

ICNAAM 2012
2012 Seminar Course on Hadronic Mechanics
Kos, Greece, 19-25 September 2012

On the Cosmological Red Shift

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<http://shpenkov.janmax.com/CosmRedshift.pdf>

A subject plan of the talk

- 1. The modern view on the nature of CRS and CMB**
- 2. Flaws of the modern view**
- 3. Flaw in principle of the Standard Model (SM)**
 - 4. A new physics paradigm**
 - 5. The Wave Model (WM)**
 - 6. Dynamic Model of elementary particles (DM)**
 - 7. The fundamental frequencies of exchange**
 - 8. The origin of mass**
 - 9. The nature of charge**
 - 10. A nucleon according to the WM**
 - 11. An atom according to the WM**
 - 12. A nucleon molecule of carbon, C**
 - 13. Basic features of nucleon molecules**
- 14. The wave feature of the hydrogen atom**
- 15. A generalized spectral formula**
- 16. The hydrogen atom - an elementary electronic system**
- 17. A background spectrum of the hydrogen atom**
 - 18. The calculated data ($n=1$)**
 - 19. The calculated data ($n=2$)**
 - 20. The nature of the Lamb Shift**
- 21. The nature of CRS in view of the WM**
- 22. Elementary notions and relations**
- 23. An oscillatory damping model**
- 24. Estimation**
- 25. Conclusion**

The modern view on the nature of CRS

The CRS is considered as an effect of the expansion of the Universe that followed the Big Bang of a “singularity”.

Flaws:

*The Big Bang conception on the origin of the Universe is an unfounded unprovable supposition
– abstract postulate:*

*there are no direct evidences on the reality of the Big Bang,
and it is impossible to verify this hypothetical phenomenon
experimentally ever, in principle.*

The modern view on the nature of CMB

The CMB at 2.728 K is considered as the left-over radiation from the Big Bang, a “relict” radiation or remnant light from the Big Bang.

Flaws:

The Big Bang conception on the origin of the CMB is also an unfounded unprovable supposition – abstract postulate;

*it goes without saying - **abstract postulates cannot serve as proofs in support of any phenomena.***

This contradicts to common sense:

Unfoundedly accepting the supposition as a reality, the CMB has become regarded as an evidence – as the main and single argument in support of the Big Bang hypothesis.

The use of CMB as a main proof in support of the mythic Big Bang hypothesis is especially unfounded after discovery of MBR of hydrogen atoms.

Hence, the modern view on the nature of CMB and CRS, and, accordingly, on the origin of the Universe must be reconsidered!

Flaw in principle of the Standard Model

(A fatal flaw on the whole)

is

an erroneous theoretical physics paradigm

*based on formal logic and numerous
abstract and abstract-mathematical postulates.*

*Unfortunately, the use of abstract (unreal, mythic) postulates has become a
routine method in creation of modern physics theories.*

Consequently, in the framework of the SM

*Cognition of Nature
is impossible!*

For this reason

modern physics does not know:

*what is the charge,
the origin of mass,
what is the nature of gravitation;*

the physical meaning of:

*the speed of light **c** in the equation $E_0 = m_0 c^2$,
the fine structure constant **α** ,
polar-azimuthal functions in Schrödinger's equation.*

It is unable to derive theoretically:

*relative atomic masses of isotopes,
magnetic moment of a neutron,
magnetic moment of a proton;*

to build

a unified field theory; etc.

A new physics paradigm

is based on:

(1) Dialectical philosophy and dialectical logic

(2) A postulate on the wave nature of all phenomena and objects in the Universe

Following the postulate

Wave structure of matter-space
is described by the well-developed methods of classical
wave physics, in particular, by the
general wave equation

$$\Delta \hat{\Psi} - \frac{1}{c^2} \frac{\partial^2 \hat{\Psi}}{\partial t^2} = 0$$

*It contains information about both the spherical and
cylindrical components of the field of matter-space
at all levels of the Universe.*

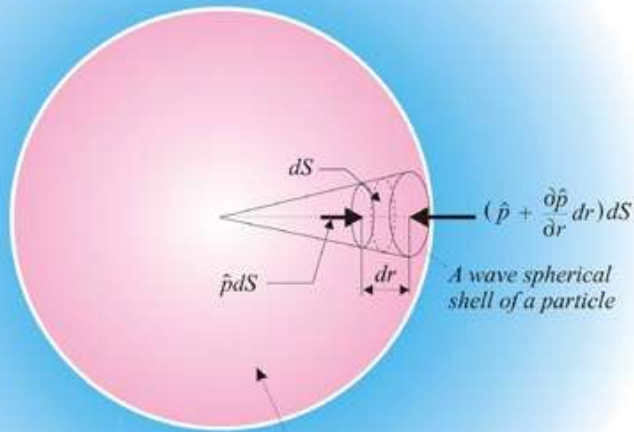
The Wave Model

The new physics paradigm led to the WM that includes:

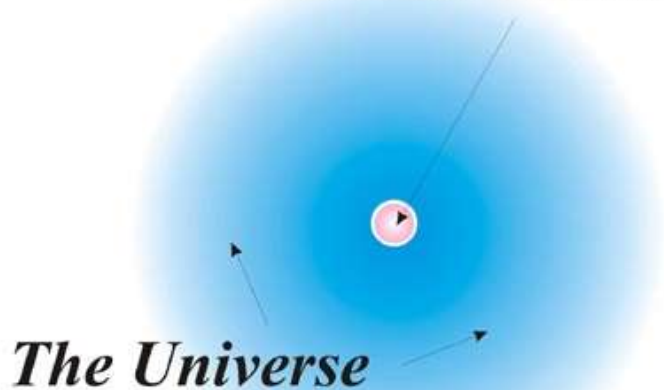
(1) The Dynamic Model (DM) of elementary particles.

