The spherical solution of Schrödinger equation does not agree with any experiment:

Toward new energy methods based on George Shpenkov's wave equation

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Abstract

In light of the fact that our world requires new energy supply in order to replace fossil based energy, then it seems that new theory is badly needed – because it is often true that new energy requires new theory. And new theory can only come from new insights. In this paper, I will review the inadequacy of spherical solution of Schrödinger equation to say anything about the structure of molecules. It is a common fact, that the spherical solution of Schrodinger equation is hardly discussed properly in many quantum mechanics textbooks, with excuse that it is too complicated. Then I will discuss George Shpenkov's wave equation which is able to derive the periodic table of elements, and other phenomena related to the structure of molecules, which is an elusive dream from the viewpoint of quantum mechanics. It is argued here that one can expect to arrive at new energy methods using this wave equation as starting point, for instance by virtue of resonance vibration theory. Nonetheless, it is not our view here that the Shpenkov's wave equation can substitute wave mechanics completely, instead we prefer to say that it can be a complementary approach of wave mechanics. By referring to Schrödinger's dream in his 1926 paper to find connection between his wave mechanics and vibration frequency, I think that Shpenkov's wave equation can fulfill that dream.

1. Introduction

"In the beginning was the Word…," says the Gospel of John 1:1. (German: "Im Anfang war das Wort". Greek: Εν ἀρχῇ ἦν ὁ λόγος). This famous prolegomena of the Gospel of John may be interpreted that everything comes from the Word of God, and since Word means Voice, and Voice means sound, and sound can be related to vibration and frequency, then it seems quite straightforward to think that everything in this universe consists of vibration and frequency. While the above analogy with the Gospel of John is suggested by this writer, such a view that everything is related to wave and frequency has been proposed by George Shpenkov [1]. He wrote as follows: "A new physics paradigm that we have accepted and follow in all our works is based on: (1) Dialectical philosophy and dialectical logic; (2) The postulate on the *wave nature* of all phenomena and objects in the Universe."[1, p.7] The Shpenkov's basic wave equation is as follows:

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

His wave equation is known as the wave equation of sound. [18, p.12][22, p.111]

In light of the fact that our world requires new energy supply in order to replace fossil based energy, then it seems that new theory is badly needed. And new theory can only come from new insights. In this paper, I will review the inadequacy of spherical solution of Schrödinger's equation to say anything about the structure of molecules. It is a common fact, that the spherical solution of Schrodinger equation is hardly discussed properly in many quantum mechanics textbooks, with excuse that it is too complicated. Then I will discuss George Shpenkov's wave equation which is able to derive the periodic table of elements, and other phenomena related to the structure of molecules, which is an elusive dream from the viewpoint of quantum mechanics. It is argued here that one can expect to arrive at new energy methods using this wave equation as starting point, for instance by virtue of resonance vibration theory. Nonetheless, it is not our view here that the Shpenkov's wave equation can substitute wave mechanics completely, instead we prefer to say that it can be a complementary approach of wave mechanics. By referring to Schrödinger's dream in his 1926 paper to find connection between his wave mechanics and vibration frequency, I think that Shpenkov's wave equation can fulfill that dream.

Among other things, George Shpenkov's wave equation is able to explain the following things:

a. Derive a periodic table of elements (slightly different from the Mendeleyev's periodic law) based on spherical solution of his standing wave equation [9];
b. Give a dynamical model of elementary particles [8];
c. Derive binding energy of deuterium, tritium, helium and carbon [10];
d. Derive the atom background radiation of hydrogen which corresponds to the observed COBE/CMBR (cosmic microwave background radiation) [7];
e. Derive the shell-nodal model of atoms and molecules [11];
f. Explain anisotropy of graphene [12];
g. Describe the shell-nodal picture of carbon and grapheme [13];
h. Explain the virtual particles;
i. Describe electron "orbitals";
j. Describe electron "spin";
k. Derive neutron magnetic moment;
l. Derive proton magnetic moment;
m. And other things [14].

Therefore, it seems that Shpenkov's wave model of particles and molecules can be a unique alternative to the standard view which is based on quantum/wave mechanics.

2. The spherical solution of time-independent Schrodinger equation does not explain anything

Before I continue, firstly allow me to admit something: I should admit that I was very interested in quantum theory especially wave mechanics since I read a book published by Santa Fe Institute/Addison-Wesley and edited by Wojniech H. Zurek with title: Complexity, Entropy and the Physics of Information [15]. I bought that book in 1996, and then studied it in my spare time. After that, I became interested in the wave mechanical model of solar system (planetary orbits) since I found a paper by Laurent Nottale from Paris. I tried to derive his result in a simpler way (based on some quantum mechanics textbooks that I read).

It took some years until I found time to put my ideas in written form and then finally I can publish my first paper in Apeiron, January 2004 [16]. In that paper, I discuss quantization of planetary orbits in solar system based on Bohr's quantization of angular momentum. I also predicted three planetoids beyond orbit of Pluto; those 3 planetoids have been discovered subsequently by several astronomers including Michael Brown from Caltech. (This journal seems to stop from functioning since last year). After that, I published many more papers discussing various aspects of quantum/wave mechanics, but the basic view remains the same: that I was quite convinced that the quantum mechanics is a wonderful theory (like many physicists today), albeit it is perhaps incomplete.

But since 2009, I took a rather different view, which is to find possible connection between quantum mechanics and classical mechanics. That view was expressed in my 2009 paper together with Florentin Smarandache with title: *A derivation of Maxwell's equations in quaternion space,* where I managed to connect Dirac equation and quaternionic Maxwell equations, based on Gersten decomposition method [17]. Since then, I sought further how to connect classical mechanics and wave mechanics. But still, my basic view is that wave mechanics eventually supersede classical mechanics. (During the period of 2006 and 2013, I have published no less than 9 books together with Florentin Smarandache and others, see the Appendix.) For an introduction to the relationship between classical and quantum theory, see for instance Landsman [19].

