WAVE UNIVERSE
AND SPECTRUM OF QUASARS REDSHIFTS

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ABSTRACT

In the framework of the Wave Universe concept it is shown, that the genesis of redshifts can be connected with the intra-system (endogenous) processes, which take place in astronomical systems. The existence of extremal redshift objects (quasars - QSO) with most probable

\[ z = 3.513 (3.847); \quad 4.677; \quad 6.947 (7.4); \quad 10.524; \quad 14.7; \quad 27.79; \]

is predicted.

THE WAVE (MEGAWAVE) ASTRODYNAMICS CONCEPT

A wide set of yet noninterpreted (enigmatic from the point of view of standard paradigm of celestial mechanics and astrophysics [1,2]) observed and experimental data, connected with the dynamical structure and geometry of the Solar system (in particular, with the arrangement of planetary, satellite orbits, distribution its velocities, etc.) and other astronomical systems can be adequately interpreted in the framework of Wave (Megawave) Astrodynamics (and Wave Universe concept) [2-6].

Accordingly to these representations, real objects observed in the Universe (in the megaworld, such as astronomical systems, for example, the Solar system) appear principally wave dynamic systems (WDS), in the some sence similar to the atom system (Micro - Mega analogy [2]), and can be described by Fundamental wave equations (in particular, Schrodinger-type equation) (Fig.1).

The unique dimensional parameter \( d \), which enters into such a wave equation, has the dimension of sectorial velocity (circulation) [cm²/s] and corresponds to characteristic scale of system (Co-dimensional principle [2]).

For the atom it has the order

\[ d = d_a = \hbar/e = 1.15767 \text{ cm}^2 \cdot \text{s}^{-1} \]

(\( \hbar = 1.054572 \times 10^{-27} \text{ g} \cdot \text{cm}^2 \cdot \text{s}^{-1} \) - Planck's constant, \( e = 9.109389 \times 10^{-27} \text{ g} \) – mass of electron), for the Solar system (SS)

\[ d = d_{SS} = 10^{19} \text{ cm}^2 \cdot \text{s}^{-1} \]

EXTRREMELY LOW MASS

From the comparison of the circulation parameters, carried out in the end of 70s in the monograph [2, p.245], naturally follows an evident, lying at surface, consequence.

Representing the Solar system constant

\[ d = d_{SS} = \hbar_{SS}/m_{SS} \]

like as for atom (\( d = d_a = \hbar/e \)), it is easy, for example, in the case \( \hbar_{SS} = \hbar \), to obtain the representation

\[ d = d_{SS} = \hbar_{SS}/m_{SS} \]

and the order of mass

\[ m_{SS} = \hbar/d_{SS} = 1.054572 \times 10^{27}/10^{19} = 10^{46} \text{ g} \]

The physical sence of appearance of such an extremally low mass merits the special discussion. Meanwhile just note that this valuation is close to the upper limit of the experimental valuation of the photon mass [7]:

\[ m_{\gamma} < 9 \times 10^{-42} \text{ eV}/c^2 = 1.604 \times 10^{-42} \text{ g} \] (Ryan, 1985),
\[ 4.73 \times 10^{-12} \text{ ev}/c^2 = 0.8432 \times 10^{-44} \text{ g} \] (Chernikov, 1992),
\[ 1.0 \times 10^{-14} \text{ ev}/c^2 = 1.782 \times 10^{-47} \text{ g} \] (Williams, 1971), etc.

SPECTRUM OF ELITE VELOCITIES

The Fundamental wave equation, described the Solar system (similarly to the atom system), separates the spectrum of physically distinguished, stationary - \( \text{elite} \) - orbits, corresponding to mean quantum numbers \( N \), including the spectrum of permissible \( \text{elite} \) velocities \( v_N \).

The following representation holds for the physically distinguished – \( \text{elite} \) – velocities \( v_N \) in the
Shells of wave dynamical (in particular, astronomical) system(s) [3-6]:
$$v_N = v_N^{[6]} = (2\pi^{1/2})^{1/2} \cdot C^{[1]} \cdot \chi^{(s)}$$, s = 0, ±1, ±2, ...

($\chi$ - Fundamental parameter of Hierarchy (Chechelnitsky Number $\chi=3.66(6)$),
$C^{[1]}$ - Sound velocity of cosmic plasma in $G^{[1]}$ Shell [Chechelnitsky, [2-6], 1980-1992]),
where elite values $N$ (as it follows from observations) are close, in the general case, to the counting set of $N$ - Integer (semi - integer).