(2) The Shell-Nodal Model (SNM) of the atoms.

Internal space of a particle -
The Universe



Outer space of a particle -
The Anti-Universe



The Universe

According to the **Dynamic Model (DM)**

an elementary particle is regarded
as a **pulsating spherical
microformation** of space, a
spatial vortex,

being in **dynamic equilibrium
with environment due to wave
pulsations of its wave shell at
the well-defined frequency ω** .

**Longitudinal oscillations of
the wave shell** in radial directions
provide interaction with other
objects and the ambient field.

A spherical wave shell ***(characteristic sphere)***

*is an intermediate region of a particle that divides
its **main part** from a **field part**;
the latter merges gradually with the ambient field-space.*

*The **main part** (**core**) is the **basis** of the particle, the
infinite **field part** represents its **superstructure**.*

*Such a model interprets an elementary particle as a
particular physical point formed in wave space
from the space itself.*

Elementary particles ***are finite-infinite in size***

A ***finite*** size of a particle is restricted by the spherical wave shell pulsating at the ***exafrequency*** ω_e . These wave pulsations, spreading in space, determine ***interaction*** of particles at the ***atomic*** and ***subatomic levels***.

An ***infinite*** size of particles has no boundary, but it includes a far remote zone restricted by the spherical wave shell that divides oscillatory and wave domains of particles at the mega level, and defines ***gravitational radius*** of the particles.

Wave pulsations of the shell at the ***ultimate low frequency*** ω_g , spreading in space as ***gravitational waves***, determine ***gravitational interaction*** of particles.

Fundamental frequency

responsible for the ***exchange*** (interaction) at the ***atomic*** and ***subatomic*** levels

$$\omega_e = 1.869162505 \times 10^{18} \text{ s}^{-1}$$

defines an ***average discreteness of space*** at the subatomic and atomic levels of the Universe.

Fundamental wave radius of the field of the exchange is

$$\hat{\lambda}_e = \frac{\lambda_e}{2\pi} = \frac{c}{\omega_e} = 1.603886998 \times 10^{-8} \text{ cm}$$

Fundamental wave diameter $D = 2\hat{\lambda}_e \approx 0.32 \text{ nm}$

correlates with an average value of lattice parameters in crystals.

Fundamental frequency

responsible for the ***exchange*** (interaction) at the
gravitational level,
the ***frequency of gravitational field***

$$\omega_g = \sqrt{4\pi\epsilon_0 G} = 9.15784 \times 10^{-4} \text{ s}^{-1}$$

$G = 6.67384(80) \times 10^{-11} \text{ m}^3 \times \text{kg}^{-1} \times \text{s}^{-2}$
is the gravitational constant, $\epsilon_0 = 1 \text{ g} \times \text{cm}^{-3}$

Gravitational wave radius of elementary particles,
(the radial elementary gravitational wave)

$$\hat{\lambda}_g = \frac{\lambda_g}{2\pi} = \frac{c}{\omega_g} = 3.274 \times 10^{13} \text{ cm} = 327.4 \text{ Mkm}$$

An existence of gravitational frequency ω_g and gravitational radius λ_g of elementary particles, along with the fundamental frequency ω_e and wave radius λ_e at the atomic and subatomic levels, shows

*an **indissoluble harmonic bond of micro and mega objects of the Universe***

*in a single complex of the
Infinitely Small and Infinitely Big.*

The origin of mass

The rest mass does not exist.

Mass of elementary particles is associated, dynamic.

$$m = \frac{4\pi r^3 \varepsilon_0 \varepsilon_r}{1 + k^2 r^2}$$

***Associated mass** is analogous to the **hydrodynamic** (added) **mass** attributed to a moving body in liquid*

For example, a hollow pulsating elastic sphere or cylinder in water sets in motion all surrounding water mass, which is called thereby **hydrodynamic**. Equations to calculate the added mass are based on traditional ship design techniques.

Thus, in view of the DM, matter is not only generated by a space, but is itself a space, although slightly modified – compacted (thickened).