That view I hold until last month (March 2014), where I found some papers written by Dr. George Shpenkov from googling. He explains that there are some weaknesses of wave mechanics especially Schrödinger's equation, for example:

i. Its spherical solution is rarely discussed completely (especially in graduate or undergraduate textbooks), perhaps because many physicists seem to feel obliged to hide from public that the spherical solution of Schrödinger's wave equation does not agree with any experiment.
ii. Schrödinger equation is able only to arrive at hydrogen energy levels, and it has to be modified and simplified for other atoms.
iii. The introduction of variable wave number k in Schrödinger equation, depending on electron coordinates, and the omission of the azimuth part of the wave function, were erroneous [6]. Schrödinger's variable wave number should be questioned, because the potential function cannot influence the wave speed or consequently the wave number.
iv. Introduction of the potential function in the wave equation, which results in dependence of the wave number *k* on the Coulomb potential, *generates divergences* that do not have a physical justification. They are eliminated in an artificial way. [6, p.27]
v. Modern physics erroneously interprets the meaning of polar-azimuthal functions in Schrodinger's equation, ascribing these functions to atomic "*electron orbitals*". [1, p.5]
vi. Schrödinger arrived at a "correct" result of hydrogen energy level using only a radial solution of his wave equation, with a major assumption: the two quantum numbers found in the solution of his wave equation were assumed to be the same with Bohr's quantum number [2].
vii. Quantum mechanics solutions, in their modern form, contradict reality because on the basis of these solutions, the existence of crystal substances-spaces is not possible. [6, p.26]
viii. Schrödinger's approach yields abstract phenomenological constructions, which do not reflect the real picture of the micro-world.[2]
ix. Schrödinger himself in his 1926 paper wanted to interpret his wave equation in terms of vibration of string [3][4]. This is why he did not accept Born's statistical interpretation of his wave equation until he died.
x. The interpretation of the wave function was a problem for physicists, and it still remains so, although many researchers understand its conditional character [6].
xi. Furthermore, in accordance with Huang, it can be shown that the establishment of the Schrödinger equation is unreasonable in physics.[5] One simple fact is that only when l=m=0, the wave functions can maintain the spherical symmetry. See Figure 1.

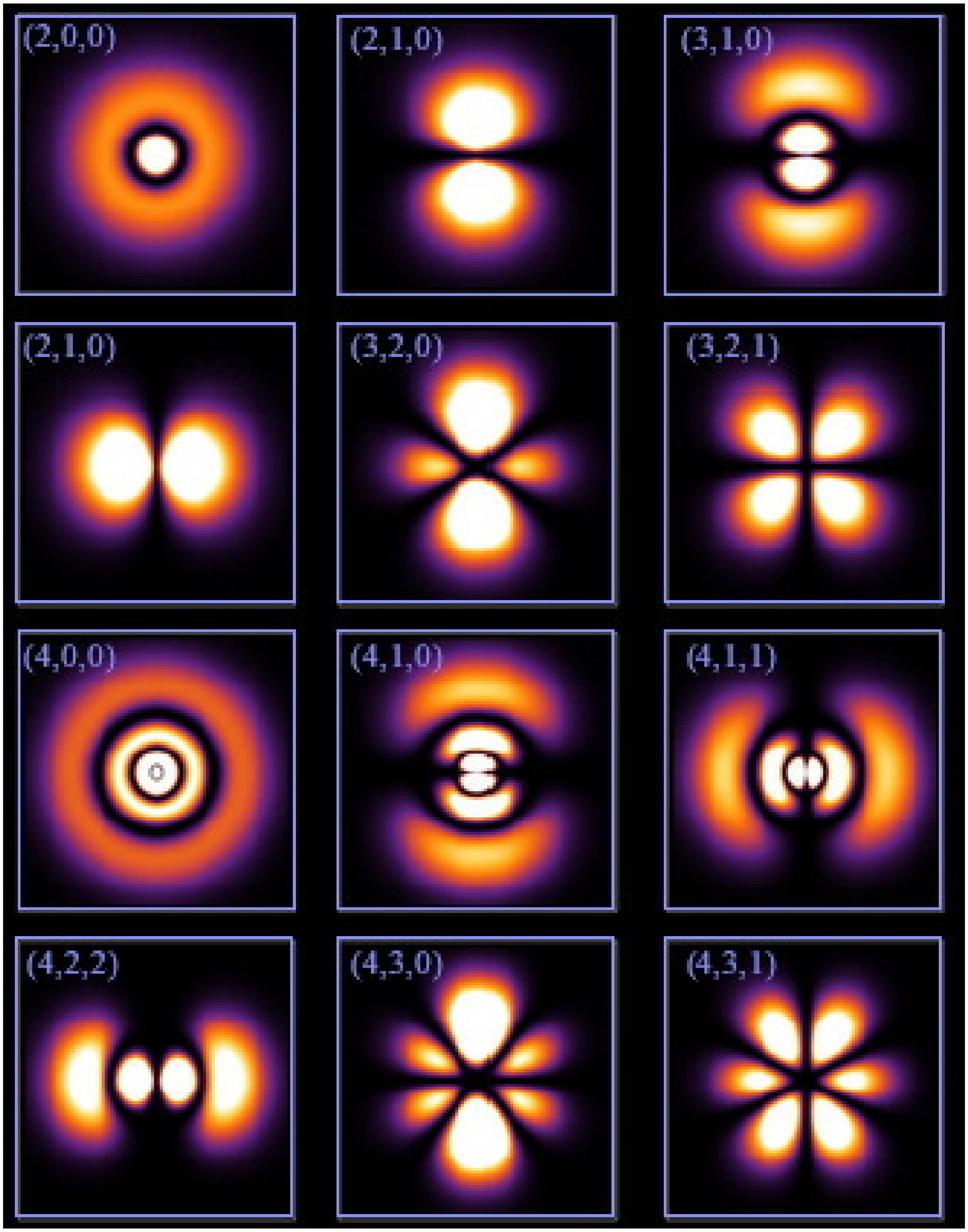

Figure 1. Some wavefunctions of the hydrogen atom predicted by Schrödinger equation. [5]

Based on the above considerations, we can be convinced that Schrödinger equation is an inadequate approach to explain atomic wave-particle as envisioned by De Broglie. Its radial solution is forced to give the desired result, which is to agree with Bohr's old quantum mechanical result. And its spherical solution can never explain any experiment. While

Huang is correct when saying that Schrödinger equation is unreasonable to be used in physics, he does not tell what the alternative theory is. However, as we shall discuss, Shpenkov's wave equation is able to derive the Mendeleyev's periodic table of elements with impressive accuracy, besides explaining other phenomena of particles and molecules.