The most stable - dominant (strong elite) - orbits and the related dominant velocities correspond to the dominant values of quantum numbers, close to

$$N = N_{Dom} = 8; 11; 13; (15.5) 16; 19.5; (21.5) 22.5.$$  

It can be shown, that $N_{TR} = \chi(2\pi^{1/2}) = 9.191$
also is the physically distinguished (dominant) value $N [6]$.

ININVARIANCE (UNIVERSALITY) OF THE ELITE VELOCITIES SPECTRUM

The spectrum of physically distinguished elite velocities $v_N$ and quantum numbers $N$ of arbitrary wave dynamic systems (WDS) has some universal peculiarity. It is practically identical - invariant (universal) for all known observed systems of the Universe.

In particular, the velocity spectra of experimentally well investigated Solar and satellite systems practically coincide for the observed planetary and satellite - dominant - orbits, corresponding to some (dominant) values of quantum numbers $N_{Dom}$. Thus it can be expected that the spectrum of elite (dominant - planetary) velocities of the Solar system (well identified by observations) can be effectively used as quite representative - internal (endogenous) - spectrum of elite (dominant) velocities, for example, of far astronomical systems of the Universe.

PHYSICALLY DISTINGUISHED REDSHIFTS

In the framework of the developed representations of Wave (Megawave) Astrodynamics and Wave Universe concept [2-6] the analytical representation can be obtained for physically distinguished - preferably observed (elite) - redshifts of far astronomical objects (galaxies, quasars).

The physically justified by experience (and correct consequences) relation $z = f(v)$ between the velocity $v$ and the redshift $z$ has the form

$$z=\beta^2 = (v/c)^2$$,  \hspace{1cm} \beta=v/c,$$
where $c=299792.458$ km·s$^{-1}$ - light velocity.

This correlation between the redshift $z$ and the (orbital) velocity $v$ (as opposed to other relations) is carefully examined experimentally in laboratory conditions - on the Earth (Paund and Rebka’s experiment) and in Space - from the Sun (Brault’s experiment) [8].

It is also interesting to note that the used square dependence in the functional (mathematical) plane is in fact identical to the relation used in the calculation of the so-called gravity redshift [8] $z=G M/c^2 r=(v/c)^2$,  
where $v^2=GM/r$, v - orbital velocity.

THE PEAKS $z$ IN OBSERVATIONS AND IN THEORY

It may be shown that the most important peaks in histograms (of distribution) of the observed $z$ unaccidentally and with sufficient reliability coincide with the physically distinguished-dominant - values $z_N^{[6]}$ (at $N=N_{Dom}$).

For example, the peaks widely known from observations peaks (Figs. 2, 3) from [9-10]

$$z=2, z=1, z=0.5, z=0.35$$ (and other)

coincide with the dominant (N=N_Dom) $z_N^{[6]}$ values of $G^{[6]}$ Shell

$$z_N^{[6]} = z^{[6]} 2\pi/N^2$$,  \hspace{1cm} z^{[6]} = (C^{[6]}c)^2$$

and also (for $N_{TR} = 9.191$) $z_{TR}^{[6]} = 1.57$.

ENDOGENOUS NATURE OF $z$

The set of large quantity of facts, agreement between of theory and observations, including the possibility of correct description of distinguishing peaks $z$ over all the observed redshifts range (beginning from $z=0$) makes the next conclusion natural.

Assertion. It seems very probable that the true genesis and physical nature of the observed redshifts is considerably closer connected with the own (inner) wave shell structure of astronomical
systems (galaxies, quasars), than with the "kinematic" motion (translation) of their mass center - with the galaxies "expansion".

ABOUT THE EXISTENCE OF OBJECTS WITH EXTREMAL $z$

In the framework of the Wave Universe representations it must be expected that replenishing statistics of newly discovered astronomical objects will be characterized by the distribution peaks at $z$ that correspond to the physically distinguished - dominant - values of redshifts, in particular, belonging to the $G^{-7}$ Shell:

$$z_{N}^{-7} = z^{-7} \cdot 2\pi/N^2, \quad z^{-7} = (C^{-[1]}/c)^2 = [(C^{-[1]}/c) \chi^{-}]^2 = 283.08668,$$

$$z_{N}^{-7} = 27.79; 14.7; 10.524; (7.4)6.947; 4.677; (3.847)3.513.$$

Already at the present it is interesting to note apparently, unaccidental compliance of the observed values $z$ of (remotest for 1986) quasars $z=3.53$ (quasar OQ 172) and $z=3.78$ (quasar PKS 2000-330) with the pointed above $z^{-7}$ dominant values of the $G^{-7}$ Shell ($z=3.513$ and $z=3.847$).

