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Determination of Rydberg's constant (R_H) to classify the structure of Hydrogen atom of Atomic Number (Z) = 1

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Abstract: *The mass of a photon [1] is most important for creation of all types of particles and thus the universe. This article totally unknown to the scientists from the view of new idea. According to present presentation of physics, the characteristics and properties of particles setups which we call traditional process. Here we can adopt new idea to classify the Rydberg's constant to classifying the structure of Hydrogen atom which is more interesting and we will entire into unknown microscopic field. This field will explain particle`s birth that in what way all these particles are interlinked beautifully. The field is very vast; here we will discuss this part only.*
Keywords: *Classification of atom, why electron and positron, gamma rays, φ and φ' photons, spectrum analysis, hydrogen structure.*

I. Introduction

Up to about 40 years ago, it was thought that protons and neutrons were 'elementary' particles. But protons collided with other protons or electrons at high speed, indicated that they were made up of smaller particles. These particles were named 'quarks' by Murray Gell –Mann. There are a number of different verities of quarks which are up, down, strange, charmed, bottom and top. Each has 3 colours—red, green and blue (this just for labels as quark has mass smaller, wavelength of visible light and do not have any colours in normal sense). Matter on the earth is made up mainly of protons and neutrons which are made up of quarks. There are no antiprotons and antineutrons, made up from antiquarks. In galaxy, there are no antiprotons and antineutrons apart from a smaller number that are produced as particles antiparticles pairs in high energy collisions, all galaxies are composed of quarks rather than antiquarks. The grand unified theory says that allows quarks to charge into antielectrons at high speed or in reversed processes, antiquarks turning into electrons and electrons and antielectrons turning into antiquarks and quarks. In general, more quarks leads than antiquarks – the laws of physics do not require that assumption [2] because; for example,

$$e^+ + e^- = 2\gamma - \text{rays}$$

That is total energy of L.H.S. = total energy of R.H.S. will always be equal.

Classification of atom from the view of photonic eyes:

We have to think over the matter from the concept of photons that how we can define atom including subatomic particles for example,

Present concept: 1) An atom consists of main three particles electron (e^-), proton (p^+) neutron (n) and other subatomic particles with its antiparticles. In atom we see that there are three types of particles. Neutral particle has no charge, 2) Particles which has positive charge, 3) Particles which has negative charge.
1

New concept: If we consider all particles in two groups as:
1) e^-, p, n and subatomic particles like μ^+, k^+, π^+, Σ^+ etc
2) e^+ and subatomic particles like μ^-, k^-, π^-, Σ^- etc in an atom and then we get the followings: Let, $\Delta_1 = \mu^+ + k^+ + \pi^+ + \Sigma^+$ etc ………… (a)

$$\Delta_2 = \mu^- + k^- + \pi^- + \Sigma^- \text{ etc. ……….. (b)}$$

Then, $\Delta_1 / \Delta_2 = \Delta'$ (some definite quantity)

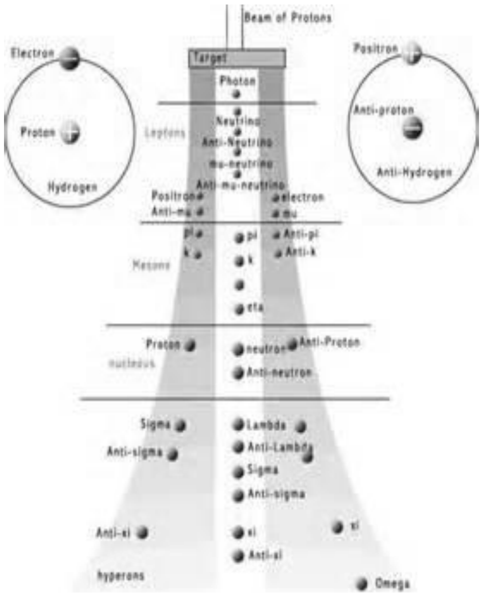
If Δ_1 is related with the particles e^- , p and n (object portion) and Δ_2 is related with a particle e^+ (image portion), then we can write,

$$\Sigma_{\text{atom}} = \frac{(e^- + p + n)\ \Delta_1}{e^+ \Delta_2} \text{ ……… .. (c)}$$

$= \Phi\Delta'(e^+)^{-1}$, where, $(e^- + p + n) = \Phi$ ……… (d)
$= \Phi\Delta'\, e^-$ where, Σ_{atom} = ratio between the object and image of atom.

How positron may convert into an electron?

