WAVE STRUCTURE
OF THE SOLAR SYSTEM

Dubna
2000
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ABSTRACT

We present a brief summary of some methods, ideas, results of Wave Universe concept and wave astrodynamics, in particular, concerning the observational dynamical structure of the Solar System.

The observational data, evident on existence of the largescale plasma waves - megawaves, which form its observing structure - geometry and dynamics are discussed.

The wave structure of the Solar system is closely connected with megaquantum aspects of its structure - quantization "in the Large", in particular, observing effects of commensurability and resonance in the motion of celestial bodies. A wide spectrum of periodicities well-known in astrogeophysics (in particular, the cycles of the Solar activity, Solar oscillations, orbital and rotational motions of celestial bodies, cycles of geospheres-magnetosphere, atmosphere. ocean, tectonosphere, etc.) is represented in the framework of the Wave Universe concept and Wave astrodynamics.

This is a set of rhythms, whose genesis depends on the wave (mega-wave) structure of the Solar system and existence of large length and great period waves in the cosmic plasma.

The researches show that this spectrum belongs to the theoretically calculated Fundamental spectrum of frequencies (periods) of the Solar system, namely - to its Megaspectroscopy.

The Wave Universe and Wave astrodynamics concept is a developing concept, that is in principle open to new ideas, observations, experiments.
NEUTON WORLD AND WAVE UNIVERSE

Newtonian "Inertia". Priorities of the Classical Celestial Mechanics

The modern university science about celestial bodies motion and Solar system structure, still continues to live in the *Newtonian World* /1/. When we formulate the basic problem of the celestial mechanics - the N-Body Problem is as follows: "To research the motion of 10 material points, that represent Sun, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Pluto, *supposing that the motion takes place in the emptiness by only the mutual attractions action*, defined by the Newton gravity Law" /2/ or talk that:

"Basic contents of the celestial mechanics is the N-Body Problem, i.e. investigation of the motion of material points, attracting each other by the Newton Law" /2/ - we, as a matter of fact, continue to speak by Newton's words and follow his representations.

Most distinctly the conceptual sense of the classical celestial mechanics was expressed by Poincare /3/:

"The true aim of the celestial mechanics is not to calculate ephemeris, in this case since it could be satisfied by the forseen of facts for the short period on time, but the aim is to convince, *if the Newton Law is sufficient enough to explain all the phenomena...*"

What is Between Planets? Substance and Field

On our searching century slowly, but persistently ripen the conviction that Newtonian and its generalized classical representations on the surrounding world are not completed, that as why we gradually begin to imagine the frontiers of that ideatization of the real world. And again, as in Kepler's and Newton's times, the convince information and new ideas, radically changing our representations, come from areas, exploring the Heaven - the Solar system and the Universe. Obviously, that under pressure of the accumulated data of cosmic observations and experiments, with the increasing degree, we begin to understand that:

* The Solar system - is not only *the dynamic system* of N attracting material points (or bodies), as followed from the model representation of *the celestial mechanics*, or

* The Solar system, together with its celestial bodies, - is not only *the wide arena* of transitional, *plasma, magnetic, eruptive processes*, as it follows from the principal notions of astrophysics...

Wave Dynamic Systems

The Solar system - that is a *Wave dynamic system* (WDS), whose, interacting, noneliminating components are both: its celestial bodies (the Sun, planets, satellites, small bodies, etc.), and interplanetary filling agents - material medium (interplanetary, cosmic plasma, electromagnetic fields, etc.), i.e., substance and field, investigated in the understandable and be-
Wave Universe. Wave Astrodynamics

The principle possibility of dynamical synthesis of the classical celestial mechanics and astrophysics continual aspects, follows from the Wave Universe concept and Wave concept of the astrodynamics - the megaquantum wave astrodynamics /4-10/ (see Fig.1).

Megawaves. One of the basic ideas of the Wave Universe conception is the assertion of the existence of some waves in any megasystem (astronomical system) of Universe, in particular, in the Solar system. These waves actual realise short-range interactions in the scale, compared with scale of the system.

The Suggestion. Studying the Solar system, as the wave dynamic system of megaworld. There are megawaves (large astronomical scale waves with large lengin and periods), which induce, propagate, and absorbed due to the cosmic medium. These megawaves are responsible for the dynamic structure (and geometry) of the Solar system (the condimension principle /4/).

Micro-Mega Analogy

When quantum mechanics was developing, the main role in the comprehension of the microobject dynamic structure belonged to the analogy of the structure between the atom and planetary system.

Apparently, the time has come to return debts. And at present this dynamic analogy works vise versa: now astronomical (in particular, planetary) systems are studied in analogy - with atom systems (Fig.2).

Besides the investigation of Fundamental wave equations /4,10/, some quantitative representations on megawaves properties (if these waves are considered as some analog of the De Broglie waves of for megaworld astronomical systems) can be received, in particular, from the following relations of the megaquantum wave astrodynamics:

\[ v = d^\neg \cdot \kappa \quad \varepsilon = d^\neg \cdot \Omega \quad \Delta x \cdot \Delta v \geq (1/2) \cdot d^\neg \]

Here \( \kappa \) - wave number,
\( v \) - velocities,
\( \Omega \) - circular frequency,
\( \varepsilon \) - normalized (divided by m_mass) energy of megawaves (\( \varepsilon = E/M=(1/2)\cdot v^2 \)),
\( d^\neg = d/2\pi \) - fundamental constant of normalized action (sectorial velocity, circulation) with the dimension [cm^2\cdot s^{-1}].

The quantization constant \( d^\neg = d/2\pi \) in the microworld for the atom is determined by Planck's constant \( h^\neg = h/2\pi \) and electron mass \( m_e \).
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\[ d^\prime \sim \frac{h}{m_0} = 1.158 \text{ cm}^2\cdot\text{s}^{-1} \]

The mentioned relations above represent the megaquantum analogs of the Bohr-Planck-Einstein, Heisenberg relations well-known in the microworld quantum mechanics, accordingly.

**Diffracting Incertaintiy Relation**

It should be emphasized that, at least, in the frame of the wave astrodynamics, the formal analog of Heisenberg incertainty relation \( (\Delta x \cdot \Delta v \geq (1/2) \cdot d) \) does not have such a wide prohibitive sense, as in the Copenhagen interpretation of microworld quantum mechanics /11/.
SOLAR SYSTEM: WAVE STRUCTURE, MEGAWAVES, QUANTIZATION "IN THE LARGE"

Megaquantum World of the Solar System Distance Quantization

Radial Quantization. The high-precision information on the geometry (in particular, on semi-major axes) of planetary orbits, gives the possibility to receive some single-valued, intriguing facts. They were found in the 70-ies using the quantum of (linear size) distance $a_\ast [1] = 8R_\odot$ and caused the astonishment surprise showing a great set of integer numbers, which characterized the dynamical structure and geometry of the Solar system (Fig.3).

It concerns differences of $\Delta a$ - normalized (divided by $a_\ast$) planetary distances $a^\wedge = a/a_\ast$ for orbits $a_i, a_j$

$\Delta a^\wedge_{i,j} = a^\wedge_i - a^\wedge_j$ (i,j = 1,2,3...),

as however in many cases, and on the normalized distances $a^\wedge_i=a_i/a_\ast$ themselves.