The nature of charges

The charge has the exchange nature and is the measure of the rate of mass exchange. We call it the exchange charge, or the power of mass exchange

$$q = \frac{4\pi r^3 \epsilon_0 \epsilon_r}{1 + k^2 r^2} \omega = m\omega$$

Electron charge

is an elementary exchange charge, or an elementary quantum of the rate of mass exchange

$$e = m_e \omega_e = e_{CGSE} \sqrt{4\pi\epsilon_0} = 1.702691627 \times 10^{-9} \text{ g} \times \text{s}^{-1}$$

$$e_{CGSE} = 4.803204401 \times 10^{-10} \text{ g}^{1/2} \times \text{cm}^{3/2} \times \text{s}^{-1}$$

$$e_{SI} = 1.602176462 \times 10^{-19} \text{ C}$$

A nucleon

according to the DM

- **Protons and neutrons are wave pulsating spherical microformations in space, a coarse materialization of physical space**

(an energy compaction, energy vortex or energy thickening of space).

- **The radius of a proton wave shell is $0.528421703 \times 10^{-8} \text{ cm}$**
- **The center of mass of a nucleon performs radial oscillations with amplitude of the order $1.4 \times 10^{-13} \text{ cm}$ and fundamental frequency $\omega_e = 1.869162559 \times 10^{18} \text{ s}^{-1}$.**

The oscillations with indicated parameters form a dynamic spherical domain in the center of a nucleon.

Just the space limited by this dynamic volume was mistakenly taken by Rutherford for a superdense nucleus of the atom.

An atom

according to the Shell-Nodal Model

Only hydrogen atoms, to which we refer protons, neutrons, and atoms of hydrogen, are one-nodal (one-centred) wave formations;

*they **are atoms** in the true sense of the word.*

The rest of the elements of The Periodic Table are multinodal (multi-centred) wave formations;

*they **are nucleon molecules** of coupled nucleons located in their nodes.*

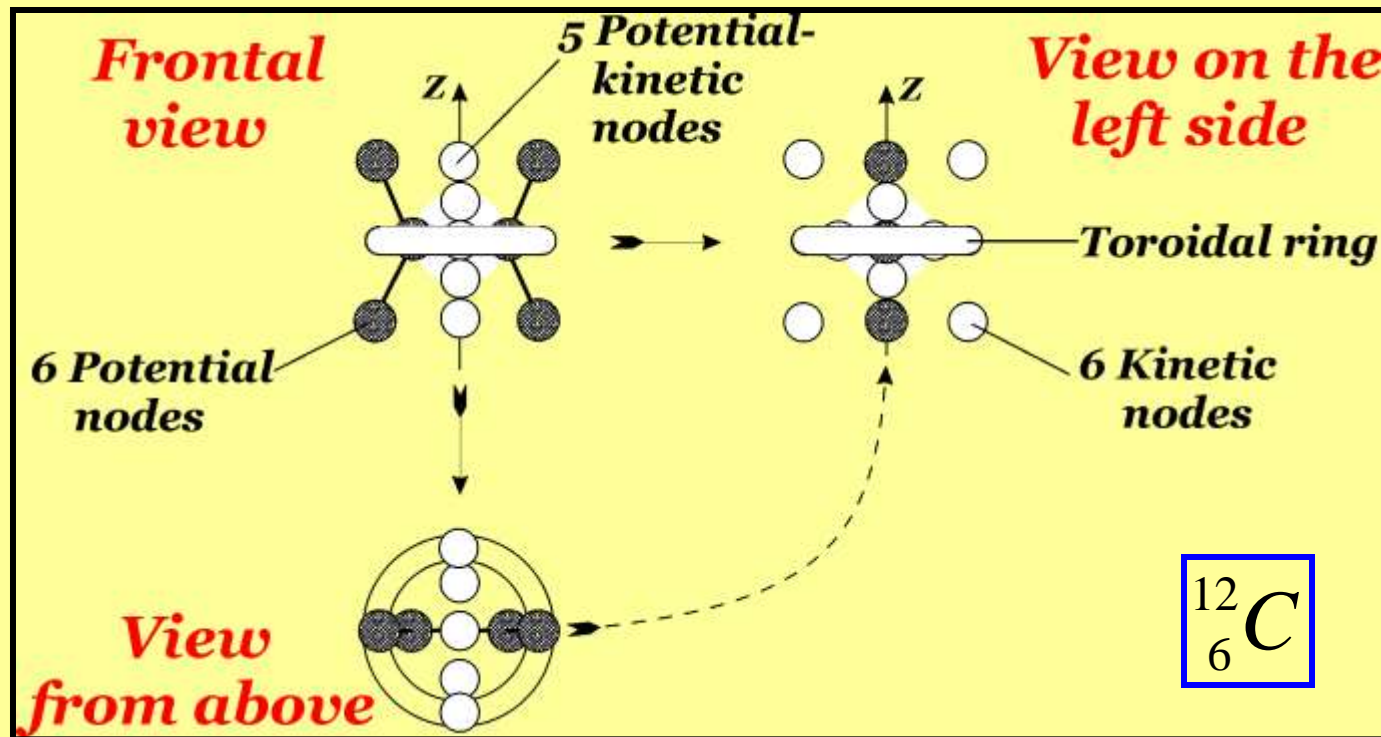
Basic features of nucleon molecules

- 1) Internodal bindings in nucleon molecules are **strong** (“nuclear”).
- 2) Centers of masses of coupled nucleons in nucleon nodes, **oscillating** (just as wave shells) at the **fundamental frequency** $\omega_e = 1.869162559 \times 10^{18} \text{ s}^{-1}$, form the scattering volumes (“nuclei”).
- 3) **Superdense atomic nuclei do not exist.**
- 4) All nucleon molecules have a “**ballistic channel**” along the axis of symmetry and **toroidal rings**.