3. Schrödinger equation (SE)

It is commonly regarded as one of the postulates of Quantum Mechanics (QM). Since 1920s, the SE began to be regarded as a major achievement of scientific thought. It became the basis for lectures on atomic physics in universities. However, let us take an objective view on the SE: for example, why was its spherical solution rarely discussed publicly in textbooks?

In the initial variant, the SE had the following form [2]:

$$\Delta\Psi + \frac{2m}{\hbar^2}\left(W + \frac{e^2}{4\pi\varepsilon_o r}\right)\Psi = 0 \tag{2}$$

The wave function satisfying the wave equation (2) is represented as:

$$\Psi = R(r)\Theta(\theta)\Phi(\varphi)T(t) = \psi(r,\theta,\varphi)T(t) \tag{3}$$

Where $\psi(r,\theta,\varphi) = R(r)\Theta(\theta)\Phi(\varphi)$ is the complex amplitude of the wave function, because

$$\Phi_m(\varphi) = C_m e^{\pm im\varphi} \tag{4}$$

For standard method of separation of variables to solve spherical SE, see for example [20][21].

The Φ, Θ and T equations were known in the theory of wave fields. Hence these equations are presented nothing new. Only the R was new. Its solution turned out to be divergent. However, Schrödinger together with H. Weyl (1885-1955), contrary to the logic of and all experience of theoretical physics, artificially cut off the divergent power series of the radial function R(r) at a κ-th term. This allowed them to obtain the radial solutions, which, as a result of the cut off operation, actually were the fictitious solutions.[2]

Furthermore, it can be shown that the time-independent SE [20]:

$$\nabla\Psi + \frac{2m}{\hbar^2}(E - V)\Psi = 0, \tag{5}$$

Can be written in the form of standard wave equation [2]:

$$\nabla\Psi + k^2\Psi = 0, \tag{6}$$

Where

$$k = \pm\sqrt{\frac{2m}{\hbar^2}(E - V)}\,. \tag{7}$$

Or if we compare (6) and (2), then we have [2]:

$$k = \pm\sqrt{\frac{2m}{\hbar^2}\left(W + \frac{e^2}{4\pi\varepsilon_o r}\right)}\,. \tag{8}$$

This means that the wave number in Schrödinger's radial wave equation is a quantity that varies continuously in the radial direction. Is it possible to imagine a field where the wave number, and hence the frequency, change from one point to another in the space of the field? Of course, it is not possible. **Such wave objects do not exist in Nature**.

The above analysis suggests that SE does not correspond to objective reality. The errors have made QM into a great caricature of the world of real wave process, while the extensive publicity created an illusion that as if mankind deals with a great theory. Therefore, I agree with Huang who says that the establishment of the Schrödinger equation is unreasonable in physics.[5]

4. The right wave equation: Introduction to Shpenkov's wave equation

Now I will introduce the Shpenkov's wave equation, which can be written simply as follows:

$$\nabla\Psi + \frac{\omega^2}{c^2}\Psi = 0, \tag{9}$$

Where the wave number $k = \frac{\omega}{c}$, is constant, instead of variable. [6, p.27] Here, ω denotes the fundamental carrying frequency of the wave field at the corresponding level of space, and c denotes the speed of light. In order to correct the faults of wave mechanics, it is necessary to write down the above wave equation, which meets the conditions: (a) the wave number is constant, and (b) the azimuth factor must be taken into consideration along with radial R(r) and polar factor of the wave-function. [6, p.27]

In this case, the differential equation for the radial factor R(r) is:

$$\rho\frac{d^2R_l}{d^2\rho}+2\rho\frac{dR_l}{d\rho}+\left[\rho-l(l+1)\right]R_l=0 \qquad (10)$$

Where ρ=kr. [6, p.27]

The value of the fundamental frequency ω determines only the absolute scale of all parameters at the corresponding level of space. At the atomic and subatomic levels, it is equal to: [6, p.27]

$$\omega_e=1.86916197\cdot10^{18}s^{-1}. \qquad (11)$$

The wave radius corresponding to (11) is:

$$\lambdabar_e=\frac{c}{\omega_e}=1.603886998\cdot10^{-8}cm. \qquad (12)$$

As we can see, $\lambdabar_e$ is equal to one-half of mean value of the interatomic distance in crystals (in terms of the generally accepted atomic model); that is not a random coincidence. [6, p.27]

The detailed analysis to find spherical solution of equation (9) is discussed in Shpenkov's other papers [9][11].

Some consequences of the solution of this wave equation are [6, p.28]:

a. As masses of atoms are multiple of the neutron mass (or hydrogen atom mass), following Haüy's ideas makes it reasonable to suppose that any atom, like the elementary Haüy's molecule, is the neutron (H-atom) molecule;
b. Therefore, atoms should be considered as neutron (H-atom) quasispherical multiplicative molecules. The word 'multiplicative' means that particles, constituted of these elementary molecules, must be coupled by strong bonds, which we call multiplicative bonds.
c. Potential polar-azimuthal nodes of spherical shells in stable atoms (nucleon molecules) contain by two coupled nucleons.
d. Polar potential-kinetic nodes (not filled with nucleons in the most abundant and stable atoms) are ordered along the z axis of symmetry (in spherical coordinate system) of the atoms.
e. Exchange (interaction) between completed nodes inside (strong) and outside (electromagnetic) of the atoms is realized by exchange charges of nucleon and electron on the fundamental frequency (11).
f. It is possible to assume that Table 1 shows the actual picture of distribution of nodes-extremes, corresponding to Haüy's elementary molecules.

g. Principal azimuth nodes of the wave space of atoms are marked by ordinal numbers. These numbers coincide with the ordinal numbers of elements of Mendeleev.s periodic table. The quantity of neutrons, localized in one node, is equal to or less than two.
h. Arranging atoms with the same or similar structure of outer shells one under another, in accordance with Table 1, we arrive at the *periodic-nonperiodic law of spherical spaces* that constitutes periodic table (Table 2), slightly differing from the conventional one of Mendeleev.

