Calculation of the wavelengths of the Balmer series in the hydrogen atom based on the quantized space and time theory of elementary particles

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Abstract: In this paper, by using the quantized space and time and elementary particle theory the all wavelengths of the different spectrum of aroused hydrogen atom he's been calculated. the main reason of disability in comprehensive analysis of aroused atoms radiation is the low understanding of kinetic energy paradox. in such a way that the maximum level of the energy of charged particles by the speed of 299792407.5m/s is exist in the x and y axis, but in the z axis the energy level does not exist and only appears in the transition procedure to the other energy level by radiation of a photon.

Keywords: Hydrogen, space and time quanta, Elementary particles

1.Introduction

In the following equation the reaction of electrons to the quantized network around the nuclear of hydrogen atom is so paradoxical, in one side the kinetic energy and speed is exist but their existence cannot be proven until they are tested and that is the restriction of the cognitive principle which is made by quantum physics through its assumes. In the other hand the tester he's no independent existence of the subject of the test. This issue has been discussed in the previous study about calculating the energy of Lyman series [3]. base on the Lyman series energy some equation can be drown and by them the energy of the other spectrums of aroused hydrogen atom can be achieved.

The key equation which helps to explain the anomalous of momentum in FANL test is $p = \frac{h\times\sqrt{1-\frac{v_{max}^2}{c^2}}}{n\times l_0\times\sqrt{1-\frac{v^2}{c^2}}}$ (1)[4]

This equation was obtained in the determination of the speed limit tine speed limit cannot be achieved except by the quantization of time and space. [2]

1-2: Internal movement in elementary particles

We can find the relative velocity of a particle concerning a reference frame using Figures 1, 2, and 3: [1]

$$\vec{V}^2 = \left(\frac{\vec{l}_{1(so1)}}{\Delta\vec{T}_{1(so1)}} \times \frac{\vec{l}_{2(so1)}}{\Delta\vec{T}_{2(so1)}}\right) - \left(\frac{\vec{l}_{2(so2)}}{\Delta\vec{T}_{2(so2)}} \times \frac{\vec{l}_{3(so3)}}{\Delta\vec{T}_{3(so3)}}\right), \text{ (2)[1][3]}$$

$$\vec{V}^2 = (\vec{V}_Y \times V_X) - (\vec{V}_X \times \vec{V}_Z) \quad \text{(3)[1]}$$

$$\vec{l}_0 = \vec{l}_1 = \vec{l}_2 \ (So1) = 1.409\times 10^{-15} m, (4)[1]$$

$$\Delta\vec{T}_0 = \Delta\vec{T}_1 = \Delta T_2 \ (So1) = 0.47\times 10^{-23} s, (5)[1]$$

$$\vec{l}_{3\ (So2)} = \frac{\vec{l}_0}{\gamma}\ (6)[1]$$

$$\Delta\vec{T}_{3\ (So2)} = \Delta\vec{T}_0\gamma\ ,(7)[1]$$

$$V^2 = C^2 - \frac{C^2}{\gamma^2},(8)[1]$$

$$\gamma \equiv \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}:\ \textit{Lorentz factor}\ (9)[1]$$

$$\vec{l} = \frac{\vec{l}_0}{\gamma},\qquad \Delta T = \Delta\vec{T}_0\gamma\ \ (10)[1]$$

$$|V| = \sqrt{c^2 - \frac{c^2}{\gamma^2}}:\ \textit{Relative velocity of the particle.(11)}\ [1]$$

determination of the Lorentz factor coefficient has been explained in my other article [2]. The maximum Lorentz factor for charged particles should be 1722.9.

This is a very great achievement because the minimum wavelength for charged particles is equal to the length quanta and it is obtained by using the DE Broglie formula here it is obtained based on the assumption of Moton existence and this equivalence shows a great attainment between the Einstein's mass-energy formula and Planck's constant [2].