The structure of nucleon molecule (“atom”) of carbon, C

*Originated from solutions
of the wave equation:*

$$\Delta\hat{\Psi} - \frac{1}{c^2} \frac{\partial^2 \hat{\Psi}}{\partial t^2} = 0$$



The wave feature of the hydrogen atom

*The wave structure and behavior of the hydrogen atom and rest of “atoms” - nucleon molecules - reveal many defined properties from the unknown earlier point of view and **led to** a series of the **discoveries**.*

Two of them are:

- (1) The generalized spectral formula of the hydrogen atom;*
- (2) The background spectrum of the hydrogen atom.*

A generalized spectral formula

From the WM it follows that elementary optical spectra, in a general case, are defined by the universal formula of energetic transitions, unknown earlier.

*It contains
right radial solutions – roots of Bessel functions:*

$$\frac{1}{\lambda} = R_{\infty} \left(\frac{e_p^2(kr_m)z_{p,1}^2}{z_{p,m}^2} - \frac{e_q^2(kr_n)z_{q,1}^2}{z_{q,n}^2} \right)$$

where

$$e_v(z_{v,s}) = \sqrt{\frac{\pi z_{v,s}}{2} \left(J_v^2(z_{v,s}) + Y_v^2(z_{v,s}) \right)} \quad R_{\infty} = \frac{v_0}{4\pi r_0 c} = \frac{\alpha}{4\pi r_0}$$

*(no customary quantum numbers – integers **n** and **m** – are here)*

R_∞ *is the Rydberg constant;*

v_0 *is the oscillatory speed of the first stationary wave shell of the radius r_0 (Bohr radius);*

$\alpha = \frac{v_0}{c}$ *is the fundamental constant reflecting the scale correlation of conjugated threshold parameters, oscillatory and wave, inherent in wave motion (called in modern physics the fine-structure constant);*

$z_{v,s} = kr_s$ *are roots of Bessel (radial) functions $J_v(z_{v,s})$ and $Y_v(z_{v,s})$;*

$k = \frac{\omega_e}{c}$ *is the wave number;*

ω_e *is the fundamental frequency of atomic and subatomic levels ($\omega_e = 1.869162505 \times 10^{18} \text{ s}^{-1}$);*

$v = l + \frac{1}{2}$ *is the order of Bessel functions;*

s *is the number of zero or maximal values of the functions.*

The hydrogen atom – an elementary electronic system

*Any electronic system is characterized by
natural electronic noise.*

*The **background radiative noise** in H-atom
is caused by natural perturbations of electron
orbiting due to the **oscillatory-wave behavior**
of the proton-electron system.*

A background spectrum of the hydrogen atom

$$\frac{1}{\lambda} = R_{\infty} \left(\frac{1}{n^2} - \frac{1}{(n + \delta n)^2} \right) = R_{\infty} \left(\frac{1}{n^2} - \frac{1}{\left(n + \sqrt{\frac{2Rh}{m_0 c}} \cdot \frac{e_p(z_{p,s})}{z_{p,s}} - \beta_n \frac{r_e^2}{r_0^2} \sqrt{\frac{2Rh_e}{m_0 c}} \cdot \frac{e_m(z_{m,l})}{z_{m,l}} \right)^2} \right)$$

here $h_e = 2\pi m_e v_0 r_e = 5.222105849 \times 10^{-28} \text{ erg} \times s$ **is the orbital action of an electron in the equilibrium state**
(caused by an electron proper rotation around its own centre of mass with the Bohr speed v_0 , analogous to the Planck action quantum h),

$r_e = 4.17052597 \times 10^{-10} \text{ cm}$ **is the radius of electron's wave shell**
calculated from the formula of associated masses;

β_n **is the numerical factor.**

The calculated data ($n=1$)

TABLE 1

The terms, $1/\lambda$, of background spectrum of the hydrogen atom

| $Z_{p,s}$ | $Z_{m,l}$ | $1/\lambda, cm^{-1}$ | λ, cm | T, K | T_{exp}, K |
|------------|--------------|----------------------|-----------------|----------------|-------------------------------------|
| $y_{0,1}$ | $y'_{0,1}$ | 41.751724 | 0.023951 | 12.10805 | |
| $y_{0,2}$ | $y'_{0,1}$ | 9.40602023 | 0.106315 | 2.72774 | 2.728 \pm 0.002 |
| $j'_{0,2}$ | $j'_{1/2,1}$ | 9.67863723 | 0.103320 | 2.80680 | (NASA's COBE) |
| $y_{0,3}$ | $y'_{0,1}$ | 5.240486 | 0.190822 | 1.51974 | |
| $j'_{0,3}$ | $j'_{1/2,1}$ | 5.255841 | 0.190265 | 1.52419 | |

$$n = 1, \quad \beta_1 = 1 \text{ (for } Z_{m,l} = y'), \quad \beta_1 = 1.203068949 \text{ (for } Z_{m,l} = j')$$

The wave $\lambda=0.106315 \text{ cm}$ is within an extremum of the spectral density of equilibrium CMB.