Suppose, we chose a number 10 and in reverse condition, 1/10 (=0.1). If 10 occupies in object portion and 1/10 in image portion, then, 10/ 0.1 = 10 x 10 = 100. Similarly, if electron (e^-) take position in object side and positron in image side, then, $e^- / e^+ = e^- \times e^- = e^{-2}$ may write. In the equation – (d), we have taken Φ as $(e^- + p + n)$ and then $\Phi\Delta'$ is expressing the combine particles electron, proton, neutron and subatomic particles. But $\Phi\Delta'$ with e^- as $\Phi \times \Delta' \times e^-$ is giving idea that total particles of an atom symbolized by Σ_{atom}. A figure of Hydrogen atom with subatomic particles is given here for an example [3].



(Reference figure of Hydrogen with subatomic particles)

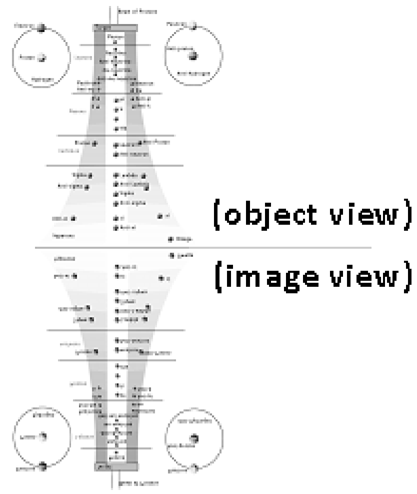


Figure – object view / image view of Hydrogen

Therefore, we can draw a diagram of atom as:

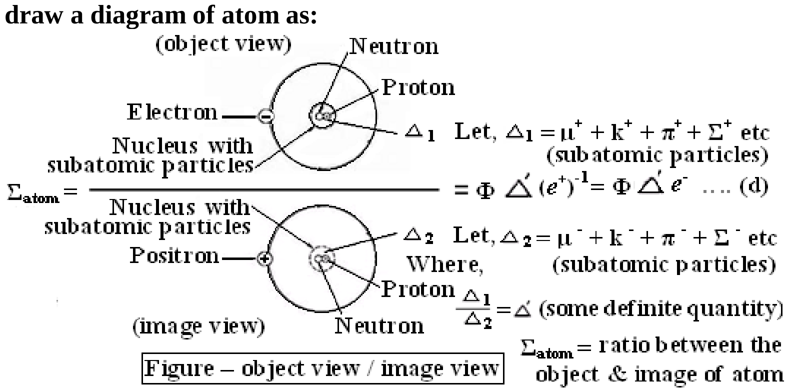


Figure – object view / image view

This figure tells us that, the reverse form of electron is positron or vice versa. That means, when electron will move in clockwise direction, it will behave as an electron and this will liberate energy. And when electron will move in anticlockwise direction, it will behave as a particle, positron. In this position, when two electrons will move both the direction simultaneously (that is one in clockwise & other in anticlockwise direction), then it will emerge gamma (γ) rays.

Thus we can draw a figure of emission of gamma rays (A New Process):

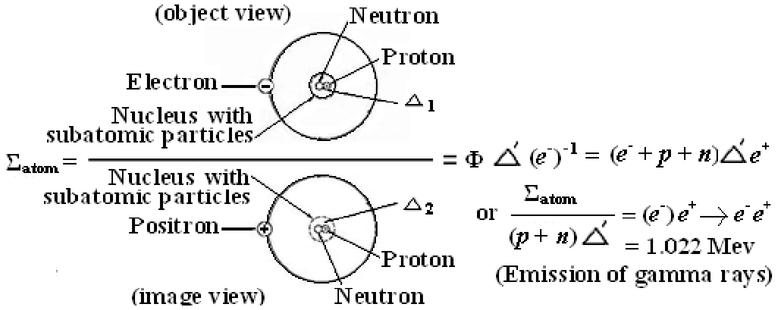


Figure - (Emission of gamma rays)

We have the equation of mass of a photon [1] is

$$\sigma = \frac{2h^2}{N_A\, m_u\, \lambda_c^{\,2}\, c^2} = 1.659619614\text{x}10^{-54}\text{ gm} \;\ldots\ldots\ldots\ldots\; (A)$$

If we replace the mass of atom (m_u) in above equation by the mass of electron (m_e) then the mass of a photon will increase, which means we will get the mass of some bunch of photons. So, the mass of this populated photons maybe devoted by σ_1, then,

$$\sigma_1 = \frac{2h^2}{N_A\, m_e\, \lambda_c^{\,2}\, c^2} = 3.025301565\text{x}10^{-51}\text{ gm} \;\ldots\ldots\; (B)$$

Or $N_A\sigma_1c^2$/ [e] = 1.021998139 Mev (in terms of energy, γ) ……… (C)