1-3: Lorentz factor

By using the desired number in Equation 11, the maximum speed of the sequence of space and time in the present time of a Moton is calculated.

$$|V| = \sqrt{c^2 - \frac{c^2}{\gamma^2}} = 299792407.5 m/s$$
(12)[2]

1-4: Calculation the energy of hydrogen atom Layer

The energy of the 2nd layers up to the infinite number of the excited hydrogen atom is obtained from the sum of the electric potential energy between the proton and the electron with the kinetic energy of the electron between the atom levels, and the electron kinetic energy at each level of the atom's energy level. The sign of kinetic energy is negative. the electric potential energy between the proton and the electron is the work required for the electron to fall in the proton's electric field. If we assume that the electron and proton are fixed relative to each other in the X axis and the electron moves only in the Y, and Z plane, then:

$$\vec{V}^2 = (\vec{V}^2{}_Y \times \vec{\delta}_X) - (\vec{\delta}_X \times \vec{V}_Z)$$
(13)[3]

Equation (12) causes the Lorentz factor to become one in the charging formula.[1]

$$q = \frac{\sqrt{(8\pi\varepsilon_0 m_0 c^2 l_0)}}{\sqrt[4]{(1 - \frac{v^2}{c^2}}} = \sqrt{8\pi\varepsilon_0 m c^2 l_0} = 1.602 \times 10^{-19} c$$

(14)[1]

Consequently, by assuming the Bohr radius for the distance of the electron of the first layer with the proton and the electric potential energy of the first layer of the hydrogen atom, it is obtained from equation 15 [1]

$$E_1 = \frac{8\pi\varepsilon_0 m_0 c^2 l_0}{4 * 2\pi * \varepsilon_0 * 37556 * l_0} = 13.605$$
eV (15)[1]

And if there is a movement in the X axis, the relative value of this equation for potential energy is equal to Equation 16.

$$E_1 = \frac{8\pi\varepsilon_0 m_0 c^2 l_0}{4 * 2\pi * \varepsilon_0 * 37556 * l_0 \times \sqrt{1 - \frac{v^2}{c^2}}} = \frac{13.6ev}{\sqrt{1 - \frac{v^2}{c^2}}}$$
(16)[1]

We define A_0 as a basic spherical network:

$A_0 = 4 * 2\pi * 37556 l_0$ (17)[1]

1-5: Kinetic and Potential Energy of the different layers of Hydrogen atom

By using the fact of quantized time and length, we can prove that the angular momentum of an electron is also quantized. Therefore, electrons can only be located on surfaces that are integral multiples of A_0:

$$A = nA_0 \tag{18}$$ [1]

n= (1, 2, 3, 4…)

$$E_n = \frac{E_1}{n} = \frac{13.605ev}{n \times \sqrt{1-\frac{v^2}{c^2}}} \tag{19}$$ [1]

n= layer number

The kinetic energy of the electron moving to the first layer in the excited hydrogen atom consists of two parts, one is the energy resulting from the movement along the X-axis, and the other is the energy resulting from the sum of each layer above the second layer that the electron passes through and this energy is in Y and Z graph plane. In the two states of the proton, in this calculation, these two energies are assumed to be constant.

Equation 20 is used to calculate the kinetic energy of the surface of the layers, Ka, and the energy of the path of the electron to the proton would be Kn.

$$p_{\max} = \frac{h \times \sqrt{1 - \frac{v^2{}_{\max}}{c^2}}}{n \times l_0 \times \sqrt{1 - \frac{v^2}{c^2}}}$$

$$n = 37556 \qquad (20) \quad [2]$$

$$v \approx \delta \Rightarrow \sqrt{(1 - \frac{v^2{}_{\max}}{c^2})} = 5.8 \times 10^{-5} \qquad (21)[2]$$

$$v = v_{\max} \Rightarrow \sqrt{(1 - \frac{v^2{}_{\max}}{c^2})} \approx 1 \qquad (21)[2]$$

2: Lyman Series

This relation is a basic component relation that explains the paradoxical states in the movement of elementary particles. The fraction numerator shows that there is an uncertainty in the calculation of the elementary particle energy at zero speed. A particle can take energy or emit radiation on the condition of observing, the quanta of time and space of the elementary particle and the surrounding space-time. If the velocity is zero in one of the X, Y, or Z axis, $\sqrt{(1-(\frac{v^2}{c^2})} = 1$, and if there is a significant amount of speed in all X, Y, and Z axis, $\sqrt{(1-(\frac{v_{\max}{}^2}{c^2})} = 1$.