The integerality phenomenon $\Delta a^\wedge = \text{Integer [Semi-Integer]}$, as and the $a^\wedge = \text{Integer [Semi-integer]}$, has a deep physical basis. Such a nonaccidental abundance of integer (semi-integer) numbers (in the absence of anything ad hoc fitting parameters) shows the conceal, early unknown, but really existing phenomenon of the Solar system waveawave structure (Fig.4).

Azimuthal Quantization. The effects of quantization "in the Large" - the megaquantum effects, are not less interesting. They were discovered for $P_i=2\pi a_i$ perimeters of planetary orbits, normalized by $a_\ast$ quantum, i.e. for

$P^\wedge_i = P_i/a_\ast = 2\pi a_i/a_\ast = 2\pi a^\wedge_i$

$\Delta P^\wedge_{i,j} = P^\wedge_i - P^\wedge_j$

Azimuthal quantization $P^\wedge, \Delta P^\wedge = \text{Integer [Semi-Integer]}$

is a very characteristic pattern of the physically distinguished orbits and it occurs rather often (Fig.4).

Sectorial Velocity Quantization. In this case we speak about the observed effect of the discreteness - the quantization of the dynamical value $L = (K\cdot a)^{1/2} = L_{N=1}\cdot N$ of the sectorial velocity, normalized by $L_{N=1} = L_\ast/(2\pi)^{1/2}$, where $L_\ast = (K a_\ast)^{1/2}$.

Taking into account the interpretation of N quantum number, as $N=L/L_{N=1}$, we can talk about integer (semiinteger) ability of the N quantum number.

For planetary orbits of Mercury (ME), Venus (V), Earth (E), Mars (MA), we have, in particular, $N=(2\pi a/a_\ast)^{1/2}$

$N = 7.911; 11.050; 12.99; 15.969$, close to integer $N = 8; 11; 13; 16$, accordingly (Fig.3, Fig.4).
At the definite conceptual supposition this effect may be connected with the well-known quantization effect \( K(m) = mva \), where \( m \) - mass) or action.

In this aspect, it has been known since the times Planck, Einstein, Bohr, De Broglie. Although, we shou stress, that in the quantum mechanics (of microworld) the quantization namely of the kinetical momentum \( K(m) = mva \) was always discussed, but not of the sectorial velocity (or circulation) \( L = K(m)/m = va \).

Since Kepler's times (his second law) the notion and dynamical value of the sectorial velocity has taken the importance place in the astrodynamics, in space sciences.

**Wave Structure. Stability. Quantization**

What does this set of integer numbers, its abundance, and variety mean? What is the reason of these effects of quantization "in the Large" - megaquantum effects in the Solar system being observed? What (or Who?) makes one measure these gain astronomical distances with such a surprising regularity and certainty in space, where any road markings are absent? God, Extra-Terrestrial Mind. Nature? We don't doubt that it is made by the Nature itself - due to its own immanent laws and general mechanisms.

* That is - in many respects - the Wave astromonics laws, including *interference* mechanisms.

* But in this case we again discover the nonlimited essential, creating *presence of medium* and its most important physical attributes, and first of all, - the propagation velocity of small perturbances, the *sound velocity* of cosmic plasma.

* The *Stability* of the wave configurations, including the distinguish and elite orbits, evidently is connected with the existence of *state waves - megawaves*, that are representing *superposition, interference of running megawaves* in the cosmic plasma.


Such is the conceptual, genetic consequence of factors and notions, and it reflects deep sense of physical processes forming the observed geometry and dynamics of WDS, including the wave structure of the Solar system.

But not the opposite, when at first a certain noncausal quantization is postulated. Beforehand we must not find any metaphysical, "philosophical" sense in the notion the quantization.

* In this case, the *quantization* in general (as megaquantum effects, in particular) - that is *some property (pattern) of stability*, the way the wave configurations exist in the WDS for a long time.
* In such case, in the astrodynamics *commensurability and resonance* effects, widely observed in celestial body motion - that is not only the fact of the classical celestial mechanics, which trouble and prevents the theorists to make their manipulations with the expanding series.

This is reflection of the *quantization "in the Large" effects, of the megaquantum effects* - the consequence of stability of the wave configurations and wave processes that take place in the large astronomical system.

**Wave Astrodynamics**

The Wave Universe concept /4-10/ and fundamental ideas of the *Wave astrodynamics* are connected to submissions that the large astronomical systems in the theoretical plan are not only multiparticle by dynamic systems in sense Poincare-Birkhof, but are considered as essentially *Wave Dynamic Systems* (WDS), systems, being somewhat analogues of atom.

**The Fundamental Wave Equations. Stability, Quantization of Megasystems**

Theoretical aspects of these problems (in particular, eigenvalue problem of the *Fundamental wave equations*) and the appropriate astronomical and astrophysical questions are discussed in the monography /4/ and subsequent publications.
SHELL STRUCTURE OF ASTRONOMICAL SYSTEMS

The any astronomical systems of the Universe considered as wave dynamic systems (WDS) have Shell structure, in many respects similar with Shell structure of Solar - planetary system /9,10/.

The exceptions in this sense and numerous satellite systems of planets do not constitute, its are good verify by experience, supervisings and space experiments.

Shell Hierarchy

Arbitrary astronomical systems of the Universe being considered as the wave dynamic systems (WDS) possesses the structure very much resembling the Shell structure of the Solar - planetary system /9,10/. Well-known satellite systems are not an exception in such sense. The astronomical system (as WDS) is characterized by hierarchy of enclosed, spatially and structurally (radially) separated regions $G^{[s]}$ Shells $(s=..., -2, -1, 0, 1, 2, ...)$. Similarly, some space separated Shells may he distinctly identified in the Solar - planetary system - the most detail and certain well-known astronomical system

$G^{[0]}$ - Intra-Mercurian,
$G^{[1]}$ - occupied by the I (Earth) planetary group,
$G^{[2]}$ - occupied by the II (Jupiter) planetary group,
$G^{[3]}$ - Trans-Pluto Shell.

Sound Velocities Hierarchy. Fundamental Parameter of Hierarchy

The hierarchy of the $C_{s}^{[s]}$ sound velocities - phase velocities of the (multi component cosmic medium) cosmic plasma small perturbations (megawaves) /8,10/ is closely connected with the hierarchy of $G^{[s]}$ Shells

$C_{s}^{[s]} = \left(\frac{1}{\chi^{s-1}}\right) C_{s}^{[1]}$ $(s=..., -2, -1, 0, 1, 2, ...)$,

where $C_{s}^{[1]} = 154.3864$ km.s$^{-1}$ is the calculated value of sound velocity in the $G^{[1]}$ Shell, that was made valid by observation, and $\chi = 11/3 = 3.66(6)$ - is the Fundamental parameter of hierarchy (Chechelnitsky Number) /4, 7-10/.

Structure of Shells. The Distinguished - Elite Orbits

Internal dynamic structure of each Shell $G^{[s]}$ (characterized by dominant component of space plasma with $G^{[s]}$ sound velocity $C_{s}^{[s]}$ sound) is connected to some physically distinguished (especially stable, stationary) elite orbits /4-10/.

In observations (it first of all concerns experimentally well investigated Solar - planetary system and satellite systems of planets) with elite orbits is usually connected rather long existence on them of celestial bodies (planets, satellite planets). Elite orbits show itself usually and by availability of a
lot others physically distinguished patterns.

Stability and Quantization
Problem of search of stable states (orbits) in wave dynamic system (characterized by gravitational parameter \( K = G \cdot M \), where \( M \) - mass of system, \( G \) - gravitational constant) in the formally mathematical plan is connected with search of the decisions of the Fundamental wave equations [4, 10].