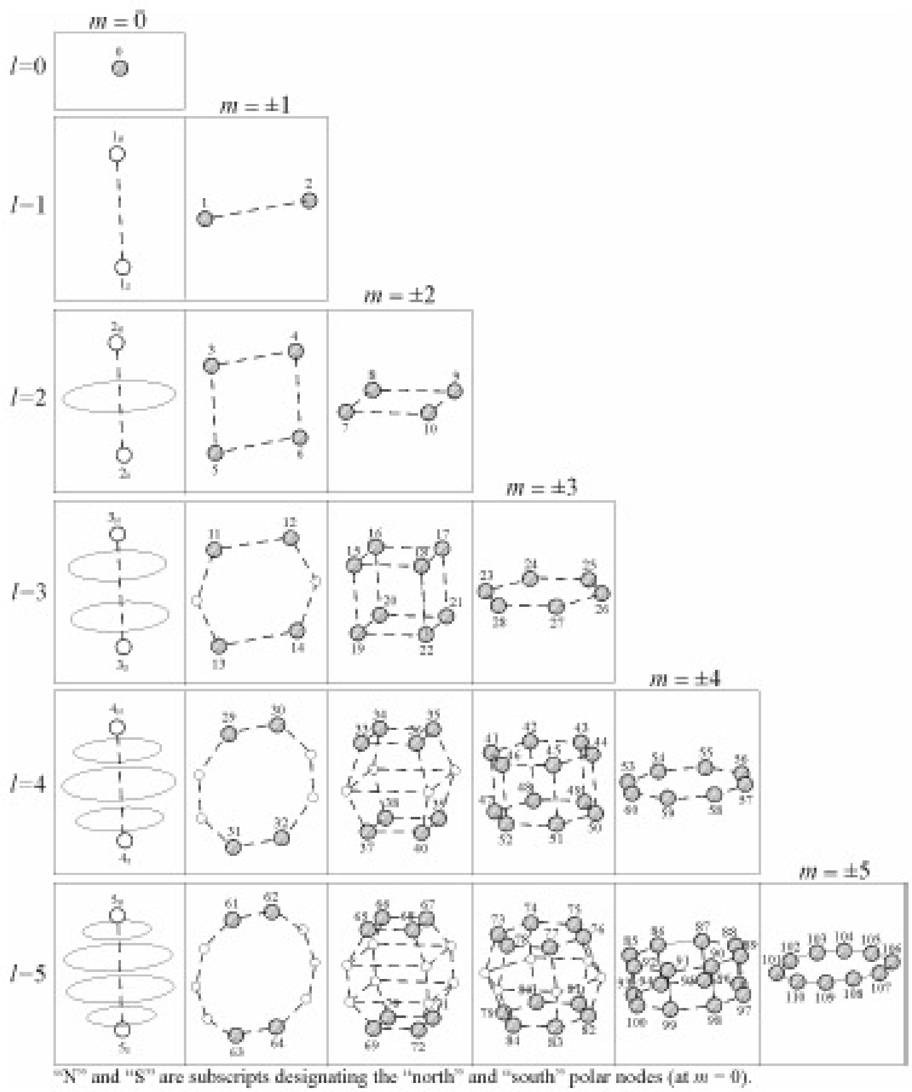

Table 1. Discrete structure of atomic spheres with potential nodes and rings. ‘N’ and ‘S’ denotes North and South polar nodes. Ref. [6, p.29]