The zero level of wave exchange exists as a standard energetic medium in the Universe.

The calculated data ($n=2$)

TABLE 2

The terms, $1/\lambda$, of background spectrum of the hydrogen atom

| $Z_{p,s}$ | $Z_{m,l}$ | $1/\lambda, cm^{-1}$ | λ, cm | T, K |
|------------|--------------|----------------------|---------------|---------|
| $y_{0,1}$ | $y'_{0,1}$ | 5.219748 | 0.191580 | 1.5137 |
| $y_{0,2}$ | $y'_{0,1}$ | 1.1758681 | 0.850436 | 0.3410 |
| $j'_{0,2}$ | $j'_{1/2,1}$ | 1.211154 | 0.825659 | 0.3512 |
| $y_{0,3}$ | $y'_{0,1}$ | 0.6550701 | 1.526554 | 0.18997 |
| $j'_{0,3}$ | $j'_{1/2,1}$ | 0.6582849 | 1.519099 | 0.1909 |

$n = 2, \quad \beta_2 = 1$ (for $Z_{m,l} = y'$), $\beta_2 = 1.018671584$ (for $Z_{m,l} = j'$)

***The MBR of the hydrogen atom has the form of the Planck distribution
(subject to Planck's law of blackbody radiation).***

[Shpenkov G.P., Kreidik L.G., *Microwave Background Radiation of Hydrogen Atoms*, Revista Ciencias Exatas e Naturais, V. 4, No. 1, 9-18, 2002]

The nature of the Lamb Shift

TABLE 3

The frequency gaps, $\Delta\nu$, between the nearest background terms of the hydrogen atom

| n | s | Terms differences | $\Delta(1/\lambda), cm^{-1}$ | $\Delta\nu, MHz$ | $\Delta\nu_{exp}, MHz [24]$ |
|-----|-----|-----------------------------------|------------------------------|-------------------|-----------------------------|
| 1 | 2 | $(j'_{0,2} - \gamma_{0,2})_{n=1}$ | 0.272617 | 8172.852 | 8172.837(22) |
| | 3 | $(j'_{0,3} - \gamma_{0,3})_{n=1}$ | 0.015355 | 460.3313 | |
| 2 | 2 | $(j'_{0,2} - \gamma_{0,2})_{n=2}$ | 0.0352859 | 1057.84466 | 1057.8446(29) |
| | 3 | $(j'_{0,3} - \gamma_{0,3})_{n=2}$ | 0.0032148 | 96.37727 | |

[Shpenkov G.P., *Theoretical Basis and Proofs of the Existence of Atom Background Radiation*, Infinite Energy, V. 12, Issue 68, 22-33, 2006]

The nature of CRS

Elementary notions and relations:

Elementary emitters of optical spectra of all nucleon molecules (regarded in physics as “atoms”) are *hydrogen atoms* located in nucleon nodes.

A wave process is a propagation of excitation in *real media*.

It is a collective phenomenon accompanied a *decrease* both *amplitude* and *frequency*.

Appearing at a level of the multi-dimensional field-space of the Universe, *regarded as a real media*, the excitation goes into an infinite series of embedded field-spaces of lower and higher lying levels.

Energy of a wave quantum of a micro galactic field of the Universe is proportional to the frequency ω :

$$\varepsilon = \hbar\omega$$

Energy density of the micro galactic field is also proportional to the frequency ω , i. e.,

$$W_\varepsilon = \rho_{\hbar}\omega$$

where ρ_{\hbar} is an **average density** of the action \hbar , the **constant magnitude**, because the action itself

$$\hbar = m_e v_0 r_0 \text{ is constant.}$$

*In infinitely embedded fields of the Universe, the wave motion is accompanied the decrease an **average energy density** w_ε (along with amplitude).*

*Because ρ_{\hbar} is **constant**, the **frequency** ω of propagated wave quanta also **decreases**.*

*By virtue of this, the length of waves, coming from objects far remote from the solar system, turns out to be **increased in a red region** of the visible spectrum.*

This mechanism naturally reveals the reason, why the night sky is dark for man.

An oscillatory damping model

*Let us consider all subelectronic particles,
participating in a wave process (propagation of a perturbation),
located along an imaginary line in space, connecting a source with an observer
(in approximation of pointlike objects),
as a unit oscillatory system.*

*Then, at a small damping, amplitude of oscillations of the
system will decrease with time following the equality*

$$x = a_0 e^{-\beta t} \cos(\omega t + \alpha) \quad (1)$$

β *is the damping coefficient;*
 a_0 *is an initial displacement (amplitude) of an oscillator;*
 α *is an initial phase of oscillations;*
 ω *is the frequency of damping oscillations,*

$$\omega = \sqrt{\omega_0^2 - \beta^2} \quad (2)$$

ω_0 *is the eigenfrequency of the oscillating system (source).*

A total energy of the system is proportional to the amplitude squared; therefore, the energy of the system decreases with time as

$$E = E_0 e^{-2\beta t} \quad (3)$$

E_0 is an initial energy of the system at $t=0$.

