On INTERCOUPLING of SOME PHYSICAL CONSTANTS

In our previous work "Physical and mathematical research of polytronic model of hydrogen atom", were offered the fundamentals of the new theory of structure of substance, which brief sense is, that the materiality of the world, perceived by our sense organs, is actually product of interaction of different phase states of some uniform energy (we shall remind, that a name of this energy - ergoline).

Postulate of our theory sounds so:

«Atoms of matter are constructed from ring derivations of linear energy having translational parameter, equal speed of light, and making sustained oscillations on discrete frequencies appropriate to an integer of half-waves, stowed on perimeter of ring ».

As follow from the title of the mentioned work, the problem surveyed only in application to atom of hydrogen and the main attention was given to the description of the qualitative sides of problem and development of main mathematical legitimacies.
Further our task consists in the analysis of spectrums of the following behind hydrogen of elements (helium, lithium, beryllium etc.) and in development of more universal mathematics usable to all elements of The Mendeleyev's Table.
In this article there are produced new formulas for the calculation of energy levels of atoms and calculations of lengths of waves in spectrums of radiation. However main attention we have decided to give for the qualitative analysis of these formulas and for studying of intercoupling between our mathematics and mathematics of generally accepted theories.
According to our model, emitter of electromagnetic energy in atom is the vibrant energy ring – polytron, i.e. multi–frequency emitter. Energy in the ring circulates with speed of light; therefore frequency of vibration of polytron can accept only discrete values. The number (or series) of discrete frequencies of polytron is characterized by its frequency order ***m***, which represents a row of quantum numbers 2, 3, 4, etc.
Other quantum parameter of polytron is its amplitude order ***n*** (***n_r*** – for radial polytron and ***n_a*** – for axial polytron). In limits of each series the amplitude order has constant value, therefore with its help it is possible to calculate all row of transversal amplitudes of vibrant polytron.
The internal energy of polytron consists of several components, each of which fulfils the specific role at interaction with objects are in contact to polytron or in surrounding space. If the oscillations of polytron happen in radial plane, at its oscillations there is variable tangential component, which adds with constant speed of circulation of energy along the ring, i.e. with speed of light in vacuum. This process is accompanied by ejection of quantums of energy into tangential direction.

The new formula for calculation of tangential energy of polytrons in application to atom of any elements is:

$$W_t(Z,m,n_r) = 1.08612 \cdot K^4 \cdot M_e \cdot 4 \cdot \pi \cdot c^2 \cdot \left[\frac{\left(\frac{n_r}{K}\right)^4}{\left(\frac{m}{Z}\right)^2 + \left(\frac{n_r}{K}\right)^2} \right] \quad |\mathrm{J}| \qquad (1)$$

where K=3.3515 – parameter of geometrical form of emitter of electromagnetic energy in atom

M_e=9.10938188·10–31 |kg| – electron rest mass

c = 299792458 |m/s| – speed of light in vacuum

Z – serial number of element in The Mendeleyev Table

Notice that numeric factors 1,08612 and K=3.3515 were found from the condition of constancy of length of quantoide under mathematical modeling of classical mechanical objects.

The product $1.08612 \cdot K^4$=137.036, i.e. takes value of the inverse fine structure constant α.

$$1/\alpha = 1.08612 \cdot K^4$$

As the parameter K enters into the fraction together with relative amplitude of oscillations, therefore, it has influence to the space characteristics of oscillator.