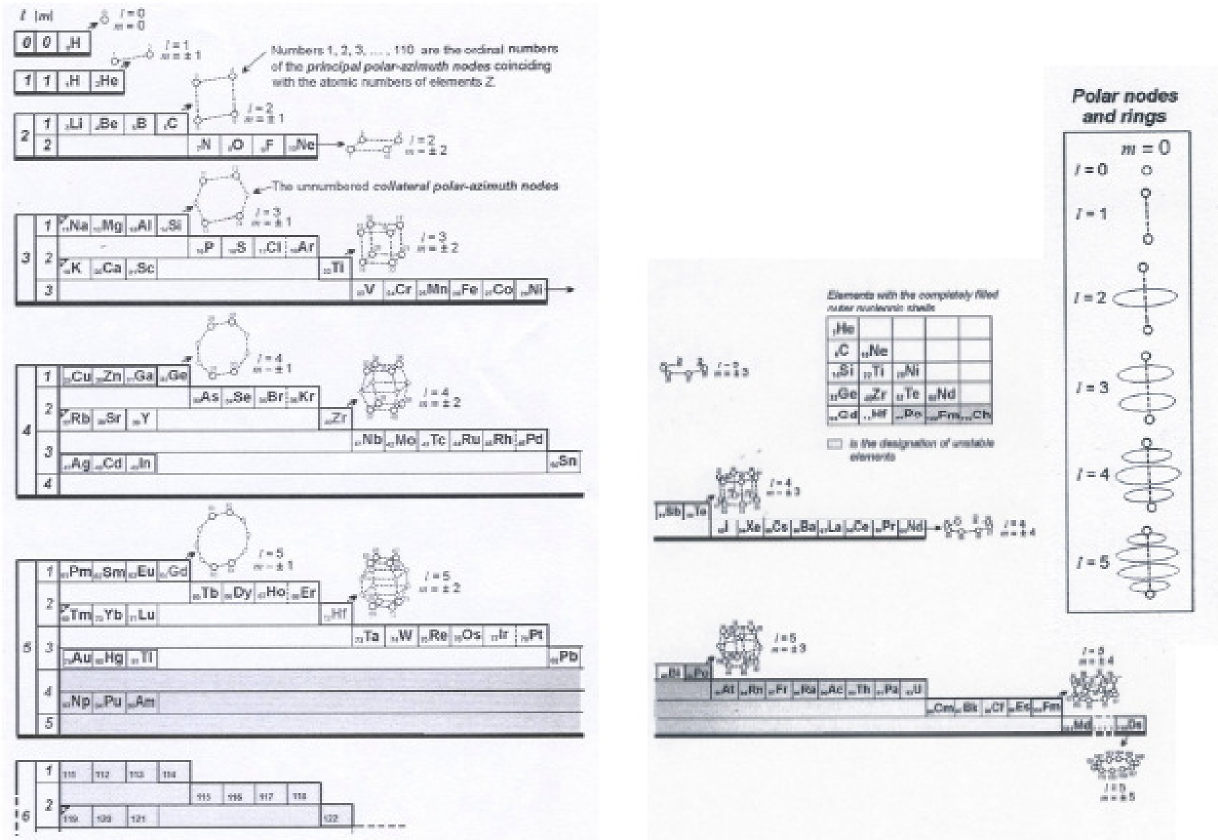

Table 2. Solutions of the wave equation (9) presented in the traditional form of the periodic law of chemical elements; or the quasiperiodicity as a result of similarity of the structure of external shells of abstract atoms drawn in Table 1. Ref. [6, p.29] [11, p. 205]

To be fair, Shpenkov may not be the first person who argues that the wave equation of sound can describe periodic table of elements. There are at least two persons that I can mention here who appear to attempt the same thing: Randell L. Mills and Robert A. Close. Randell Mills calls his theory Classical Quantum Mechanics, while Robert Close calls his theory The Classical Wave Theory of Matter.

While Randell Mills seems to argue that Maxwell's equations is capable to explain stability of hydrogen [23][24], according to Rathke [25], Mills assumes that the dynamics of the electron are described by a classical wave equation for its charge-density function, ρ(t,x),

$$\left(\nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\right)\rho(t,x) = 0 \qquad (13)$$

Which is similar to equation (1). According to Rathke [25], this equation leads to Euler differential equation which has general solution:

$$f(r) = c_1 + \frac{c_2}{r}, \tag{14}$$

Which is different from the solution given by Mills:

$$f(r) = \frac{1}{r}\delta(r - r_n). \tag{15}$$

Therefore, according to Rathke, Mills's conclusion that there are fractional energy levels of hydrogen (which he calls 'hydrino') is erroneous. [25, p.5-6]

Close takes a similar approach, based on classical wave equation. Before suggesting his wave equation, he arrives at a conclusion, that if we take the curl of the third of Maxwell equations and combine it with the time derivative of the fourth equation we obtain [26, p.36]:

$$\nabla^2 E - \frac{1}{c^2}\frac{\partial^2 E}{\partial t^2} = 0 \tag{16}$$

$$\nabla^2 B - \frac{1}{c^2}\frac{\partial^2 B}{\partial t^2} = 0 \tag{17}$$

Each of these equations is a homogeneous wave equation. In vacuum, both E and B have zero divergence, so these equations have the same form as the conventional equation for shear waves.

Therefore, we find that there exists formal connection between wave equation of sound and Maxwell's equations. Such a connection is known as electrical-mechanical-acoustical analogy.[2]

While Close does not give exact solution of his classical wave equation, he finds some interesting points. For example, he is able to find coupled wave equation from factorization of 1-dimensional scalar wave equation [26, p. 82-83]. For clarity, we give his factorization procedure for 1-dimensional case of equation (1), which can be written as follows:

$$\partial_t^2 a = c^2 \partial_z^2 a. \tag{18}$$

This equation can be factored:

$$[\partial_t - c\partial_z][\partial_t + c\partial_z]a = 0 \tag{19}$$

[2] http://www.isi.ee.ethz.ch/teaching/courses/ak2/elektro-mechanische-akustische-analogien-english.pdf (accessed at March 25th, 2014)

The general solution is a superposition of forward and backward propagating waves:

$$a(z,t) = a_F(z-ct) + a_B(z+ct) \tag{20}$$

It can be shown that we can reduce the equations for forward and backward waves into a first-order matrix equation [26, p.83]:

$$\left[\partial + \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} c\partial_z \right]\Psi = \partial_t \begin{pmatrix} \dot{a}_F(z-ct) \\ \dot{a}_B(z+ct) \end{pmatrix} - c\partial_z \begin{pmatrix} a'_F(z-ct) \\ a'_B(z+ct) \end{pmatrix} = 0 \tag{21}$$

It shall be noted that solution of wave function of Helmholtz equation has been obtained in [34]. For discussion on the theory of ordinary differential equations, see [35].

5. Some possible applications of Shpenkov's wave model

a. Application in molecular vibration

A possible test of the Shpenkov's model of atom and molecule based on classical wave equation is fundamental ground tone vibration of H_2, HD, and D_2. It may open new experiment on how the Shpenkov's wave model can be compared to QED prediction.[27] It is noted here that Shpenkov is also able to derive Lamb shift of hydrogen using his wave model. [28] There also exists plenty of information on water vibration.[3]

b. Application in cosmic microwave background radiation

Kreidik & Shpenkov [7] derive microwave background radiation of hydrogen atom based on Shpenkov's wave equation. They conclude that the microwave background radiation, observed in Cosmos, apparently is the zero-level (background) radiation of all atoms in the Universe. Following their dynamic model, the H-atom is a paired dynamic system with the central spherical microobject of a complicated structure (proton) and the orbiting electron. The electron in H-atom under the wave motion exchanges the energy with the proton constantly at the fundamental frequency ω_e. this exchange process between the electron and proton has the dynamically equilibrium character. It is represented by a system of radial standing waves, which define "zero level exchange" in a dynamically stable state of the atom. At p=0, they obtain λ=0.106267 cm, then they can find an estimate of the absolute temperature of zero level of radiation:

$$T = \frac{0.290 cm \cdot K}{\lambda} = 2.7289K \approx \Delta K \tag{22}$$

Where Δ=2π.lge=2.7288 is the measure of the fundamental period (fundamental quantum measures). The temperature obtained coincides with the temperature of