Observed frequency of emitted quanta, ω , and frequency of the source for the observer, ω_0 , are related with the redshift z as

$$\omega = \frac{\omega_0}{1 + z} \quad (4)$$

Estimation

*The quanta emitted from the IOK-1 galaxy
(Lyman- α radiation, $\lambda_0 = 121.6 \text{ nm}$)
have been observed with a redshift $z = 6.96$.*

*This galaxy is considered as one of the oldest and most
distant galaxies found in 2006; its age, about **12.88 billion
years**, as assumed, has been more reliable established.*

*[Iye, Masanori; Ota, Kazuaki; Kashikawa, Nobunari et al., A
galaxy at a redshift $z = 6.96$, Nature 443 (7108): 186–188, (2006)]*

At the redshift $z = 6.96$,

$$\omega = \frac{\omega_0}{7,96} \quad (5)$$

For $\lambda_0 = 121.6 \text{ nm}$,

$$\omega_0 = \frac{2\pi c}{\lambda_0} = 1.55 \times 10^{16} \text{ s}^{-1},$$

hence,

$$\beta = \sqrt{\omega_0^2 - \omega^2} = 0.992\omega_0 = 1.538 \times 10^{16} \text{ s}^{-1} \quad (6)$$

Thus, during 12.88 billion years ($t = 4,062 \times 10^{17} \text{ s}$) **energy of the system, decreasing exponentially, takes the value**

$$E = E_0 e^{-2\beta t} = \frac{E_0}{\exp(1.25 \times 10^{34})}, \quad (7)$$

that is typical for parameters of cosmic scale phenomena.

Thus,

(in view of the WM)

Cosmological Redshift

*is a result of natural damping (fading) of waves
with passed distance accompanied the
decrease not only amplitude, but also frequency.*

*This feature is
characteristic for all real physical media,
to which the cosmic space also relates.*

Conclusion

From particular solutions of the general wave equation, it follows that nobody noticed before:

the peculiar dynamic structure and behavior of elementary particles and shell-nodal structure of the atoms;

unknown earlier fundamental parameters that characterize their behavior and interactions;

a series of other relevant discoveries, including the discovery of the hydrogen atom background spectrum.

The discovery of the MBR of hydrogen atoms has made it unacceptable the usage of the Big Bang hypothesis for the explanation of the origin of CMB and CRS phenomena.

Considering the cosmic space as a not empty physical entity, the CRS is naturally explained without the expanding Universe conception in the framework of the WM.

Enhanced Conclusion is at:
<http://shpenkov.janmax.com/Conclusion-Eng.pdf>

LITERATURE

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http://shpenkov.janmax.com/Cosmological_Redshift.pdf