This is the energy of pair production of electron and positron ($e^- + e^+$ = 1.022 Mev). The ½ of the energy of the equation (C) is 0.510999 Mev or 0.511 Mev and this is the energy of electron. From the figure – gamma rays emission, we get, e^- x e^+ = 0.511 Mev x 0.511 Mev = 0.26112 Mev^2, then, √0.26112 Mev^2 = 0.511 Mev which is the energy of an electron. So, energy of two particles in combine is $e^- + e^+$ = 1.022 Mev. Again, from the view of the equation – C, the equation $N_A\sigma_1c^2$/ [e] is explaining that Avogadro's number (N_A) of populated photons (σ_1) in terms of energy (c^2/ [e]) is showing the energy of two electrons. Therefore, an electron is composed of ½ of $N_A\sigma_1$ number of photons whatever the particle is electron or positron. In this formation of particles, we can tell that an atom is composed of electron, proton, neutron, subatomic particles with Avogadro number of photons which takes place in the atom in the form of energy.

Therefore, we can calculate the energy of particles and atomic weight of elements (known & unknown) by using the equation (d) in the following way:

If every particle within the atom is able to produce particular number of photons in excited state, then we will get some number of photons from that atom. If an electron, a proton, neutron is able to produce 1000, 10, 10 photons respectively, the we can write,

$\Sigma_{atom} = (e^- + p + n)\, \Delta' e^-$,

$= (1000 + 10 + 10)\, \Delta'$ x 1000

$= (0.102\text{x}10^4)$ x $10^3\, \Delta' = (\Phi')$ x Δ' x 10^3 photons ……… (e)

Here, $\Phi' = (0.102\text{x}10^4)$ photons for an element Deuterium atom as it has one electron, one proton and one neutron.

If some amount of photons comes out from an element of atomic number Z and atomic weight m_0, then we will get,

$\Sigma_{m_o} = N_A\, m_0\, \Phi'\Delta'\, 10^3 / Z$ photons. …….. (f)

For any element, $\Phi' = Ze + Zp + (A - Z)n = Z10^3 + Z10 + (A - Z)10$ photons... (g)

Where, $Z = e = p$ and $n = A - Z$

Again, we see that, $\Sigma_{m0} = m_0$ x $m_u / \sigma = m_o / N_A\, \sigma$ photons …….. (h)

From the equation (f) and (h) we get,

$\Phi'\Delta' = 1 / N_A^{\,2}\, \sigma 10^3 = 1.66146127$ x 10^3 photons. $= 1.54678376\text{x}10^{-18}$ eV……. (i)

Knowing the value of $\Phi'\Delta' / Z$, we can determine the total number of photons of any element.

1. For an example,
Atomic weight of Hydrogen = m_o = 1.0079 atomic mass unit (amu) and then,
Σ_H = N_A x 1.0079 x 1.66146127 x 10^3 x10^3 photons = 1.008459071x10^{30} photons. (Where, N_A = 6.0221367x10^{23} photons). Again, Σ_H = mass of Hydrogen / mass of a photon = 1.0079 amu / 1.659619614x10^{-54} gm = 1.008459071x10^{30} photons. But, 1.66146127x 0^3x10^3 photons / 2(3/2) = x $\bar{\varepsilon}$ = 6.31471826x10^{-16} ev which is almost equal to Planck constant as ħ/[e] = 6.582122x10^{-16} ev-s, where, j = l + 1/2, l = 1, then, j = 3/2 = angular quantum number and $\bar{\varepsilon}$ = energy of a photon = 9.309779229x10^{-22} ev. So, Φ′Δ′ / Z is important for microscopic field of particles.

2. We know that, Φ = 3.7 x 10^{10} / 4π x 10^4 = 2.944366447x10^5 photons [4]. (π = 3.141592854), We can get these photons from the following way:
100 x √π x Φ′Δ′ / Z = 2.944863426x10^5 photons. …… (j). Here the value of Φ′ ≈ Φ, varied after 1/1000th decimal numbers. Therefore, the idea of Φ′ for emission of photon from atom is justified. Knowing the value of Φ′ from Φ′ = Ze + Zp + (A – Z)n = Z10^3 +Z10 + (A – Z) 10 photons, we can calculate the value of Δ′ as,
Δ′ = Z / Φ′σN_A^2 x 10^3 = 1.62 …. Nearly constant for elements.
So, Δ′ = Δ_1 / Δ_2 = 1.62 …. Nearly constant, the ratio of subatomic particles as positive group / negative group. For higher atomic weight, Δ′ = 1.6204… the value of Δ′ is different for each element, it differs only in decimal value (0.62) after 1.62 etc. But for lower atomic numbers for,
1) Hydrogen (mass = 1.0079 amu), Δ′ = 1.645011158
2) Helium (isotopic mass = 3.01605 amu), Δ′ = 1.636907655
3) Deuterium (mass = 2.0141 amu), Δ′ = 1.628883598.
Gradually this value of Δ′ will decrease in decimal value when mass of element will increase. For example, mass of Radium = 226 amu, then, Δ′ = 1.620039798, from this verification, we may come to conclusion that Δ′ = 1.6 is constant for all elements. The values of Φ′ photons are given in table photons for all known and unknown elements.