[3] URL: http://www1.lsbu.ac.uk/water/vibrat.html (accessed at March 25th, 2014)

"relict" background measured by NASA's Cosmic Microwave Background Explorer (COBE) satellite to four significant digits ($2.725 \pm 0.002K$).[7] The concept of zero level radiation of H-atoms questions quantum mechanical probabilistic model, which excludes an electron's orbital motion *along a trajectory* as matter of principle.[7]

c. Application in cosmology

Neven Bilić studied sound wave propagation in a relativistic perfect fluid with a non-homogeneous isentropic flow. [29] The sound wave equation turns out to be equivalent to the equation of motion for a massless scalar field propagating in a curved space-time geometry. Among other things, he obtained that the free classical wave equation (1) is a simplest case of the generalized wave equation [29]:

$$\partial_\mu \left\{ \frac{n}{w} \sqrt{-g} \left[g^{\mu\nu} - \left(1 - \left(\frac{n}{w}\frac{\partial w}{\partial n}\right)^{-1} \right) u^\mu u^\nu \right] \right\} \partial_\nu \varphi = 0 \qquad (23)$$

The above wave equation (23) can be rewritten as [29]:

$$\partial_\mu f^{\mu\nu} \partial_\nu \varphi = 0\,. \qquad (24)$$

And then he used this form of the acoustic wave equation to construct the acoustic metric. It is known that acoustic metric may have application in astrophysics and early cosmology.

d. Application in graphene [12]

Graphene, one-atom-thick layers of graphite, having a two dimensional hexagonal lattice, gives us a new unique possibility for the direct verification of some predictions, originated from the solutions of wave equation (9). According to modern notions, a two dimensional hexagonal lattice of graphene is regarded as having crystallographic symmetry of a six order. Hence, electrical conductivity of graphene in a hexagonal plane perpendicular to this axis must be isotropic, in full agreement with the basic symmetry theory as having more than two-fold symmetry. This is why an examination of feasible conductivity anisotropy in pristine unstrained graphene has never been undertaken till now, and a question about such studies has never been raised among researchers. For this reason, a talk about an existence of natural conductivity anisotropy in graphene seemed nonsensical. However, according to the shell-nodal structure of the carbon atom originated from said solutions, graphene has two-fold axis of symmetry. Accordingly, it makes sense to undertake efforts to verify that. The tests are not so complicated, but obtained result can change many things in physics. Graphene anisotropy explains also the fact that graphene nanotubes, rolled-up form of graphene, have either conductivity, metallic or semiconducting. The rolling-up of graphene is realized mainly along two crystallographic directions: along the major axis (we called it the Z-axis) and in perpendicular to it direction. Nanotubes obtained have the minimal energy of state in these crystallographic directions. The rolling-up of graphene sheets runs spontaneously at the high temperature conditions; it is not yet controlled process. The rolling-up in other directions is thermodynamically unfavorable unstable process and, therefore, is not going on spontaneously.

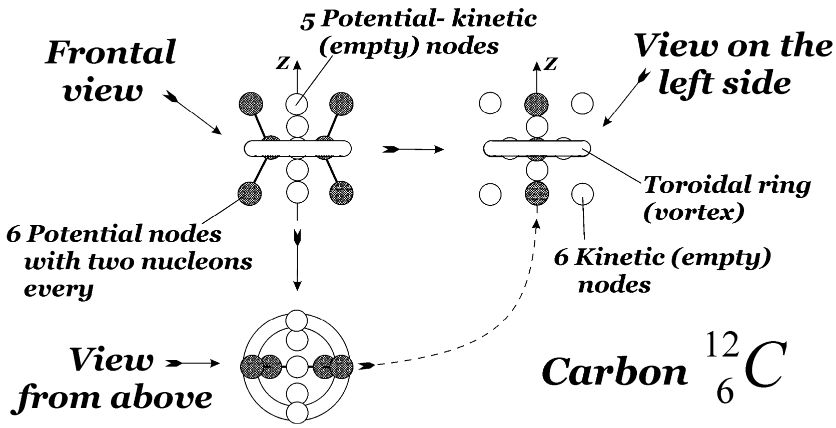

Figure 2. The structure of a nucleon molecule ("atom") of carbon-12 originated from particular solutions of the wave equation (9). [12]

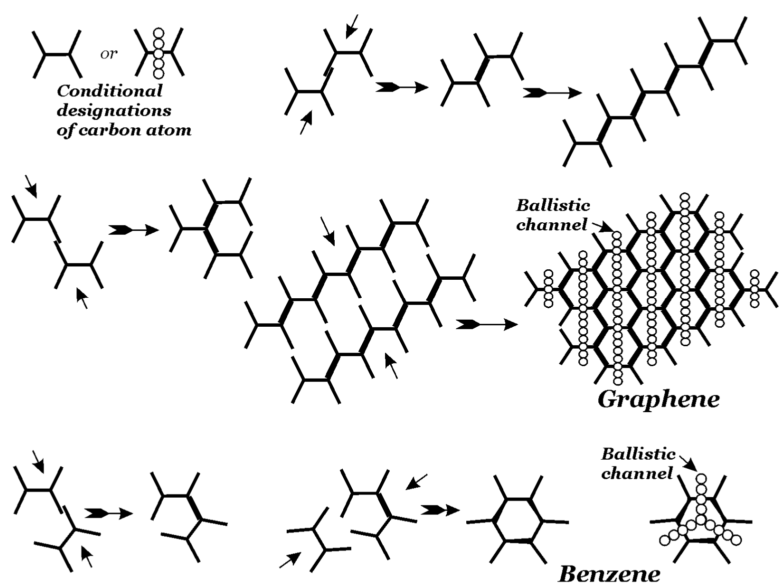

Figure 3. A conditional designation of the carbon atom, a schematic representation of self-building (assembling) of two-dimensional carbon compounds, and the shell-nodal structure of graphene and benzene. The formation of molecules is realized along strong internodal bonds of contacting atoms (nucleon molecules) by overlapping nucleon nodes with nucleons in them.[12]