Appendix

An elementary particle

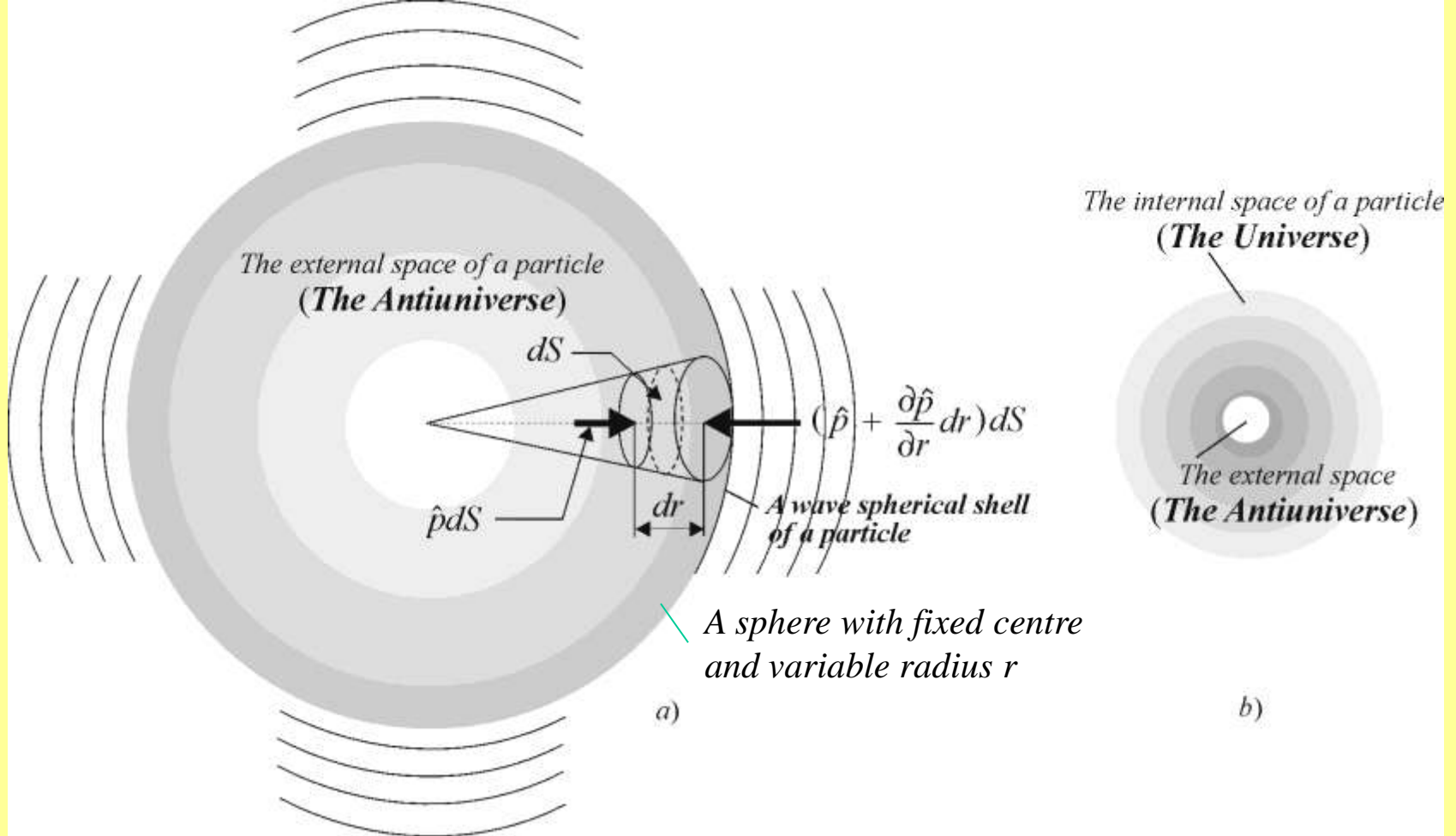
(according to the DM),

an interference microformation of wave space,

***a local three-dimensional
pulsating vortex of wave space
(an antinode of standing waves),***

looks like

a spherical micro pulsar



Dynamic model of elementary particles

\hat{p} is the two-dimensional density of exchange, or a pressure of the field of exchange;

$\hat{p}dS$ and $(\hat{p} + \frac{\partial \hat{p}}{\partial r} dr)dS$ are powers of exchange of the ambient field of matter-space-time with an element dS of the shell of a particle.

Power of the central exchange \hat{F}_s with the ambient field

(at the boundary of the spherical shell of a particle
with the area S and radius r)

$$\hat{F}_s = \frac{4\pi r^3 \varepsilon_0 \varepsilon_r}{1 + k^2 r^2} (1 - ikr) \hat{v} i\omega$$

$\varepsilon_0 = 1 \text{ g} \times \text{cm}^{-3}$ is the ***absolute unit density***; ε_r is the ***relative density***.

$\hat{v} = v(kr)e^{i\omega t}$ is the ***speed of wave exchange*** (interaction)

$k = \frac{2\pi}{\lambda} = \frac{\omega}{c}$ is the ***wave number*** corresponding to the well-defined ***fundamental frequency*** ω of the field of exchange (which is characteristic of the corresponding level of the Universe).

c is the ***basis speed of wave exchange*** of matter-space-time.

*The general equation of the exchange
contains information about both the*

exchange of motion

$$\frac{4\pi r^3 \epsilon_0 \epsilon_r}{1 + k^2 r^2} \left(\frac{d\hat{v}}{dt} + kr\omega \hat{v} \right) = \hat{F}_s$$

and

exchange of mass

$$\frac{4\pi r^3 \epsilon_0 \epsilon_r}{1 + k^2 r^2} \omega(i + kr) \hat{v} = \hat{F}_s$$

***Gravitational radius determines
the radii of shells
of the gravitational domain:***

$$r = \hat{\lambda}_g z_{m,n} = 327.4 \times z_{m,n} \text{ Mkm}$$

($z_{m,n}$ are roots of Bessel functions)

and the relation between the shells:

$$r_s = r_1 \frac{z_{m,s}}{z_{m,1}}$$

Neutron

*is a basic particle of atomic systems
(as the main unit of mass).*

Gravitational exchange charge of the neutron

$$q_{ng} = m_n \omega_g = 1,53392 \times 10^{-27} \text{ g} \times \text{s}^{-1}$$

Neutron

*is the **fundamental quantum of mass**
and the **fundamental graviton**
with the gravitational charge of exchange q_{ng} .*

A Universal Law of Exchange

(Originated from the DM; valid for dynamic spherical objects in any field of matter-space-time)

$$\langle F \rangle = \omega_f^2 \frac{m_1 m_2}{4\pi \varepsilon_0 r^2} *$$

(* - Averaged, for the inphase and antiphase ($\Delta\varphi = 0; \pi$) cases, modulo)

m_1 and m_2 are ***associated masses*** of the objects,

$\varepsilon_0 = 1 \text{ g} \times \text{cm}^{-3}$ is the ***absolute unit density***,

ω_f is one of the two ***fundamental frequencies*** (ω_e, ω_g)