Thus, it is not excluded, that the quasars OQ 172 and PKS 2000 - 330 will become not as much the last from discovered quasars of preceding population QSO ($G^{-6}$) with active $G^{-6}$ Shell (as the first (and evidently having not the highest values of $z$) from discovered quasars of new population QSO ($G^{-7}$) with active $G^{-7}$ Shell).

THE PROBLEM OF SEARCH

Basing on the above - discussed prognosis, we may also point to a set of supplementary physical orientating circumstances, that essentially shorten the search field for the objects with external $z$. One of them resides in the fact that the search must be carried out, in particular, among the astronomical objects having abundant radiation (peculiarities, peaks, radiation anomalies), besides gamma, in close infrared range, too. Really, for example, for hydrogen $L_{\alpha}$ - line

$$\lambda(L_{\alpha}) = 1215.67\,\text{Å} = 121.567\,\text{nm} = 0.121567\,\mu\text{m}$$

we have the system of shifted (by the redshift $z=z^{-7}$) wave lengths

$$\lambda_{N}^{-7} = \lambda(L_{\alpha})(1+z_{N}^{-7}) = 3.50; 1.90; 1.40; (1.02) 0.966; 0.69; (0.589) 0.548\,\mu\text{m}$$

that lay in IR-range.

Purposeful search of objects (most probably having $z$ that are close to the pointed above), in particular, among objects as Seyfert galaxies, Markarjan galaxies, may lead to discovery of new astronomical systems, which are characterized by extremal, so far unknown values of redshifts.

FOLLOWING OBSERVATIONS

Three years after the exposition of preceding results in 1986 [11-12] followed by a discussion between a confined circle of researchers - astrophysicists, in the end of 1989, american scientists from the Palomar Observatory M. Schmidt, J. Gunn, D. Schnader discovered the extremly far object of the Universe - quasar in the Ursa Major constellation. It is interesting to note also that using of the experimental "solar" value $N=19.43$ (instead of $N=19.5$) indicates the more close (to discovered) value $z=4.71$ (instead of $z=4.677$).

REFERENCES

1. Roy A.E. Ovenden M.W. - On the Occurrence of Commensurable Mean Motion in the Solar System, Mon.Not.Roy.Astron.Soc.,114, pp.232-241, (1954).
2. Chechelnitsky A.M., Extremum, Stability, Resonance in Astrodynamics and Cosmonautics, M., Mashinostroyenie, 312 pp. (1980) (Monograph in Russian). (Library of Congress Control Number: 97121007; Name: Chechelnitskii A.M.).
3. Chechelnitsky A.M., - The Shell Structure of Astronomical Systems, Astronomical Circular of the USSR Academy of Science, N1410, pp.3-7; N1411, pp.3-7, (1985).
4. Chechelnitsky A.M., - Wave Structure, Quantization, Megaspectroscopy of the Solar System; In the book:Spacecraft Dynamics and Space Research, M., Mashinostroyenie, 1986, pp.56-76 (in Russian).
5. Chechelnitsky A.M., - Uranus System, Solar System and Wave Astrodynamics; Prognosis of Theory and Voyager-2 Observations, Doklady AN SSSR, 1988, v.303, N5, pp.1082-1088.
6. Chechelnitsky A.M., - Wave Structure of the Solar System, Tandem-Press, 1992 (Monograph in Russian).
7. Review of Particle Physics, Phys.Rev. D, Part I, Vol. 54, N1, 1 July 1996.
8. Lang K. R. - Astrophysical Formulae, Mir, v.2, p.310, (in Russian) (1978).
9. Arp H., Bi H.G., Chu Y., Zhu X. - Periodicity of Quasar Redshifts, Astron. Astrophys. 239, p. 33-49 (1990).
10. Arp H. - Extragalactic Observations Requiring a Non-Standard Approach, Review given at IAU Symposium 124, Beijing, China, 29 Aug. 1986.
11. Chechelnitsky A.M. - Wave Universe and the Possibility of Existance of Extremal Redshift Quasars, Moscow, The original date of promulgation and discussion - November 30, 1986.
12. Chechelnitsky A.M. - Megawave and Shell Structure of Astronomical Systems and Redshift Quantization, Moscow, The original date of promulgation and discussion - December 4, 1986.