e. Application in water as fuel (ultrasonic electrolysis of water) [30]
One possible application of the atomic vibration model outlined here is the ultrasonic electrolysis of water. When an electrical current passes through water, the hydrogen and oxygen become separated and escape as gasses. This process is referred to as electrolysis. You can demonstrate a simple form of electrolysis by

holding the connection end of a nine-volt battery in a glass of water. Tiny bubbles will begin to form on each electrode, oxygen on one and hydrogen on the other. Higher electrical current will cause the gas to form much more rapidly. These facts indicate that it may be possible to build a motor that runs on water. A battery would be used as a source of electrical energy which would separate the hydrogen/oxygen into gases. The gasses would then fuel an internal combustion engine, which would power a generator to continously recharge the battery as well as deliver useable mechanical energy. If this sort of motor can be made to work, the energy crisis on this planet will be over forever.

Whether or not this device would produce more energy than that required separating the gasses, and thus produce useful work, depends upon the efficiency of the gas separation process. It has been demonstrated that in addition to electrical current passing through water, ultrasonic vibrations and radio waves are also capable of breaking the molecular bonds in water to release the hydrogen and oxygen. The design below uses a combination of ultrasonic vibrations and pulsed electrical energy (which just happens to produce radio waves as well) as a means for increasing the efficiency of the gas separation process.

One possible design of such ultrasonic electrolysis device is shown here:

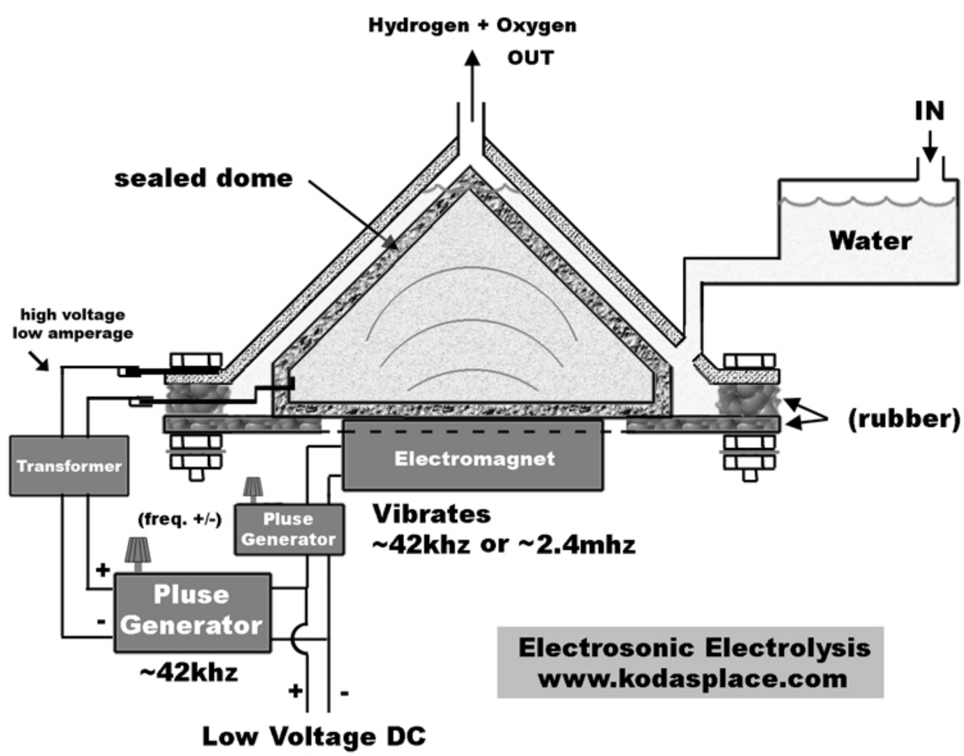

Figure 4. Koda's Ultrasonic Electrolysis device [30]

The above illustration shows the principle of how a combination of pulsed low voltage electricity and ultrasonic vibrations may result in the efficient production of hydrogen and oxygen gas from water. The device could be used as a constant source of hydrogen to fuel an internal combustion vehicle, or perhaps as a hydrogen injector at each cylinder. In other words, this device is intended to enable cars to use water as fuel, as well as power generators and provide essentially free, non-poluting energy for the entire world.

The resonant frequency of water is ~42.7kHz. When water molecules vibrate at this frequency they tend to become unstable. In the above illustration a piezoelectric crystal is glued to the base of a hollow metal dome, which is attached to a flexible material (in this case, rubber). When stimulated by electric current the crystal will vibrate, which in turn will vibrate the hollow dome. The dome is surrounded by water, which will vibrate at the same frequency. This vibration will cause the water molecules to disassociate into hydrogen and oxygen gas. (Some literature indicates that water will disassociate at frequencies near 2.4MHz so this device also assumes that possibility.)

It should be noted that there have been reports of large explosions when water is physically disassociated using ultrasonic vibrations. The explosive force reported is substantially greater than can be accounted for by the chemical burning of the hydrogen (in one case this was 29,000 pounds of pressure from 3 drops of water). Experimenters constructing this device should use appropriate caution.

f. Application in Condensed Matter Nuclear Science (CMNS)

Another possible use of resonance and vibration theory is to understand mechanism in CMNS. There are many theories which have been proposed to understand CMNS/Cold fusion, one of them is the Selective Resonant Tunneling Model proposed by Li et al. [31]. Selectivity of the resonant tunneling can be learnt from the electronic harmonic circuit. It is known that at the low energy, the Coulomb barrier is thick and high; hence, the incident deuteron wave in the nuclear well is very weak due to the Coulomb barrier. The amplitude of weak penetrating wave may be enhanced by the resonance effect when the phase of the reflected wave inside the nuclear well is same as that of the incident wave. This is the resonant tunneling. The damping in resonant tunneling of the Coulomb barrier is just the fusion reaction itself, because the deuteron wave function disappears due to fusion reaction. Thus, this fusion reaction rate cannot be very fast, otherwise the fast damping will stop the resonant effect.[31] It is worth mentioning here that this Li's model is able to provide explanation of Huizenga's three miracles of cold fusion, therefore it may be useful to look CMNS from this viewpoint.

