{[s]} N/2\pi$, $s = \ldots,-2,-1,0,1,2,\ldots$

$M_{s}^{[s]} = (\chi^{2})^{s} M_{s}^{[0]}$

More detail representation is possible.

Spectrum of Masses. Mass Formulæ.

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

$M_{N}^{(k)} = M_{s}^{(k)} N/2\pi$, $k = \ldots,-2,-1,0,1,2,\ldots$

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

Preferable values of $N$ belong to set physically distinguished

- Elite states;
- Dominant states - strong elite states.

Generative ("Transspheric", critical, General) $M^{(0)}$ mass, which forms the mass spectrum of examined $U^{(k)}$ local Level of matter, itself belong to the General Homological series (GHS) of masses

$M_{s}^{(0)} = \chi M_{s}^{[0]}$, $k = \ldots,-2,-1,0,1,2,\ldots$

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

$\chi$ - Fundamental Parameter of Hierarchy (FPH) (Chechelnisky Number $\chi = 3.66(6)$).

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)

$M_{s}^{(k)} = \chi^{k} M_{s}^{[0]}$, $k = \ldots,-2,-1,0,1,2,\ldots$

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 \( m_\pi \) (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 \( \chi = 3.666(7684) \) coinsides with standard, accepted value of \( \chi = 3.66(6) \) - Fundamental parameter of hierarchy (FPH).

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

Pion, Di-proton and \( \chi \) constant.
Once more we point importance of the following observation.

**Proposition**

# Masses of \( m_\pi \), pion, \( m_{2p} \) Di-proton and value of \( \chi \) 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 \( \chi \) FPH.

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

**Proposition**

# By using equation
\[
m_\pi/m_e = \beta 2\chi^{-1}
\]

# 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 \( \beta = 0.996623 \) is approximating coefficient (\( \beta - 1 \)).

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
\[
M_{[0]} = \chi^0 M_{[0],} \quad \kappa = \ldots,-2,-1,0,1,2,...,
\]
and
\[
M_{[2s]} = (\chi^{2s}) M_{[0]} \quad \kappa = \ldots,-2,-1,0,1,2,...,
\]
are is completely represented by the \( \pi^\pm - meson - Di - proton \) GHS (or \( \pi - D \) Homology) of masses.

For the definiteness (and there have specific physical sense) it may be considered, that for GHS of masses
\[
M_{s} = (\chi^{2s}) M_{[0]} \quad s = \ldots,-2,-1,0,1,2,...
\]
valid
\[
M_{[1]} = m_\pi, \quad M_{[2]} = M_{2p} = 2m_p = 1876.5446 \text{ Mev/c}^2
\]
and then
\[
M_{[s]} = (\chi^{2s}) M_{[0]} = M_{2p} = 2m_p
\]
In this circumstances GHS of masses
\[
M_{[s]} = (\chi^{2s}) M_{[1]} = (\chi^{2s}) M_{[2]}, \quad s = \ldots,-2,-1,0,1,2,...
\]
become fully definite (by Chechelnitsky Number \( \chi = 3.66(6) \)) and following set - hierarchy of masses (fragment) \( M_{[s]} \Rightarrow \ldots, M_{[6]} = 10.3816, M_{[5]} = 139.575, M_{[4]} = 1876.5446, M_{[3]} = 25228.6 \text{ Mev/c}^2, \ldots
\]

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
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.

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) 
\[M^{[1]}_\pi = m_\pi \cong 139.575 \text{ Mev/c}^2\]

that belongs to \(\pi-D\) General Homological Series (\(\pi-D\) GHS).

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

The \(\gamma\) Family.

It is interesting to point, that spectrum of \(\gamma\) 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 \(M^{[2]}_\pi=2m_p=1876.51\) Mev/c\(^2\) that belongs to \(\pi-D\) GHS (\(\pi-D\) Homology).

At initial stage of search investigations it is hardly advisable 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 \(M^{[3]}_\pi = 25.2286\) Gev/c\(^2\) that belongs to \(\pi-D\) GHS (\(\pi-D\) 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 \(M^{[4]}_\pi = 0.339\) Tev/c\(^2\) that belongs to \(\pi-D\) GHS (\(\pi-D\) 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]}_\pi = 0.05743\) Mev/c\(^2\)

that belongs to \(\pi-D\) GHS. The state ME \((N=8.083)\) of \(G^{[2]}\) Shell 
\[m = 0.5973\) 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 
\[N = (2\pi M^{[2]})^{1/2} = 7.477054, \ M^{[2]} = m_p/M^{[2]}_\pi = 8.89777, \ P^{[2]} = 2\pi M^{[2]} = 55.9053\]
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∧, P∧ 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 signifiicantness of description of mass spectrum. Physically preferable mass, that belongs to π−D GHS (π−D Homology)

\[ M_{\pi^{-}}^{[0]} = 10.3816 \text{ Mev/c}^2 \]
generates the mass spectrum of stationary states, that corresponds to (elite) dominant \( N_{\text{Dom}} \) 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 \( \pi^- \) meson and \( \rho^- \) 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 \( \eta' \) (958) meson with \( m = 957.77 \text{ Mev/c}^2 \) we have quantum number

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

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 \( \nu_\tau \) (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 \( M = 107.97 \text{ Mev/c}^2 \) mass, evidently close to indeed corresponding (as indicate analysis) muon state. Even for considered 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 \( 2.2 \times 10^{-6} \) 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 disintegrated by the way

\[ \mu^- \rightarrow e^- + \gamma ? \]

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

\[ m_{\mu} = 105.658389 \text{ Mev/c}^2 \]

is equal to

\[ N = (2\pi m_{\mu}/M_{\mu}^{[0]})^{1/2} = 7.9966806, \]

that is close to integer.