Post Scriptum (2000) [From Chechelnitsky, 2000]:

What Quasars with Record Redshifts Will be Discovered in Future?
Megquantization in the Universe.

It is clear, Megquantization (quantization “in the Large”), observed megaquantum effects are not monopolic privilege of only Solar system.

Let us point the brief resume of research (prognosis), connected with problem of redshift quantization of far objects of Universe – quasars (QSO) [Chechelnitsky, (1986) 1977]:

“Abstract: In the framework of the Wave Universe concept it is shown that the genesis of redshifts can be connected with the intra-system (endogenous) processes which take place in astronomical systems. The existence of extremal redshift objects (quasars – QSO) with most probable $z=3.513$ (3.847); 4.677; 6.947 (7.4); 10.524; 14.7; 27.79; … is predicted.”

Prognosis already had justified successively for extremal values of z redshifts

$z_{\text{theory}} = 3.513$, $z_{\text{obs}} = 3.53$ (quasar OQ172)
$z_{\text{theory}} = (3.847)$, $z_{\text{obs}} = 3.78$ (quasar PKS2000-330)
$z_{\text{theory}} = 4.677$, $z_{\text{obs}} = 4.71$ (Schmidt, Gunn, Schnaider, 1989)
$z_{\text{obs}} = 6.949$ (4.672) (quasar BR1202-0725, Wampler et al., 1996)

At the present time, apparently, also the object Q2203+29 G73 with record value z of redshift z=6.97 is discovered in special Astrophysical Observatory (SAO, Russia) $z_{\text{theory}} = 6.947$, $z_{\text{obs}} = 6.97$ (Q2203+29 G73, Dodonov et al., 2000).

The Quene – for objects with even more high redshifts $z = 10.524$; 14.7; …

Consequences of such successfully realizable prognosis, imperatives of observations not only are unexpected for the Standard cosmology, but also, probably, its can stimulated the radical reconsideration of many habitual representations, having become as freezeen dogmas.

Chechelnitsky A.M.-Hot Points of the Wave Universe Concept: New World of Megquantization, International Conference: Hot Points in Astrophysics, JINR, Dubna, Russia, August 22-26, 2000; http://arXiv.org/abs/physics/0102036.
Dodonov S. N. et al., The Primeval Galaxy Candidate, Submitted to Astronomy and Astrophysics, 2000; Also JENAM 2000.
Tifft W. G. – Global Redshift Periodicities and Periodicity Structure, Astrophysical Journal 468, pp. 491-518, Sept 10, 1996.
Wampler E. J. et al., High Resolution Observations of the QSO BR 1202-0275: Deuterium and Ionic Abundances at Redshifts Above $z = 4$, Astronomy and Astrophysics, v.316, p.33-42, (1996).
Figure 1

MICRO – MEGA ANALOGY

MICROSYSTEM QUANTUM SYSTEM ATOM

MEGASYSTEM ASTRONOMICAL SYSTEM SOLAR SYSTEM

FUNDAMENTAL WAVE EQUATION

∇²ψ + (2/d²)(|E – V|ψ = 0

d = dₑ = h/mₑ = 1.158 cm² s⁻¹
U = V/mₑ, V = - e²/a – Electric Potential
K = Kₑ = e²/mₑ
E = E/mₑ, E – Energy
e – Electric Charge
h = Planck’s Constant
mₑ – Electron Mass

SCHRÖDINGER’S EQUATION

∇²ψ + (2mₑℏ²)E/|V|ψ = 0

Relations of Quantum Mechanics
DE BROGLIE: P = ℏk
PLANCK-EINSTEIN: E = ℏω
HEIZENBERG: ΔxΔp > (1/2)ℏ
P = mv, k – Wave Number
ω – Frequency

BOHR’S STATE ORBITS

Quantization of the Sectorial Velocity (Circulation) L [cm² s⁻¹]

L = LₑN, N – Integer
L = vₑ(ka)¹/², LₑN₁ = Constant
d = LₑN₁ (d = ℏLₑN₁, ℏ – Constant)
N = L/LₑN₁ – Normalized Sectorial Velocity – Quantum Number

Relations of the Wave Astrodynamics
v = dK
ε = dΩ
ΔxΔv > (1/2)d
K – Wave Number
Ω – Frequency

ELITE ORBITS

PLANETARY (DOMINANT) ORBITS
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