It, in particular, results in effects of quantization of sectorial velocity (normalized on mass of the kinetic momentum). In a general view with allowance for hierarchies of \( G[\text{s}] \) Shells probably following representation for the sectorial velocity of an elite orbit

\[
L_N^{[\text{s}]} = L_{N-1}^{[\text{s}]} N, L_{N-1}^{[\text{s}]} = \text{const}
\]

It is easy to understand, that widely used in wave astrodynamics the quantum number \( N \) can be interpreted in habitual astrodynamic sense and as dimensionless (normalized) value of sectorial velocity of some orbit (state)

\[
N = L_N^{[\text{s}]} / L_{N-1}^{[\text{s}]}
\]

Strong and Weak Elite States (Orbits)
Research of a measure of stability of elite orbits (states) as in theory, and in observations, allows to divide them, on extreme to measure, on two crossed classes

* Weak (recessive) elite orbits (states) it is usual are characterized by significances \( N \) close to integer, semi-integer numbers.

* Dominant (strong) elite orbits (states) are characterized by values \( N \) (is not necessarily exact integer, semi-integer), laying in some vicinity (area of an attraction) of dominant (Planetary) values

\[
N_{\text{Dom}} = 8; 11; 13; (15.5) 16; 19.5; (21.5) 22.5,
\]
as it follows from the observational data of Solar (Planetary) system /10/.

It is necessary to note, that the speech goes about the data of first-main approach in the description of complex (multipartial) systems, with what are the real-exist astronomical systems. Here not the problem of probable splitting of physically distinguished elite levels, states, orbits is considered.

Quantization of Dynamic Parameters
The linear dependence between the \( L \) sectorial velocity and (quantum) \( N \) number is elated to other dynamical parameters. Let's give some of them - relations of the first (the main) approximation:

* Orbital velocities

\[
v_N^{[\text{s}]} = C_e^{[\text{s}]} (2\pi)^{1/2}/N
\]

* Semi-major axes
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\[ a_N = a_s \cdot N^2 / 2\pi, \quad a_s = K / (C_s)^2 \]

That is an analog of Bohr square law for atomic orbits semi-major axes /11/.

* Sectorial velocities
  \[ L_N = L_s \cdot N / (2\pi)^{1/2}, \quad L_s = (K \cdot a_s)^{1/2}, \quad L_N = L_s / (2\pi)^{1/2}, \]

Elite Orbits. Week and Strong (Dominant) Orbit

# Elite states (orbits, levels) - that are preferable, physically distinguished states, that are characterized by high stability, more times long age of existence.

# Characteristic properties, physical-mathematical patterns of elite orbits are properties of discreteness, quantization of:

* Sectorial velocities (circulations) \( L = v \cdot a = (K \cdot a)^{1/2} \);

Distances (space coordinates):

* Radial (a),

* Azimuthal (\( P = 2\pi a \))

Observed physical - mathematical effects of the quantization (discreteness, integer), both separately and in totality, defined the measure of stability, depth of potential well, existence time of physically distinguished, elite states (orbits, levels).

Dominant orbits - that are most strong, most potential wells, states of wave dynamic system. Observed orbits of planets in the Solar system - dominant states from that set.
ISOMORPHISM OF WAVE DYNAMIC SYSTEM

SATELLITE SYSTEMS OF PLANETS

In accordance with the basic ideas of the Wave astrodynamics /1-10/, the Solar (planetary) and satellite systems (of planets) are characterized by definite isomorphism - up to a gravitational parameter \( K = G \cdot M \) of the central body (\( M \) - mass, \( G \) - gravitational constant).

The last individualizes (personificates) the concrete astronomical system (WDS).

In particular, the value

\[
a_{N}^{[s]} / K = \left(1/(C_{*}^{[s]} \cdot 2\pi) \cdot \sqrt{\frac{N}{2}} \right) = \text{Idem}
\]

is universal (invariant) to arbitrary astronomical system

[The World is unit:”The Nature is very consonant and similar to itself”].

Of course, this affirmation in at more degree physical than formally mathematical. It's justice depends on universality (invariance) of the \( C_{*}^{[s]} \) sound velocities hierarchy and of nondimensional quantum number \( N \) of elite (dominant) orbits.

Summary Table of Solar (planetary) system and satellite system wave structure demonstrate the presence of such isomorphism (Fig. 5, 5A).

Small Bodies of the Solar System.
Megaquantum Frankness of the Halley Comet

The Halley Comet is the most famous and long-time living object among small bodies of the Solar system. Due to the connection with the stability of orbital motion and properties of quantization "in the Large", it is naturally to expect a development of megawave stability patterns in the special dynamical analysis of Halley Comet orbits from point of view of the Wave astrodynamics. In fact, it is discovering very bright manifistations of megaquantum effect /12/ (see Fig. 6).
TRANSSPHERES HIERARCHY

The Fig. 7 presents some data concerning with the $\text{TR}_{[s]}$ Transspheres of the Solar-planetary and satellite systems with semi-major axes $a_{[s]} = K/(C_{[s]})^2$.

Gravitational parameters $K = G \cdot M$ are individualizing the quantization constants of each from them.

**Magnetospheres - as Transspheres**

The long experience of researches and set of received in the last time (in connection with the Voyager-2 flight) observing information indicate the validity of the suggestion, long time investigating in the frameworks the Wave astrodynamics /14,15/.

**The Suggestion.**

The magnetosphere boundaries of the celestial body with the gravitational parameter $K = G \cdot M$ coincide with the border of the $\text{TR}_{[4]}$ Transsphere, that is characterized by semi-major axis $a_{[4]} = K/(C_{[4]})^2$.

It is interesting to note that in this case the magnetosphere size is defined only by gravitational data ($K = G \cdot M$) and cosmic plasma ($C_{[4]}$) properties, but not from the calculation of celestial body specific magnetic parameters (properties) (Fig. 7).
GROUND TOUR OF VOYAGER-2 AND THEORY DEVELOPMENT. PROGNOSES AND OBSERVATIONS

Uranus. The Voyager-2 encounter with Uranus confirmed the basic prediction of the theory concerning the Uranus system's wave structure with the arrangement and dynamics of its satellites and rings /9,10,13/ (Fig. 8).

Neptune. Once more in detail repeated prognosis concerning with the Neptune wave structure (after the prognosis that had been published earlier in /9,10/) was represented to press on 17 March 1987 /14/.

The Voyager-2 observations show that the prognosis and Wave astrodinamics representations (also the arrangement of new Neptune satellites, rings, the size of the Neptune magnetosphere, etc.) has been proved true in accordance with the expectations of the theory /15,16/ (Fig. 9).
INTERNAL STRUCTURE OF CELESTIAL BODIES.
MEGAWAVE TOMOGRAPHY

"Inside - as Outside"

The G$^\text{[s]}$ Shells hierarchy, that is continued with use of the recursion by fundamental hierarchy parameter $\chi$ (and due Shells isomorphysm) in the direction of decrease of its sizes, inevitably leads to the border, when the description of internal regions of celestial body ($a \leq R$) begins.

* Is such analitical extansion correct?

* Have the real sence received by such manner Shells and elite states inside the celestial body? Evidently, that the any formal mathematical argumentation can't seem convincing in the problem, that is essentially physical. The decisive criterion of the true can be only observations and experiments. Till there is a sense to state the expectations in the form of following suggestion (see Fig. 10, 11).