In that case the \( P^\wedge = 2\pi m_{\mu}/M_{\mu}^{[0]} = 63.9469 \) 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.

Propo sition.
# 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 \[ \mu^- \rightarrow e^- + \gamma \] - decay is connected, becouse that is decay
in the 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) recurreront of electron in the another distant $G^{[6]}$ 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 $\nu_e$ 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 lying down by masses $G^{[8]}$ Shells).

**Hierarchy, Recurrences, Isomorphism. 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 appearance 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 $G^{[k]}$ Shell) - to another $U^{(k+p)}$ Level of matter (to another $G^{[k+p]}$ Shell).

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

In general case, some properties of components of Homological (by $\chi$ - 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, euristics 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

$$M = \chi^2 m(\pi^0) = 3.6666 \cdot 134.9764 = 89457.136 \text{ MeV}/c^2$$

$$M = \chi^2 m(\nu_e) = 3.6666 \cdot 139.56995 = 92501.56 \text{ MeV}/c^2$$

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

$$M = \chi^2 \cdot m_\pi = \chi^4 \cdot 2m_\pi = 92506.67 \text{ MeV}/c^2$$

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

$$M^{(k)} = \chi^k M_\pi (0)$$

at $q=3 (k=7)$, if $M^{(3)} = M^{(2)} = 2m_\pi$.

# That is coinside also with fact, that heavy $Z^0$ boson is the elite state of $G^{[2]}$ Shell $(M^{[2]}=2m_\pi=1.8765 \text{ GeV}/c^2)$ with N quantum number close to $N_\pm 17.5$.

# Heavy $W^\pm$ boson is also elite state the same $G^{[3]}$ Shell with N close to and $N_\pm 16.5$ (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) $\nu_N^{[s]}$ velocities

- and $M_N^{[s]}$ masses

in Universe are not independent,

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

$$E = 2T_{\text{kin}} = 2(1/2)M_N^{[s]}(\nu_N^{[s]})^2 = M_N^{[s]}(\nu_N^{[s]})^2 = \text{const} \Rightarrow \text{Invar}$$
It is essentially, that Universal Invariant (UI) of E Energy (H Hamiltonian) 
\[ |H| = E = 2T_{\text{Kin}} \]
also may be considered
- and as Universal Invariant of T Temperature

\[ T = (1/3k)E = \text{const}, \]
where \( k = 1.3807 \times 10^{-16} \text{ erg} \text{ K}^{-1} \) - Boltzmann constant.

\# Numerical value (of right part - const) of that Energy UI is equal to
\[ E = \text{const} = E^{(2)} = M^{(2)}(C^{(2)})^2 = 2m_p(C^{(2)})^2 = 0.593066 \times 10^{-10} \text{ erg} = 37.016 \text{ ev}, \]
where \( m_p = 1.672623 \times 10^{-24} \text{ g}, \)
\[ C^{(2)} = 42.10538 \text{ km} \text{s}^{-1} = 0.4210538 \times 10^7 \text{ cm} \text{s}^{-1}, \]
\[ 1 \text{ erg} = 6.2415 \times 10^{11} \text{ ev}, \]
and of that Temperature UI is equal to
\[ T = \text{const} = T^{(2)} = (1/3k)E^{(2)} = 143180.12 \text{ K}. \]

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

There are immense amount of evident and less evident consequences, 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, overgrowing 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 appearances 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 appearances 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 \( M = M_r(N^2/2\pi) \) \([\text{Mev/c}^2]\) | Mass \( M \) (Experiment) \([\text{Mev/c}^2]\) |
|--------|------------------|--------------------------------|--------------------------------|
| TR, \( \pi \) | 2.5066 | 139.575 | 139.56995 |
| ME | 8.083 | 1451.64 \( f(1420) \), \( m = 1426.8 \pm 2.3 \); \( \omega(1420) \), \( m = 1419 \pm 31 \); \( p(1450) \), \( m = 1465 \pm 25 \); \( \eta(1440) \), \( m = 1420 \pm 20 \); NN, \( m = 1468 \pm 6 \); | |
| TR | 9.191 | 1876.51 | |
| V | 11.050 | 2712.56 | |
| E | 12.993 | 3750.10 | |
| (U) | 15.512 | 5345.36 | |
| (NE) | 19.431 | 8387.17 | |
| CE | 21.614 | 10378.34 | |
| (P) | 22.235 | 10982.55 | |