This creates a paradox, the paradox is that there is velocity, but it is not, and this paradox is solved for the ionic particle by the radiation of a photon.

By numbering the relation for the kinetic energy caused by the movement of the electron from the S1 to S2 layer, which is equal to the path length

$$L_{S2-S1} = n \times 37556 l_0 \quad (22)[1]$$

$$K_n = \frac{h \times 299792407.5}{37556 \times 1.409 \times 10^{-15} \times 1722.9} = 13.59ev$$
(23)[3]

Incredibly, the kinetic energy of the electron in the state of transition from S2 to S1 is calculated. Formula 23 is a new equation for elementary particle mechanics.

By summing the kinetic energy and the electric potential of the electron from formulas 19 and 21, the electron transfer from a level to the S1 level is obtained.

$$E_{PHOTON} = h\nu = E1 - E2 = U_1 - K_2 - U_2 - Ka_2$$ (24)[3]

$$U_N = \frac{13.6ev}{n}$$ (25)

$$K_n = \frac{h \times 299792407.5}{(n-1) \times 37556 \times 1722.9 \times 1.409 \times 10^{-15}} \quad n \succ 1$$ (26)[3]

$$Kan = \frac{h \times 299792407.5}{N \times 37556 \times 1722.9 \times 1.409 \times 10^{-15}}$$ (27)

Kan is the kinetic energy of each electron in the squares of the quanta of the Z and Y axes.

$$N = \frac{4\pi \times (nr)^2}{4\pi \times r^2} = n^2$$ (28)[3]

Therefore, for the electron to fall from level S2 to S1, we will have

$$E_{photon} = h\nu = Es_1 - Es_2 = 13.6ev - 13.59ev - 6.8ev - 3.4ev = -10.2ev$$
$$\Rightarrow \lambda = 121.5nm$$
(29)[3]

The kinetic energy of the path of electron fall from higher to lower layers destroys the electric potential energy, so the energy of 10.2 electron volts is repeated for all layers up to the sixth layer.

$$Un = -Kn + 1$$

(30)[3]

And only the kinetic energy in the quantized squares of the Y and Z axes is added periodically.

$$E_{photon} = h\nu = Es_1 - Es_n = -10.2ev - \sum_{i=3}^{n} \frac{1}{n^2} \times \frac{h \times 299792407.5}{37556 \times 1722.9 \times 1.409 \times 10^{-15}}$$

(31)[3]

n=2

$\lambda = 121.5nm$

n=3

$\lambda = 105nm$

n=4

$\lambda = 98nm$

n=5

$\lambda = 94.6nm$

n=6

$\lambda = 92nm$

With a good approximation, the linear radiation spectrum of the Lyman series for excited hydrogen is obtained by using the theory of quantization of time and space and the internal structure of elementary particles.

3-1: Balmer Series

By numbering in the formula obtained for the Lyman series, the Balmer series can be obtained with high accuracy and shown that excitation of hydrogen atom can be analyzed both in the Lyman and Balmer series

$$E_{photon} = h\nu = Es_1 - Es_n = -10.2ev - \sum_{i=3}^{n} \frac{1}{n^2} \times \frac{h \times 299792407.5}{37556 \times 1722.9 \times 1.409 \times 10^{-15}}$$

$$ƛ = \frac{M^2 \times 2\pi}{M^2 - 2^2} \times \left(C \times \frac{1}{n^2} (\left(\left(\frac{10.2ev}{h}\right) + \left(\frac{13.54ev}{h}\right)\right)^{-1}\right) \tag{32}$$

h: plank constant

ƛ is related with the π number, because the quantized space and time are bent by the passing photon and this makes the m number "M" integer and this is blamers discovery that wavelengths should be related to numbers. The variety of colors that the hydrogen atom he's created in nature is due to the bending of time and space and the production of color and the magic of π number.