Besides at the formula (1) there is the electric constant of vacuum

$$\varepsilon_o = \frac{10^7}{4 \cdot \pi \cdot c^2}$$

In view of these replacements the formula (1) becomes

$$W_t(Z, m, n_r) = \frac{M_e \cdot 10^7}{\alpha \cdot \varepsilon_o} \cdot \left[\frac{\left(\frac{n_r}{K}\right)^4}{\left(\frac{m}{Z}\right)^2 + \left(\frac{n_r}{K}\right)^2} \right] \quad |\text{J}| \qquad (2)$$

The fine structure constant in the formula (2) can be expressed through elementary charge and Planck's constant.

$$\alpha = \frac{q_e^2}{2 \cdot \varepsilon_o \cdot h \cdot c}$$

After this replacement there is third sort of the formula of tangential energy, which allows most simply to pass to radiation of atoms (***E= h·v***)

$$W_t(Z, m, n_r) = h \cdot \frac{2 \cdot c \cdot M_e \cdot 10^7}{q_e^2} \cdot \left[\frac{\left(\frac{n_r}{K}\right)^4}{\left(\frac{m}{Z}\right)^2 + \left(\frac{n_r}{K}\right)^2} \right] \quad |\text{J}| \qquad (3)$$

where q_e=1.602176462·10^{-19} |C| – elementary charge

h = 6.62606876·10^{-34} |J·s| — Planck's constant

In the formulas (1), (2), (3) dimensionality of energy define those terms, which are located before square brackets.

The matching of the formulas (1) and (3) probably will advance us in understanding of physical sense of electric charge

$$q_e = \sqrt{\frac{h \cdot 10^7}{1.08612 \cdot K^4 \cdot 2 \cdot \pi \cdot c}} = 1.6021764 \cdot 10^{-19}$$ — dimensionality of charge |N$^{1/2}$·s|

In brought formulas, energy is given in joules. For the expression of tangential energy of polytron in electron volts it is necessary value of energy in joules |J| to divide into the value of elementary charge in coulombs |C|. In this case, formula (3) takes type

$$w(Z,m,n) = h \cdot \frac{2 \cdot c \cdot M_e \cdot 10^7}{q_e^3} \cdot \left[\frac{\left(\frac{n}{K}\right)^4}{\left(\frac{m}{Z}\right)^2 + \left(\frac{n}{K}\right)^2} \right] \quad |\text{eV}| \qquad (3a)$$

At calculation of work of moving of the point elementary charge from infinity till distance x_o to ionized hydrogen atom (potential energy of electrostatic interaction)

$$A_e = \frac{q_e^2}{4 \cdot \pi \cdot \varepsilon_o} \cdot \int_{\infty}^{x_o} \frac{dx}{x^2} = \frac{q_e^2}{4 \cdot \pi \cdot \varepsilon_o \cdot x_o} \quad |\text{J}| \qquad (6)$$

we have the work of an ionizing of hydrogen atom $\boldsymbol{A_e/q_e}$ = 13.59843 |eV| corresponds to x_o=105.89196 pm.

Hydrogen polytron of radius 98.857pm, with amplitude order $\boldsymbol{n_r}$ = 0.0528466 and $\boldsymbol{m}$=2 has the same tangential energy, i.e. sizes of emitters of energy coincide sufficiently exactly.

The new formula for calculation of frequency of polytronic radiation at transition from energy level $\boldsymbol{m_o}$ to energy level $\boldsymbol{m}$:

$$\nu(Z,m_o,m,n_r) = \frac{2 \cdot c \cdot M_e \cdot 10^7}{q_e^2} \cdot \left[\frac{\left(\frac{n_r}{K}\right)^4}{\left(\frac{m_o}{Z}\right)^2 + \left(\frac{n_r}{K}\right)^2} - \frac{\left(\frac{n_r}{K}\right)^4}{\left(\frac{m}{Z}\right)^2 + \left(\frac{n_r}{K}\right)^2} \right] \qquad (4)$$

Under the formula (4) the frequencies and lengths of waves in the short-wave series of spectrums of hydrogen, helium, lithium, beryllium and boron were calculated. In the atomic spectroscopy such states of atoms are identified as high-excited or Rydberg's states.