TABLE 2

**MASS SPECTRUM: STATIONARY STATES - G \([2]\) SHELL**

| States | Quantum Number N | Mass \( M = M_r(N^2/2\pi) \) \([\text{Gev/c}^2]\) | Mass \( M \) \([\text{Gev/c}^2]\) |
|--------|------------------|--------------------------------|--------------------------------|
| TR, \( \pi \) | 2.5066 | 1.8675 | 1.8675 |
| ME | 8.083 | 19.516 | 7.734 | 17.865 |
| TR | 9.191 | 25.228 | 9.197 | 25.265 |
| V | 11.050 | 36.468 | 10.938 | 35.731 |
| E | 12.992 | 50.418 | 13.007 | 50.531 |
| (U) | 15.512 | 71.865 | 15.468 | 71.462 |
| (NE) | 16.038 | 76.823 | 16.5 | 80.918 |
| CE | 21.614 | 10378.34 | 21.876 | 142.925 |
| (P) | 22.235 | 10982.55 | 21.395 | 142.925 |
### TABLE 3
MASS SPECTRUM: STATIONARY STATES - G$^{[3]}$ Shell

| States | Mass M=$M_\ast(N^2/2\pi)$ | General Dichotomy | States | Mass M=$M_\ast \times (N^2/2\pi)$, $N_\nu=N_{\nu0}=2^{\nu2}$, $N_{\nu0}=6.5$ | Experiment |
|--------|----------------------------|-------------------|--------|---------------------------------|-------------|
|        |                            |                   |        |                                 |              |
|        | [Tev/c$^2$]                | [Tev/c$^2$]       |        | [Tev/c$^2$]                      |              |
| TR$_\ast$ | 0.025228           | 0.0252            |        |                                 |              |
|        | 0.26238          | 0.26238           |        |                                 |              |
|        | 0.33918          | 0.33918           |        |                                 |              |
|        | 0.49030          | 0.49030           |        |                                 |              |
|        | 0.67784          | 0.67784           |        |                                 |              |
|        | 0.96619          | 0.96619           |        |                                 |              |
|        | 1.03285          | 1.03285           |        |                                 |              |
|        | 1.516            | 1.516             |        |                                 |              |
|        | 1.87591          | 1.92154           |        |                                 |              |
|        | 1.98512          | 2.71747           |        |                                 |              |
|        | 2.0              | 2.5               |        |                                 |              |
|        | 2.5              | 2.5               |        |                                 |              |
|        | 3.0              | 3.0               |        |                                 |              |
|        | 3.5              | 3.5               |        |                                 |              |
|        | 4.0              | 4.0               |        |                                 |              |

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

| States | Mass M=$M_\ast(N^2/2\pi)$ | General Dichotomy | States | Mass M=$M_\ast \times (N^2/2\pi)$, $N_\nu=N_{\nu0}=2^{\nu2}$, $N_{\nu0}=6.5$ | Experiment |
|--------|----------------------------|-------------------|--------|---------------------------------|-------------|
|        | [Tev/c$^2$]                | [Tev/c$^2$]       |        | [Tev/c$^2$]                      |              |
| TR$_\ast$ | 0.339            | 0.339             |        |                                 |              |
|        | 3.527            | 3.229             |        |                                 |              |
|        | 4.560            | 4.566             |        |                                 |              |
|        | 6.591            | 6.458             |        |                                 |              |
|        | 9.113            | 9.133             |        |                                 |              |
|        | 12.989           | 12.917            |        |                                 |              |
|        | 13.886           | 18.267            |        |                                 |              |
|        | 20.381           | 25.384            |        |                                 |              |
|        | 25.220           | 25.384            |        |                                 |              |
|        | 26.688           | 36.534            |        |                                 |              |

LHC
### TABLE 5

#### MASS SPECTRUM: STATIONARY STATES - $G^{[8]}$ Shell

| States | Quantum Number $N$ | Mass $M = M_0(N^2/2\pi)$ [Mev$^2$] | Mass $M$ (Experiment) [Mev$^2$] |
|--------|-------------------|-------------------------------|-------------------------------|
| TR*   | 2.5066            | $M_0 = 10.3816$               |                               |
| ME    | 8.083             | 107.97                        | $\mu$, $m = 105.658398$      |
| TR    | 9.191             | 139.57                        | $\pi$, $m = 139.56995$       |
|       |                   |                               | $\nu_c$, $m < 125$, $m < 143$, $m < 157$ |
| 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                        | $\rho$ (770), $m = 769.9\pm0.8$ |
| (P)   | 22.235            | 816.88                        | $\omega$ (782), $m = 781.94\pm0.12$ |
|       |                   |                               | $\eta'$ (958), $m = 957.77\pm0.14$ |

### TABLE 6

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

| States | Quantum Number $N$ | Mass $M = M_0(N^2/2\pi)$ [ev$^2$] | Mass $M$ Experiment [RPP] $\nu$, Neutrino mass [ev$^2$] |
|--------|-------------------|-------------------------------|-------------------------------|
| TR*   | 2.5066            | $M_0 = 0.130757$              |                               |
| 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                       | $<11.7$                       |
|       |                   |                               | $<13.1$; $<14.0$              |