6. **Possible correspondence between classical wave equation and quantum mechanics**

a. Ward & Volkmer's derivation of Schrödinger equation from wave equation

As mentioned above, my viewpoint is that there is connection between classical and quantum mechanics. Therefore it seems possible to find theoretical correspondence between classical electromagnetic wave equation and Schrödinger equation. Such a correspondence has been given by Ward & Volkmer [32]. They give a simple derivation of the Schrödinger equation, which requires only knowledge of the electromagnetic wave equation and the basics of Einstein's special theory of relativity.

They begin with electromagnetic wave equation (16) in one dimensional case:

$$\frac{\partial^2 E}{\partial x^2} - \frac{1}{c^2}\frac{\partial^2 E}{\partial t^2} = 0. \qquad (25)$$

This equation is satisfied by plane wave solutions:

$$E(x,t) = E_0 e^{i(kx-\omega t)}, \qquad (26)$$

Where $k = \frac{2\pi}{\lambda}$ and $\omega = 2\pi v$ are the spatial and temporal frequencies, respectively.

Substituting equation (26) into (25), then we obtain:

$$\left(\frac{\partial^2}{\partial x^2} - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\right) E_0 e^{i(kx-\omega t)} = 0 \qquad (27)$$

Or

$$\left(k^2 - \frac{\omega^2}{c^2}\right) E_0 e^{i(kx-\omega t)} = 0 \qquad (28)$$

Solving the wave vector, we arrive at dispersion relation for light in free space:

$k = \frac{\omega}{c}$. Note that this is similar to wave number in equation (9).

Then, recall from Einstein and Compton that the energy of a photon is $\varepsilon = hv = \hbar\omega$ and the momentum of a photon is $p = \frac{h}{\lambda} = \hbar k$. We can rewrite equation (26) using these relations:

$$E(x,t) = E_0 e^{\frac{i}{\hbar}(px-\varepsilon t)}, \qquad (29)$$

Substituting this equation into (25) we find:

$$-\frac{1}{\hbar^2}\left(p^2 - \frac{\varepsilon^2}{c^2}\right) E_0 e^{\frac{i}{\hbar}(px-\varepsilon t)} = 0 \qquad (30)$$

Then we get an expression of relativistic total energy for a particle with zero rest mass:

$$\varepsilon^2 = p^2 c^2. \qquad (31)$$

We now assume with de Broglie that frequency and energy, and wavelength and momentum, are related in the same way for classical particles as for photons, and consider a wave equation for non-zero rest mass particles. So we want to end up with:

$$\varepsilon^2 = p^2c^2 + m^2c^4 . \tag{32}$$

Inserting this equation (32) into equation (30), it is straightforward from (27), that we get:

$$\left(\nabla^2 - \frac{m^2c^2}{\hbar^2}\right)\Psi = \frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2} \tag{33}$$

Which is the Klein-Gordon equation for a free particle [32]. Now we want to obtain Schrödinger equation, which is non-relativistic case of (33). The first step is to approximate $\varepsilon^2 = p^2c^2 + m^2c^4$, as follows:

$$\varepsilon = mc^2\sqrt{1+\frac{p^2}{m^2c^2}} \approx mc^2 + \frac{p^2}{2m} \approx mc^2 + T . \tag{34}$$

After some approximation steps, then Ward & Volkmer obtained the Schrödinger equation starting from (34) and (33):

$$-\frac{\hbar^2}{2m}\nabla^2\phi = i\hbar\frac{\partial\phi}{\partial t}, \tag{35}$$

Where the non-relativistic wave function Φ is also constrained to the condition that it be normalizable to unit probability.
While we can conclude that there exists formal connection between classical wave equation and Schrödinger equation, but it still requires some assumptions and approximations. Therefore we can consider that Shpenkov wave equation (9) is more realistic for atomic and molecular modeling.

b. Sound wave analog to quantum mechanics

Hilbert and Batelaan [33] explores equivalence between the quantum system and the acoustic system. They find that the analytic solution to the quantum system exhibits level splitting as does the acoustic system. A simple physical system is discussed that mirrors the quantum mechanical infinite square well with a central delta well potential. They compare the acoustic resonances in a closed tube and the quantum mechanical eigenfrequencies of an infinite square well. They find that the acoustic displacement standing wave is:

$$\xi(x) = \xi_{\max}\sin\left(\frac{n\pi x}{2a}\right), \tag{36}$$

For the nth resonance. Equation (8) is the same shape as the quantum mechanical wave function. Their approach may be useful to be investigated further.

7. Concluding remarks

We have discussed some weaknesses of Schrödinger equation for description of atom and molecules. Then we discuss Shpenkov's wave model of atom and molecules based on classical wave equation. It is shown that his model is able to arrive at a periodic table of elements which is near to Mendeleyev's periodic law. Some possible applications are also discussed, and future research in energy applications may be found fruitful.

While we emphasize that a wave equation should be able to model atom and molecule in realistic way, our view is that there can be possible correspondence between classical mechanics and quantum mechanics. Further investigation in this direction is recommended, in particular using Shpenkov's wave equation.

Acknowledgment

Special thanks to Dr. George Shpenkov who has replied to some questions by this writer regarding his wave model of the periodic table of elements, along with sending some of his work. However, any mistakes or mis-interpretation of his work are mine.

Version 1.0: April 2, 2014

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Appendix: List of my books from 2006 until 2013, available at
http://vixra.org/author/Victor_Christianto

a. *MultiValued Logic, Neutrosophy, and Schrödinger Equation* (2006).
b. *Unfolding the Labyrinth: Open Problems in Physics, Mathematics, Astrophysics and other Areas of Science* (2006). A collection of scientific papers.
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