The Suggestion.

# Investigating in seismology of celestial bodies physically distinguished levels and Shells (the core, mantle, nucleus) have (or, carefully, must have) the megawave sense.

# Its are the Shells and the elite levels, that possess properties of discreetness, quantization "in the Large" - megaquantum effects of radial, azimuthall distances quantization and the quantization of the sectorial velocity (circulation).

# The well-known in seismology tendency to separate the internal structure of celestial bodies to the core, the mantle and the nucleus really has in its fundamental basis the Shell structure and elite levels in the standard sence of the wave astrodynamics.

Due to limits of this summary we can not cite the argumentation to the expressed assertions.

Therefore, there is a sense to examine this summary as proposal and reason for the conducting of special theoretical and experimental investigations in the area of the megawave seismology. There is no sense also to discuss specially the perspectives that are discovering such analytical introspection of celestial bodies structure in the case of correctness of the fundamental basis of theory.

The last reason - at the observations, comparison with space experimental data.
COSMOGRAPHY OF THE SOLAR SYSTEM

Near by the Sun. Intra-Mercurian Space

$G^{[0]}$ Shell. Vulcan Orbits. The region from the Sun to the Mercury orbits is the space of the Solar system $G^{[0]}$ Shell. The geometry of physically distinguished - elite (dominant) orbits, the consequence arrangement are show in Fig. 12.

Orbits of transient small bodies probably observed in the past tense in this region (Vulcan orbits), correspond to there more stable orbits. The presence of Transsphere $TR_{e}^{[1]}(=a_{e}^{[1]})$ at the distance $a_{e}^{[1]} = 8R_{\odot}$ from the SUN, ab definition, coinciding (or being closing) with elite orbit $TR_{0}^{[0]}$ of this $G^{[0]}$ Shell are important sights.

The identification, conceptual and observing, of this peculiar surface play the extraordinary and heuristic role in the comprehension of the Solar system wave dynamic structure, for the first time discovering the scale (standard) of the quantization "in the large" (Fig. 3, 17, 18).

I (Earth) Planetary Group Region

$G^{[1]}$ Shell. The geometry, the consequence of arrangement of elite (dominant) orbits and observing planets (and asteroids) of this group - Mercury (ME), Venus (V), Earth (E), Mars (MA), Ceres (CE) - as the most bright representative of the small bodies (asteroids), are present in Fig. 12. It is shown also transponate here (dominant) orbits - analogous to orbits Uranus (U), Neptune (NE) and Pluto (P).

It is interesting to pay attention to the existence of the $TR_{e}^{[2]} (=a_{e}^{[2]})$ Transsphere at the distance $a_{e}^{[2]} = 0.5$ AU from the Sun, coinciding with the $TR^{[1]}$ elite orbits of this $G^{[1]}$ Shell.

II (Jupiter) Group Region

$G^{[2]}$ Shell. Apart regions, directly closing to giant planets, which are sufficient fully investigated by Pioneers and Voyagers, it's of interest the general structure, the order of physically distinguished orbits and, in particular, the $TR_{e}^{[3]} (=a_{e}^{[3]})$ Transsphere position at the distance $a_{e}^{[3]} = 6.7275$ AU from the Sun.

It coincides (or is close) with the $TR^{[2]}$ elite orbit this $G^{[2]}$ Shell of the Solar system.

Near by Stars. Trans-Pluto Space

The Prognosis, bases upon the conceptions /14/ predict the existence, apart known regions: $G^{[1]}$ - that is occupied by the space of I (Earth) group planets, $G^{[2]}$ - that is occupied by the space of II (Jupiter) group, at least still Trans-Pluto $G^{[3]}$ Shell and, probably, following it $G^{[4]}$ Shell.

$G^{[3]}$ Shell. The dominant orbits system in this Trans-Pluto Shell with us-
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ing of the (linear size) distance quantum
\[ a_{[3]} = K_\odot / (C_{[3]}^2) = 6.7276 \text{ AU} \]
in the main approach is as follow:
\[ a_{[3]} = 68.5; (70); 90.44; 129.5; 181; 257; 274; 407(403); 495(500); 542(530) \text{ AU}. \]

\( G^{[4]} \) Shell. In this far region of the Solar system with using of the (linear size) distance quantum
\[ a_{[4]} = K_\odot / (C_{[4]}^2) = 90.4475 \text{ AU} \]
the geometry of dominant orbits (semi-major axes values) seem as following
\[ a_{[4]} = 921; 1216; 1742; 2433; 3458; 3685; 5474; (6654)7287 \text{ AU}. \]

"X" Planets of the Solar System

Potentially possible Trans-Pluto bodies with the most probability may be discovered on these dominant orbits of \( G^{[3]} \) and \( G^{[4]} \) Shells. Outside of the successes of continuing search of remote celestial bodies, as the experience of the space investigations shows, the dominant orbits are preferable, physically distinguished states in many their aspects, fixed by observations (in particular, in measuring of count proton flux. etc.) too.

Having other observational data, including that are connected with small celestial body motions in the Solar system (in particular, with distribution of semi-major axes and of aphelions of long-periodical comets) also point out to the preferable character of these dominant orbits.

Infrared satellite IRAS data evident on existence tens nonidentified cold objects at distance \( a > 6000 \text{ AU} \) (i.e. at the periphery \( G^{[4]} \) Shell, probably, in the \( a_{CE}^{[4]} = 6654 \text{ AU} \) region). Nevertheless, decisive proofs on existence of celestial bodies at the far periphery of the Solar system may be expect from future purposeful space investigations.

Heliosphere Boundaries. Heliopause

Accordingly to the representations of modern astrophysics, the interaction of the Sun with interstellar medium surround its leads to formation of the Solar system Heliosphere (that in some sense reminds the well investigated Earth magnetosphere). In dependence from the choosing parameters, it is considering that the bow shock, after which the Heliosphere begin, can be placed at the distance \( 30 \div 50 \text{ AU} \) or \( 75 \div 200 \text{ AU} \).

There are reasons to expect, that the bow shock (and inside it - the Heliopause) may be discovered at the heliocentric distance
\[ a = a_{[4]} = K_\odot / (C^{[4]}^2) = 90.447 \text{ a.e.}, \]
connected with the Solar system \( G^{[4]} \) and \( G^{[4]} \) Shell.
TIME AND RHYTHMS OF THE SOLAR SYSTEM

Together with the importance, necessity of clear space description of the Solar system wave structure, very important aspect of understanding its dynamics rhythmics of the processes that run in it, is the temporal aspect.

What is the genesis of the Solar system rhythms?
How are the rhythms of Cosmos, Earth, Biosphere connection between themselves?
What is induced?
What is connection between orbital and wave motions?
What stands at the observatory effects of commensurability and resonance in the celestial bodies motion?

Fundamental Spectrum (Frequencies, Periods) of the Solar System

Megaspectroscopy. In the certain physical sense the Solar system can be characterized by its Fundamental spectrum (frequencies, periods). As a matter of fact it is the spectrum of natural frequencies WDS, in the mathematical plane - the consequence of the eigenproblem analysis for the Solar system, which is considering as a wave dynamic system and describing by fundamental wave equations /5, 6, 10/.

The fact of the observability of planetary - elite orbits give the attractive opportunity in this summary (in aims of brevity, clearness and simplicity) to avoid the formal mathematical eigenproblem analysis.