Comparing of calculated lengths of waves λ_p and observed in the experiment λ_o there was discovered the small reduction of observed lengths of waves in contrast with calculated. This shift possible to explain that under any experiments exists background radiation. This background is present in the manner of weak electromagnetic radiating with different lengths of waves. Background radiation influences as on atoms of under investigation material, so and on atoms of instruments. For this reason, in instruments the total influence of ensemble of flows of energy is registered. Since background is also created by atoms, for its calculation the same formulas (1), (2), (3), (4) are applicable.

With provision of background radiation the formula for calculation of lengths of waves (in picometers) radiated by atoms in short-wave spectrum has the form of:

$$\lambda_p(Z,m_o,m,n_r,n_o) = \frac{h \cdot c \cdot 10^{12}}{W_t(Z,m_o,n_r) - W_t(Z,m,n_r) + W_t(Z,m,n_o)} \quad |\text{pm}| \qquad (5)$$

where $W_t(Z,m,n_o)$ – energy of background radiation.

For checking formulas (4) and (5) on accuracy were taken spectral lines from NIST Atomic Spectra Database and Kelly Atomic Line Database. In the Table 1 brought results of calculations for ionized boron B_V.

As possible to see from Table 1, difference between observed and computable lengths of waves λ_o - λ_p does not exceed several hundredth fractions of picometer. Taking into account the simplicity of shown formulas, new method allows faster and exactly to define spectral features of atoms.

Table 1

The Element (ion)	$m_o \rightarrow m$	λ_o, pm (in vacuum)	λ_p, pm	λ_o - λ_p, pm	$W_t(Z,m,n_o)$, eV
B_V	2 → 4	4858.6	4858.6	0	0.115741
First series	2 → 6	4099.6	4099.62	-0.02	0.059052
n_r=0.05287656	2 → 8	3887.1	3887.08	0.02	0.035723
	2 → 10	3796.0	3795.99	0.01	0.023914
	2 → 12	3748.3	3748.28	0.02	0.017122
	2 → 14	3720.1	3720.08	0.02	0.01286
	2 → 16	3702.0	3702.01	-0.01	0.010012
	2 → 18	3689.7	3689.72	-0.02	0.008015
	2 → 20	3681.0	3680.99	0.01	0.006561
B_V	4 → 6	26229.4	26229.38	0.02	0.019373
Second series	4 → 8	19431.7	19431.72	-0.02	0.012969
n_r=0.05286244	4 → 10	17350.4	17350.42	-0.02	0.009285
	4 → 12	16396.5	16396.45	0.05	0.006974
	4 → 14	15870.3	15870.32	-0.02	0.00543
	4 → 16	15546.6	15546.56	0.04	0.004347
	4 → 18	15332.1	15332.12	-0.02	0.003558
	4 → 20	15182.3	15182.33	-0.03	0.002966
B_V	6 → 8	74943.2	74943.19	0.01	0.00634
Third series	6 → 10	51238.4	51238.46	-0.06	0.004762
n_r=0.05285857	6 → 12	43725.6	43725.54	0.06	0.003708
	6 → 14	40173.8	40173.77	0.03	0.002968
	6 → 16	38161.9	38161.89	0.01	0.00243
	6 → 18	36895.2	36895.14	0.06	0.002026
	6 → 20	36039.4	36039.46	-0.06	0.001714
B_V	8 → 10	161920.5	161920.49	0.01	0.002902
Fourth series	8 → 12	104940.9	104940.96	-0.06	0.002398
n_r=0.05285666	8 → 14	86571.9	86571.86	0.04	0.002015
	8 → 16	77740.1	77739.99	0.11	0.001717
	8 → 18	72658.2	72658.14	0.06	0.001481
	8 → 20	69412.5	69412.56	-0.06	0.00129
B_V	10 → 12	298091.0	298090.94	0.06	0.00158
Fifth series	10 → 14	185991.1	185991.31	-0.21	0.0014
n_r=0.05285549	10 → 16	149501.6	149501.57	0.03	0.001249
	10 → 18	131776.8	131776.76	0.04	0.001121
	10 → 20	121475.2	121475.22	-0.02	0.001011