For $\Delta\varphi = 0$:

$$\langle F \rangle = -\omega_f^2 \frac{m_1 m_2}{4\pi \varepsilon_0 r^2}$$

Coulomb's and Newton's laws
are

particular cases of the Universal Law of Exchange

$$\langle F_e \rangle = \omega_e^2 \frac{(zm_e)(Zm_e)}{4\pi\epsilon_0 r^2}$$

and

$$\langle F_g \rangle = \omega_g^2 \frac{(zm_n)(Zm_n)}{4\pi\epsilon_0 r^2}$$

describe, correspondingly, exchange-interaction at the level of the wave “*electric*” field on the basis of electron with the associated mass m_e and the exchange (“*electric*”) charge

$$q_e = m_e \omega_e ,$$

and the exchange-interaction at the level of gravitational wave field on the basis of graviton-nucleon with the associated mass m_n and the exchange (gravitational) charge

$$q_{ng} = m_n \omega_g$$

Electron exchange charge q_e

responses for the strength
of ***electromagnetic interactions***, in particular, for
interatomic bonds in molecules and crystals.

Actually, the energy of ***electron binding*** is equal to

$$E_e = \frac{q_e^2}{8\pi\epsilon_0\lambda_e} \approx 4.49 \text{ eV}$$

Strong (nuclear) interactions depend on the ***exchange charges of nucleons*** (q_n and q_p). Internodal binding energy of neutrons of the length $r = 1.20 \cdot 10^{-8} \text{ cm}$ (in the shell-nodal atomic model)

$$E = \frac{q_n^2}{8\pi\epsilon_0 r} = 20.29 \text{ MeV}$$

is characteristic for ***strong (nuclear) interactions***.

Energy of the fundamental interactions,

at every level, is defined by the exchange charges squared.

If the energy (strength) of ***electromagnetic*** interaction

is taken as 1, then in this scale, the

energy of ***strong*** interaction has the order of

$$q_n^2 / q_e^2 = 3.4 \times 10^6$$

and ***gravitation*** interaction,

$$q_{ug}^2 / q_e^2 = 0.8 \times 10^{-36}$$

Hence, the strengths of three fundamental interactions: ***strong***, ***electromagnetic***, and ***gravitational***, relate approximately as

$$10^6 : 1 : 10^{-36}$$

overlapping the range of 42 decimal orders in magnitude.

($q_{ug} = m_u \omega_g \approx 1.52 \times 10^{-27} \text{ g} \times \text{s}^{-1}$, m_u is the unified atomic mass unit)

Gravitational frequency ω_g defines

the radial time wave-period T_g ,

$$T_g = 2\pi / \omega_g = 0.686077 \times 10^4 \text{ s}$$

and the azimuthal time wave of the fundamental tone T_c ,

$$T_c = 4\pi T_g = 8.62150 \times 10^4 \text{ s}$$

(Earth day, $24 \text{ h} = 8.640 \times 10^4 \text{ s}$)

The **time wave** T_c repeats the structure of **spatial wave** of the fundamental tone on the Bohr orbit, $\lambda = 4\pi r_0$, and the azimuthal (transversal) electron wave of the fundamental tone, $\lambda_e = 4\pi r_e$, where r_e is the radius of the electron wave shell

Thus, gravitational constant G can be presented as

$$G = \omega_g^2 / 4\pi\epsilon_0$$

and

$$G = 16\pi^3 / T_c^2 \epsilon_0$$

*The relationships show that the Earth is in a **harmonic resonance bond** with the **fundamental gravitational frequency** ω_g .*

*Just like the **electron** on the Bohr orbit is in a **harmonic resonance bond** with the **fundamental frequency of the subatomic and atomic levels** ω_e .*

Thus, the Earth is fundamentally distinguished from other planets (just like the hydrogen atom is distinguished from all other elements of the periodic table), taking a special place in the field-space of the Solar system and maybe in Cosmos on the whole!

Dynamic Model
is not a casual invention or a fruit of
imagination.

The DM naturally originates from a new
approach in physics based on dialectics.

Dialectical philosophical system
with its logic
supersedes Aristotelian with its formal
logic of limited possibilities dominated
currently in physics.

**Correct statement of a problem - half of the success
to get a right solution**

***Dynamic Model
gave rise the domino effect in
physics:***

a chain reaction occurred when a fundamental change of our view on elementary particles structure caused the discovery of new fundamental parameters, which then caused a change of basic notions, which then caused another change of accepted theories, and so on in linear sequence.

<http://shpenkov.janmax.com>

***Dynamic Model of Elementary Particles
revealed also the next great mystery:***

Why the speed c (equal to the speed of light) plays the fundamental role for the internal energy E of a quiescent particle?

$$E = m_0 c^2$$

Because the *speed* c is the innate property of elementary particles as the *basis speed of their wave exchange (interaction) with ambient at the subatomic, atomic and gravitational levels*, both in rest and motion; therewith, m_0 is the *associated mass* of a particle.

Accordingly, E is the energy of wave exchange of matter-space-time of an elementary particle at the levels; or ***intrinsic dynamic energy*** of the particle, which is regarded as a pulsating microobject of the Universe.