In fact, the observing set of elite-planetary distances can examine, as the result of "solution" of the Solar system eigenproblem (of the Solar system) fulfilled by the Nature itself. The Fundamental spectrum (of the Solar system) can be represented by its two subsets

* Of Wave frequencies (periods) (Fig. 14, 14A÷14D).
* Of Keplerian frequencies (periods) (Fig. 15).

Wave Frequencies

The dependence of \( \theta \) wave frequency on the spatial characteristics of some elite orbit with a semi-major axis looks as follows

\[
\theta = D \cdot (1/a), \quad D - \text{const}
\]

This representation can be rather easily received, for example, with use of a fundamental relation of wave astrodynamics

\[
\varepsilon = d \cdot \Omega
\]

Taking into account relations

\[
\varepsilon = v^2/2, \quad v^2 = K/a, \quad \Omega = 2\pi \theta
\]

We receive the equation
Wave Structure of the Solar System

\[ \varepsilon = v^2/2 = (1/2) \cdot (K/a) = \omega \cdot d \cdot 2\pi \cdot \theta \]

Besides representation
\[ \theta = (K/4\pi d) \cdot (1/a) = D \cdot (1/a) \]

It appears fair and expression
\[ \Omega \cdot a = K/2d \]

It is reduced to representation
\[ \Omega \cdot a = v \cdot C \]

if to take into account equalities \(2d = L \cdot C \)

Actually this condition of connection of wave frequencies \( \Omega = 2\pi \theta \), of semi-major axis \( a \) and constancy of velocity of distribution wave perturbances \( C \) in allowable area WDS (in some Shell \( \mathcal{G}^{[8]} \)).

Appropriate to \( \theta \) wave frequency \( \tau \) wave period, length \( \Lambda \) of wave and \( k \) wave number traditionally image as
\[ \tau = 1/\theta, \quad \Lambda = C \cdot 1/\theta, \quad k = 2\pi/\Lambda \]

Terms of wave frequencies. The basic wave frequencies - Terms of wave frequencies correspond to the distinguished elite (planetary) orbits at \( a = a_i \), where \( a_i \) - semi-major axis of elite (planetary) orbits
\[ \theta_i = D \cdot (1/a_i), \quad (i = 1, 2, 3,...) \]

Intercombinations of Wave Frequencies

Alongside with the basic wave frequencies - Terms \( \theta_i \) the consideration of various intercombinations \( \theta_{ij} \) (beatings) between them (of intercombinational wave frequencies), in general case - of difference and summary
\[ \theta_{i,j}^{(\pm)} = \theta_i \pm \theta_j \]

is possible.

Main intercombinations of wave frequencies are intercombinations between terms of neighbouring elite orbits
\[ \theta_{i,i+1}^{(\pm)} = \theta_i \pm \theta_{i+1} \]

Fundamental Spectrum of Wave Frequencies

Set of Terms of wave frequencies and their intercombinations for elite states (orbits) of Solar system represent a Fundamental spectrum of wave frequencies (periods) of Solar system.

In the Fig.14 the Fundamental spectrum of wave (frequencies) periods of Solar system is presented (more precisely is presented its fragment for expansion of a Shell \( \mathcal{G}^{[1]} \)), appropriate to observable elite (planetary - dominant) astrodynamical levels of Solar system. The scheme of astrodynamical levels is specially presented in the form reminding the scheme of spectroscopic levels of Hydrogen-like atom - the Diagram of Bohr - Grotrian (Fig. 13). By analogy with known radiating series - Terms and intercombi-
nations in atom - of Lyman, Balmer, Paschen etc., - on the scheme its are presented series of wave (frequencies) periods of Solar system - Terms and intercombinations between astrodynamic elite levels appropriate to planets of Solar system (a Series of asteroids - Cerera - is indicated conditionally).

**Hierarchy of Shells and Wave Frequencies (Periods)**

General representation for wave periods $\tau$ and frequencies ($\theta = 1/\tau$), taking into account influence of $G^{[p]}$ and $G^{[q]}$ Shells, hierarchy of $G^{[s]}$ Shells, looks like

$$
\tau_{N^{[p,q]}} = 2\pi a_{N^{[p]/C_{[q]}}} = \tau_{*^{[0]}} \cdot \chi^{2p+q} \cdot (N^2/2\pi), \quad \tau_{*^{[0]}} = 2\pi a_{*^{[0]}} / C_{*^{[0]}},
$$

when $p = q = s$ it is followed

$$
\tau_{N^{[s]}} = 2\pi a_{N^{[s]/C_{[s]}}} = \tau_{*^{[0]}} \cdot \chi^{3s} \cdot (N^2/2\pi) = \tau_{*^{[s]}} \cdot (N^2/2\pi),
\tau_{*^{[s]}} = 2\pi a_{*^{[s]}} / C_{*^{[s]}} = \tau_{*^{[0]}} \cdot \chi^{3s},
\theta_{N^{[s]}} = 1/\tau_{N^{[s]}},
\theta_{N^{[s]}} = \theta_{*^{[s]}} (2\pi / N^2), \quad \theta_{*^{[s]}} = C_{*^{[s]}} / 2\pi a_{*^{[s]}} = \theta_{*^{[0]}} \cdot \chi^{3s}.
$$

**Keplerian frequency (periods)**

From Kepler times it is known, that a period of orbital movement of a celestial body (we shall speak, the *Kepler period*) is represented depending on character of linear value (a semi-major axis of an orbit) by the way of the *Ill Kepler law*

$$
T = 2\pi / K^{1/2} \cdot a^{3/2}
$$

Accordingly submission for *Keplerian frequency* $\nu = 1/T$ looks like

$$
\nu = (1/2\pi) \cdot (K^{1/2} / a^{3/2}).
$$

Obviously, the Kepler law for Keplerian - orbital movement, *Keplerian frequencies and periods* and construed above relation for wave movement (for wave frequencies and periods) define *temporary* (periodic, rhythmic) structure of WDS, its interrelation with spatial structure, geometry of wave dynamic system.

**Terms of Keplerian Frequencies**

The fundamental basis of a spectrum of Keplerian frequencies constitute the *basic Keplerian frequencies* - the *Terms of Keplerian frequencies*, - appropriate to the distinguished elite (planetary) orbits with a semi-major axes

$$
\nu_i = (1/2\pi) \cdot (K^{1/2} / a_i^{3/2}).
$$

Accordingly for periods we have

$$
T_i = 1/\nu_i = (2\pi / K^{1/2}) \cdot a_i^{3/2}.
$$
Intercombinations
Generally, intercombinations of Terms of Keplerian frequencies,  
difference and summary  are represented by the way
\[ \nu_{i,j}^{(\pm)} = \nu_i \pm \nu_j \]

Conjunction. It is interesting to note, that difference intercombinations
\[ \nu_{i,j}^{(-)} = \nu_i - \nu_j \]
In essence, are frequencies of connections (conjunctions) of planets \( P_i \) and \( P_j \).

Main Intercombinations
The large role in understanding of wave structure intercombinations between Terms of neighbouring elite orbits - main intercombinations
\[ \nu_{i,j}^{(\pm)} = \nu_i \pm \nu_j \]
play.