3-2: Balmer Series in case of N=1

ƛBalmer=52nm n=1

$$E_{photon} = h\nu = Es_1 - Es_n = -10.2ev - \sum_{i=3}^{n} \frac{1}{n^2} \times \frac{h \times 299792407.5}{37556 \times 1722.9 \times 1.409 \times 10^{-15}} \tag{33}$$

this means that the electron totally falls to the nuclear of hydrogen atom and we put the number in the Balmer series.

$$ƛ = \frac{M^2 \times 2\pi}{M^2 - 2^2} \times \left(C \times (\left(\left(\frac{10.2ev}{h}\right) + \left(\frac{13.54ev}{h}\right)\right)^{-1}\right)\right) \tag{34}$$

h: plank constant

M=3 so ƛ=588nm

M=4 so ƛ=435nm

M=5 so ƛ=388nm

M=6so ƛ=367nm

M=7 so ƛ=355nm

M= 10so ƛ=340nm

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M=∞ so ƛ=326nm

3-3: Balmer Series in case of n=2

ƛBalmer =91nm n=2

$$E_{photon} = h\nu = Es_1 - Es_n = -10.2ev - \sum_{i=3}^{n} \frac{1}{n^2} \times \frac{h \times 299792407.5}{37556 \times 1722.9 \times 1.409 \times 10^{-15}}$$

$$ƛ = \frac{M^2 \times 2\pi}{M^2 - 2^2} \times \left(C \times (\left(\left(\frac{10.2ev}{h}\right) + \left(\frac{3.39ev}{h}\right)\right)^{-1}\right)\right) \tag{36}$$

h: plank constant

M=3 so ƛ=1029nm

M=4 so ƛ=762nm

M=5 so ƛ=680nm

M=6 so ƛ=643nm

M=7 so ƛ=622nm

M= 10 so ƛ=595nm

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M=∞ so ƛ=571nm

4- Conclusion: Calculation of the energy of a particles and the photons radiated from it, can be done only when the potential and kinetic energy are calculatable . In this study, the potential energy is obtained from the relativistic charge formula(14) and the kinetic energy is achieved from the momentum formula(1), so the calculations leads to accurate numbers

REFERENCES

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[1]. Karimi Hamid reza, Quantized space a- Time and internal structure of elementary particles: A new model, Hadronic journal volume 33, Number3, June 2010

[2]. Karimi Hamid reza, Calculation of the exact range of the mass of higgs boson in the large Hadron collider (LHC) of the basis of the quantized space and time theory, Hadronic journal Vol.44, Number 1, 2021

[3]. Karimi Hamid reza CALCULATION OF THE WAVELENGTHS OF THE LYMAN SERIES IN THE HYDROGEN ATOM BASED ON THE QUANTIZED SPACE AND TIME THEORY OF ELEMENTARY PARTICLES**,** ,Vol.46, No.2, 2023

[4]. Karimi Hamid reza, Anomalous magnetic moment um of mouns in FNAL oon the basis of quantize space and time theory .it published in Hadronic journal vol 44 no2, 2021

[5]. Ernest M Henley, Alejandro Garcia.Subatomic Physics, Thirdedition. world

scientific publishing Co.pte.ltd**.**2007

[6]. Griffiths, David J.(davidjeffry). Introduction to elementary particle. john Wiley &sons, Inc.1987

[7]. Robert Resnick, Introduction to Special Relativity, *Wiley Fastern Private Limited*, 1972.

[8]. James William Rohlf.Modern Physics from α to z.Wiley.1994Abstract