Hierarchy of Shells and Keplerian Frequencies (Periods)
General representation for Keplerian periods \( T \) and frequencies \( \nu = 1/T \) of elite orbits in \( G^{[s]} \) Shells looks like
\[ T_{N}^{[s]} = \left( \frac{2\pi}{K^{1/2}} \cdot (a_N^{[s]})^{3/2} \right) = T^{*}[s] \cdot (N^3/(2\pi)^{3/2}) \]

Fundamental Spectrum of Keplerian Frequencies
Set of Terms of Keplerian frequencies and its intercombinations for elite states (orbits) constitute a Fundamental spectrum of Keplerian frequencies (periods) of Solar system.
Its fragment appropriate to the elite (dominant, planetary) orbits, is presented in the Fig.15 (intercombinations are difference).

Dynamic Aspects of Keplerian and Wave movements
The physical sense of Keplerian period \( T \) - ab definitio - is obvious:
* The material point (body, planet, satellite), driven on an orbit with Keplerian velocity \( \nu = (K/a)^{1/2} \),  closes an orbit - comes in an initial point through a period \( T \).

Can be similarly considered and period \( \tau \) of wave movement.
# The representing point driven on an orbit with \( C_* \) velocity (with a sound velocity of space plasma), closes an orbit through the period \( \tau \).
Really, we have
\[ \tau = \left( \frac{4\pi d^*}{K} \right) \cdot a = \left( \frac{2\pi a \cdot 2d^*}{K} \right) = 2\pi a/C_* \]

Group and Phase Velocity
According to the basic representations of Wave astrodynamics -
* Observable Keplerian (orbital) velocities of movement of celestial
bodies (substance, the matter) in essence, are group velocities - velocities of carry of energy and matter of Solar system considered as wave dynamic system.

* In turn (azimuthal) wave movement is connected to movement of a wave along an orbit with phase velocity $C_\ast$ - velocity of propagation of small perturbations in Space plasma (sound velocity).
Wave Structure of the Solar System

WAVE RESONANCE

The Wave Universe concept very attentively tries to understand observed effects of frequencies commensurability (which are represented in the Fundamental spectrum of Solar system wave and keplerian frequencies) with it observed frequencies of orbital, rotational, precession - nutational motions of celestial bodies, with rhythms of astrophysical and geophysical processes.

In the brief survey, at least selectively, in particular, following brightly observed in the Solar system wave resonance effects could be indicated.

Differential Rotation of the Sun General.
Magnetic Field of the Sun

In accordance with Wave astrodynamics representations the Sun differential rotation has discret (by latitude) structure and in many aspects reminde the differential rotation of giant planets. In this case, the observed periods of general magnetic field of the Sun (as the star) /17/, in particular,

\[ T = 27^d.18; 27^d.87; 28^d.42 \]

are close to \( \tau \) wave periods of Mercury series from the Fundamental wave spectrum of the Solar system

\[ \tau = 27^d.277; 27^d.839; 28^d.43. \]

Interplanetary Magnetic Field

The space of the Solar system inside the Mercury orbit is characterized by the presence of similar periods of interplanetary magnetic field /17/

\[ T = 27^d.20; 27^d.45; 27^d.87; 28^d.50; 29^d.36; \]

as well as according to /18/

\[ T = 27^d.20; 27^d.45; 28^d.45; 29^d.35; \]

close to wave periods of the Mercury series

\[ \tau = 27^d.277; 27^d.54; 28^d.839; 28^d.43; 29^d.47. \]

Month is a Wave, Running along the Mercury Orbit

It is interesting to note the proximity of the Term of the Mercury orbit Wave period \( \tau_{\text{ME}} \) = 27\(^d\).277 to Karrington period of the Sun rotation \( T = 27^d.275 \) (13.199 grad/day).

The Wave, running during the month along the Mercury orbit with the velocity \( C \approx 154 \text{ km s}^{-1} \), possesses the similar (or close to it) angular velocity, as the rotation of the Sun near equatorial zone.
Corotation of Interplanetary Plasma

That attaches some evident sense to the known phenomenon of interplanetary plasma corotation in the Intra-Mercurian region of the Solar system.

In fact, the proximity nearness (or the equality) of angular rotation of the some Sun nearaequatorial zone (with $T = 27^d.27$) to the Mercury wave period (Term) (the wave, running along Mercury orbit) with $\tau = 27^d.277$ indicates that one of main motions of cosmic plasma in Intra-Mercury region is the accordant, coherent rotation - the corotation of the cosmic plasma with the nearby month period.

Own Mercury Rotation

It is not difficult to notice the commensurability, coincidence the observed period of own Mercury rotation $T = 58^d.6$ with the main intercombination period $\tau_{ME-V} = 58^d.68$ of Mercury and Venus wave periods.

Period $T \cong 151^d$

Judgin from the sudden increase in information stream /19-22/, the experimental discovery of the period $T \cong 151^d$ became an unexpected event for the observing astrophysics.

But up till now in the frames of traditional knowledge it genesis is not known, it interpretation is not clear.

Meanwhile, its natural existence was forcasted, followed from the Fundamental wave spectrum [5,6].

Period $\tau_{MA-J} = 151^d.845$ appears to be the intercombination of two significant in the Solar system wave periods of Mars and Jupiter with the following dynamical and astrophysical consequences (Fig. 14).

Seasonal Half-Year Rhythm

The widely observed in many fields of astrogeophysics $T \sim 184^d$ period can be interpreted not only formally, as the arithmetic half of year period, but - physically and genetically - as induced by the main intercombination $\tau_{V-E} = 184^d.229$ of Venus and Earth wave periods.

Earth Pole Nutation and the Moon Seismicity

In the (transponate) nearday nutation of the Earth pole /23/ and in seismicity of the Moon periodicities, close to the $\tau_{E-MA} = 205^d.013$ main intercombination are observed. In the nutation of the Earth pole the $T = 24^a$ component close to $\tau_{NE-P} = 24^a.548$ /24/ is observed, too.

Year is a Wave, Running along Jupiter Orbit

It is the intriguing phenomenon of Wave astrodynamics, that the wave,
running along Jupiter orbit, runs round (encloses) it by the time equal to the Earth’s year

\[ \tau_{\text{J}} = \frac{2\pi a_J}{C} = 366^{d}.613. \]

Besides the periods commensurability (wave resonance) of orbital (Keplerian) Earth motion and wave motion along Jupiter orbit, is signifies another view at the nature, genesis of, one would think, pure Earth’s period, as a Year.

It turned out, that it belongs to the entire Solar system (and, in particular, is connected with the Jupiter orbit) not in the lower degree, as to Earth.

In that case, the presence of the observed effects of nearby year period (in particular, in the cosmic plasma) far from the Earth /25/ is not, necessarily of pure Earth origin.

They are connected with the wave structure of the hole Solar system.

**Irregular Earth Rotation**

“I regard these fluctuations as the most enigmatical phenomenon presented by stellar motions being so difficult to account for by the action of any known cause that we cannot but suspect them to arise from some action in nature hitherto unknown” - that statement made by the famous orbit astronomer Newcomb, in 1902 and quoted by Munk and McDonald in about determined (fixed) by astronomical methods (by stars observations) fluctuations of Earth rotation angular velocity.

Then Munk and McDonald point out that “Sea level variations, continental unrest, melting on Antarctica and other observable processes cannot possibly be the cause. The only known hope is the core, we have arrived at this conclusion by what Sir Edward Bullard has called the Sherlock Holmes procedure of eliminating one possibility after another.”

In variations spectrum of Earth rotation angular velocity there are observed, in particular, periods /23/

\[ T = 27^{d}.6; \ 0^{a}.16\div0^{a}.17(58^{d}.4\div62^{d}); \ 0^{a}.20(73^{d}); \ 0^{a}.26(95^{d}); \ 0^{a}.35(128^{d}); \ 0^{a}.5(183^{d}); \ 1^{a}; \ 1^{a}.8\div1^{a}.95; \ 2^{a}.2; \ 3^{a}.5; \ 10^{a}; \]

In Fundamental wave spectrum of Solar system it is not difficult to find the resonating wave periods, correspondingly with

\[ \tau = 27^{d}.548; \ 58^{d}.68(59^{d}.2); \ 72^{d}.89; \ 97^{d}; \ 127^{d}.8; \ 184^{d}.2; \ 1^{a}; \ 1^{a}.837; \ 1^{a}.212; \ 3^{a}.65; \ 10^{a}.194; \]

**Chandler’s Oscillations (Wobble)**

The nature of the known in the astroseismology Chandler’s wobble /23/ can be understood, if its commensurability with wave periods of Jupiter series (in particular, with \( \tau_{\text{J},\text{NE}}=443^{d}.32 \)) is taken into account.
Orbital Motion of the Mars

The commensurability of $T = 1^{a}.88$ Mars orbital period with the $\tau_{SA-\infty} = 1^{a}.837$ Saturn wave Term lies in accordance with similar observed effects for Mercury and Jupiter.

Solar Activity Rhythms

Periodical components of the Fundamental wave spectrum - near by month ($\tau = 27^{d}.277 \div 31^{d}.713$), half - year ($\tau = 184^{d}.229$), year ($\tau = 366^{d}.613$), quasi - two - year ($\tau = 2^{a}.212$), many year ($\tau = 5^{a}.8$, $\tau = 10^{a}.194$, $\tau = 24^{a}.548$) are commensurable to the observed astrogeophysical rhythms - from oscillations of geomagnetical and meteorological parameters on the Earth /26/ to variations of interplanetary magnetic field /25,27,28/ and Solar activity.

Variations of Neutrino and Cosmic Ray Flows

Similar and many other components which coincide with the Fundamental Wave spectrum, can be identified in interplanetary magnetic fields /27/

$$T = 87^{d}; 95^{d}; 127^{d}; 147^{d}; 180^{d}; 240^{d}; 360^{d}; 445^{d}; 510^{d}; 2775^{d}$$

in cosmic ray variations /29,30/

$$T = 56^{d}; 180^{d}; 204^{d}; 240^{d}; 360^{d}; 500^{d}; 800^{d};$$

Enen at the beginning of 80-th we forcasted the discovery of neutrino flow (variations) periodicities, belonging to the Fundamental Wave spectrum /6/. Later, with development of (Davis R.) neutrino experiments, many of them have been discovered.
WAVE COSMOGEONOMY

In light of accumulated information it becomes evident that wide complex of Wave astrodynamics representations can be promote to the new comprehension of not only special problems of astrodynamics and of celestial mechanics. The wide set of problems not only of astrophysics, but also of Earth sciences, including biosphere sciences, can be comprehended in the frameworks of the Wave cosmogeonomy - that is of the science about Cosmos and Earth, its interaction. Some representation about its principles, and constructive content following assertions give.

Theses (of the Wave Cosmogeonomy)

(1) The Cosmogenical Induction. Dominate (and, it seems, endogenic) processes taking place in all Shells of Earth (including - in the Biosphere), in the significant degree, are controlled by the located out of Earth cosmogenical factors.

(2) Wave Channel. The material channel of the short-range action, the energy, impuls, momentum impuls carrier, that realizes the interaction between processes following in Earth Shells and in the Solar system, and thus realizes the interaction of endogenic and cosmogenic factors, is the wave channel.

(3) Fundamental Spectrum and Wave Resonance. The rhythmics of astrophysical, geophysical, biological and another natural processes corresponds to the rhythmics of the wave processes in the Solar system, and thus the dominate frequencies spectrum of astrophysics, geophysics, chronobiology belong to the Fundamental Spectrum of the Solar System [see Fiog.14,15; periods indicate in days (d), years (a)].

(4) Spectroscopy - Unity and Universality. The spectroscopy (and Megaspectroscopy), corresponding to this Fundamental Spectrum of the Solar System, is the dynamic basis of existence of observing spectrums of the Wave Cosmogeonomy (astrophysics, geophysics, chronobiology), of theirs unity and universality.
"KEYS" FROM WAVE UNIVERSE.
FUNDAMENTAL PARAMETER of HIERARCHY

For the first time authentically certain size of Fundamental parameter of hierarchy (Chechelnitcky Number ($\chi = 3.66(6)$)) was received within the framework of representations of the Wave Universe concept long before the publication /4/ at research of dynamic isomorphism in a structure of two well known groups of planets of Solar system - I (Earth) and II (Jupiter), i.e. of the $G[1]$ and $G[2]$ Shells.

From understanding that they represent physically distinguished, but in some dynamic (and wave) sense similar structures, similar designs /4/, followed, for example, that orbits of Mercury and Jupiter, Venus and Saturn represent some dynamic analogues.

# Coefficient of Similarity (Scale) of Sectorial Velocity.
From this coefficient of recalculation $\chi$ of L sectorial velocity for astronomical levels of Mercury and Jupiter /4/ followed
$$\chi = \frac{L_J}{L_{ME}} \approx \frac{11}{3} = 3.66$$

# Coefficient of Similarity of Keplerian Velocities.
The similar picture can be received from the relation of Keplerian velocities for the same orbits
$$\chi = \frac{v_{ME}}{v_J} \approx \frac{11}{3} = 3.66$$

Scale Coefficient of Distances (Semi-Major axis)
From recalculation of the geometrical characteristics of orbits, obviously, the appropriate size followed also
$$\chi^2 = \frac{a_J}{a_{ME}} \approx \left(\frac{11}{3}\right)^2 = 13.444$$

Sound Velocity of Space Plasma
Hierarchy of value of dominante in Solar system, at least, in $G[1]$ and $G[2]$ Shells sound velocity of multicomponent space plasma $C_\ast^{[1]}$ - 154 km/s and $C_\ast^{[2]}$ - 42 km/s were known within the framework of the Wave Universe concept for a long time - also considerably before the publication /4, 6/.

It was supposed, that all complex of megawave representations will be stated in the publication "Wave Structure of the Solar system". It has not taken place - not on guilt of the author. Nevertheless, the value of the sound velocity appeared in "The Fundamental wave spectrum of the Solar system" in the report presented at 1981 in Kirov at an All-Union conference /5/.

Evidences of Independent Observations and Experiments
Direct and independent observations evidences of another authors are of special interest for background of wave astronomy. They don't result from some prejudiced analysis, speculative interpretation. If some pur-
poseful attention is paid, they can be discovered among a wide massif of
the already accumulated information/

Here are some of the independent evidences concerning in particular,
the TR_{1}^{[1]} (= a_{1}^{[1]}) Transsphere phenomenon of G^{[1]} Shell, C_{1}^{[1]} sound ve-
locity of cosmic plasma (Fig. 16).

Transsphere Localization

i) The presence of the special surface - the special transition region (the
jump of physical parameters) at the a_{1}^{[1]} \approx 8R_{\odot} discovered distance (Fig.
16) (which is associated with TR_{1}^{[1]} Transsphere position) is discovered by
the presence of characteristic of bend at the plot (Fig.17) of experimental
data (obtained from “Helios - 1,2” and “Pioneer - 6,10,11”), which describe
the dependence of interplanetary plasma parameters from heliocentric dis-
tance /38/.

ii) The special surface, on which the observed in space experiments U
solar wind velocity /38/ is equal to V = (K_{\odot}/a) \frac{1}{2} keplerian velocities of or-
bital motion, also positioned at a_{1}^{[1]} \approx 8R_{\odot} region (Fig.18), which is associated
with TR_{1}^{[1]} Transsphere surface. By that once more nontrivial dynam-
ical aspect of Transsphere is underlined - gradual increasing in the Sun
orbits the space plasma (“sound wind”, locally perturbative velocity tran-
sits the critical velocity (“sound velocity”, close to C_{1}^{[1]} = 154.38 km s^{-1})
namely in a_{1}^{[1]} \approx 8R_{\odot} TR_{1}^{[1]} Transsphere region.

Velocity C_{1}^{[1]} Localization. The space plasma T_{p} proton temperatures, in
accordance with the empirical dependence, discovered by Burlage and
Ogilvie /39,40/ as the result of spacecrafts (“Explorer - 34”) experiments,
are proportional to the observed space plasma (“solar wind”) U velocities
(Fig.19). It is not difficult to notice that at the minimal possible T_{p} \rightarrow 0 pro-
ton temperature of the observed space plasma velocity equals to U_{0} \approx 151
km s^{-1}. The same result follows from the proposed by them empirical de-
pendence /40/

\begin{align*}
(10^{-3}T_{p})^{1/2} &= 0.036U - 5.44, \quad [T_{p}] = [^{\circ}K], \quad [U] = [km s^{-1}]; \\
\text{at } T_{p} \approx 0 \quad U &= 5.44/0.036 = 151.11 \text{ km s}^{-1}.
\end{align*}

That experimental value practically coincides with the examined above
interplanetary plasma pertubations velocity (megawave velocity C_{1}^{[1]} =
154.3864 km s^{-1}) - the fundamental constant of wave astromonics.

Observations of Base Transsphere Period. In accordance with Wave
astrodynamics representations, together with the existence of intercombi-
nations (summary period T^{(\ast)} \approx 160^{\circ} and difference period T^{(\dagger)} \approx 175^{\circ}),
in wave processes accruing in the Solar system /41/, base (keplerian, group)
periods of Sun (characteristic period) T_{R_{\odot}} = 0^{d}.1159 = 166^{m}.9 and TR_{1}^{[1]}
Transsphere T_{\ast} = 2^{d}.6227 must be observed, too.

In processing the SMM satellite data of the Sun X - Ray bursts /49/, to-
gether with T = 160^{m} and T = 175^{m} components there has been discov-
ered and $T = 2^{d}.6$ component. It practically coincides with the Transsphere base keplerian (group) period $T_* = 2^{d}.6227$ (ab definito, at the Transsphere $\tau_* = T_*$).

In accordance with /41/, in Sun oscillations ther is also observed the component with $T = 166^{m}.9$ period, which (accordingly to above representations) may be associated with the $T_{R\odot} = 166^{m}.9$ Sun characteristic period /10/.

**Independent Observations**

"... Experimental researches of Sun and interplanetary medium by radar, optical and radiolocation methods give the possibility to specify the physical parameters of internal Sun corona and solar wind. From experimental data really follows that in 8 \(\div\) 10 $R_\odot$ region at interplanetary plasma characteristic velocity near 150 km\(\cdot\)s\(^{-1}\) there exists some break of its physical parameters..." /43/.

"... Between chromosphere and corona, there is apparently, contact break (break of density and termodynamical parameter); hesting of corona is ofter is explained by wave dissipation, which carry mechanical and magnetical energy. These waves can be transformed in weak shock waves observed by radars. Its velosity is about 150 km\(\cdot\)s\(^{-1}\)." /43/.

"... At 1970 there have been carried out interferometric measurings of scattering of 3C2 radiosource at 3 \(\div\) 10 $R_\odot$ distance from the Sun and at 1420 MHz frequency. There was discovered very strong dependence of dissipation from distance. Dissipation decreases with distance proportionally to $R^{-0.5}$ at \(\sim\)(2\(\div\)8)$R_\odot$ distances and at $R^{-7}$ at \(\sim\)(8\(\div\)15)$R_\odot$ distances. Therefore, at $R \geq 8R_\odot$ distances dissipation fastly decreases to the value comparable to dissipation in minimum solar activity epoch." /44/.

**Wave Image of Astronomical Systems**

The visual, integral image of astronomical systems wave (megawave) structure can be percepted, for example, from direct observations and measurements of cosmic medium and physycal continuum of planetary satellite systems, obtained as result of “Pioneers” and “Voyagers” flights to Solar system giant planets - Jupiter, Saturn, Uranus, Neptuns (see, in particular, Fig.20) /45/.

It is interesting to note, that in the theoretical aspects, the independent approach, which uses the analysis quasi classical methods of magnetohydrodynamical problems, also results, in particular, in the quantization, namely, of sectorial velocities of giant planets rings /46/.
DISCUSSION

Still at the beginning of the XX century, one of the famous creator of the physics and astronomy of the new time - Henry Poincare was worried by the problem:

"...Will the \textit{discretness} be rule by the Universe and will its triumph be completed and decisive? Or will it be defined that this discontinuity only seems and it conceals the sequence of continuous processes? The first, who saw the collision, though, that he saw the discontinuity phenomenon, but we now understand that he saw only very fast, but continuous changes of the velocity. Today the attempt to give the answer for this question - is the useless expenditure of ink."

Still earlier - almost a century before - Poincare kept in his mind one more question (we shall present it also in other, especially acute and unequivocal form) /3/:

"The final aim of the celestial mechanics is the solution of the great question: if the Newton Law - and only this phenomenon-can explain all astronomical phenomena; the only way of solving this question is to perform high-precision observations and compare them with calculation results...

...This epoch, when we have to refuse old methods, of course, is still very far, but the theoretician must foresee it, since theoretician's works must should be ahead outstrip, and often of many years, the calculators works".

At the end of the XX century new investigations and accumulated information at last seem to be able to give answers for these questions. But today their sense still depend on partialities and "scientific faith" much more then on the objective analysis and all the accumulated knowledge without exceptions.

Its own variant of the answer, evidently, the discussed system of ideas can give. But it is unlikely, that this variant may be final today. In this sense the Wave Universe concept, ideas of the wave astrodynamics are the system, of representations that on principle is open for the discussions.

As in general in searching science (and this is - fundamental science) complicated solutions are not dogmas, frozen for ever-they develop, transform, improve, and then, sometimes, get old.

The man is always excited only by the problems of Nature and Life which are eternal like the Universe whom we appeal our childish and (rather seldom) fundamental questions.
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ordering of planets in the Solar system [4,5]. The physical nature such ordering of planets was not ex-plained and in connection with the detection of extrasolar systems was become necessary to analyze these principles. This led to a detection of the wave algorithm as a possible explanation of the order-ing of planets in the Solar system. Standing waves and the spatial organization of the Solar planetary system. Thus, in the Solar system exists a common âœ L0 - resonance" of the planets with the "scaleâ€. Discrete structure of the Solar system looks in the mechanism of standing waves as a quite natural and nonrandom phenomenon. The spatial organization of the Solar planetary system is de-scribed by two interrelated kinematic algorithms of the single wave mechanism.