Determination of Rydberg's Constant (R_H = 3.289841949x10^{15} Hz).
Bohr's theory of hydrogen spectrum gives the frequency of a special line as [5]:

$$\nu = \frac{2\pi^2 Z^2 m_e^{\,4}}{h^3} \text{ x } \left(\frac{1}{n_1^{\,2}} - \frac{1}{n_2^{\,2}}\right) = RZ^2\left(\frac{1}{n_1^{\,2}} - \frac{1}{n_2^{\,2}}\right) \quad \text{……. (1)}$$

(R = Rydberg's Constant, Z = Atomic Number, for Hydrogen = 1)

i) Lyman series of special lines lying in the ultraviolet region, when, n_1 = 1 and n_2 = 2, 3, 4, etc.
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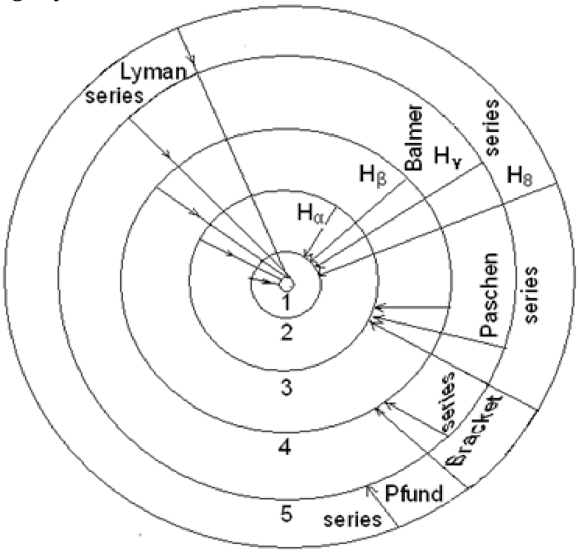
ii) Balmer series of visible region, when, n_1 = 2, n_2 = 3, 4, 5, etc.
iii) Paschen series of infrared region, when, n_1 = 3, n_2 = 4, 5, 6, etc.

The relations between Rydberg, Lyman, Balmer, Paschen, Pfund, Bracket series for Hydrogen atom.



Transition of an electron in Bohr Model of Hydrogen atom.

So, Rydberg's constant (R_H) is most important that is interlinked to all series discovered by the scientists. Therefore, we need to find the value of $R_H = 3.289841949 x10^{15}$ Hz using Φ photons.

We already discussed about the Φ - photons and Φ′- photons. The three most stable isotopes of hydrogen: protium (A =1), deuterium (A = 2), and tritium (A = 3). The Φ′ values of these isotopes are:
Φ'_P for Hydrogen or Protium = $0.101x10^4$ photons, Φ'_D for Deuterium = $0.102x10^4$ photons Φ'_T for Tritium = $0.103x10^4$ photons.
The value of $\Phi = 2.944366447x10^5$ photons, frequency of a photon $\bar{v} = 2.251093763x10^{-7}$ Hz. And $N_A = 6.0221367x10^{23}$. Then the following arrangement gives the results as:
i) 10 x {[(N_A Φ'_P / Z Φ)] / √2} x $\bar{v}$ = $3.288203674x10^{15}$Hz, (Stable element)
ii) 10 x {[(N_A Φ'_D / Z Φ)] / √2} x $\bar{v}$ = $3.320760146x10^{15}$Hz, (Less stable element)
iii) 10 x {[(N_A Φ'_P / Z Φ)] / √2} x $\bar{v}$ = $3.353316618x10^{15}$Hz, (Least stable element)
Where, j = l + ½, l = 0 = quantum number.

The average value of Protium, Deuterium & Tritium is $3.320760146x10^{15}$Hz. From these 3 results, we see that the frequency of Hydrogen **$3.288203674x10^{15}$Hz** ≈ **$3.289841949x10^{15}$ Hz,** the frequency of Rydberg's constant (R_H). Therefore, we can write the equation – 1 as,

$$v = \frac{10 \text{ x } N_A \Phi'}{\surd 2 \;\; Z \Phi}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) \text{ x } \overline{v} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

The value 10/√2 = 7.0710678 is almost to number 7, so the equation may write as,

$$\text{Or, } v = 7 \text{ x } \frac{N_A \Phi'}{Z \Phi}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) \text{ x } \overline{v}$$

$$\text{Or, } v = ń \text{ x } \frac{N_A \Phi'}{Z \Phi}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) \text{ x } \overline{v} \quad \ldots\ldots\ldots (3)$$

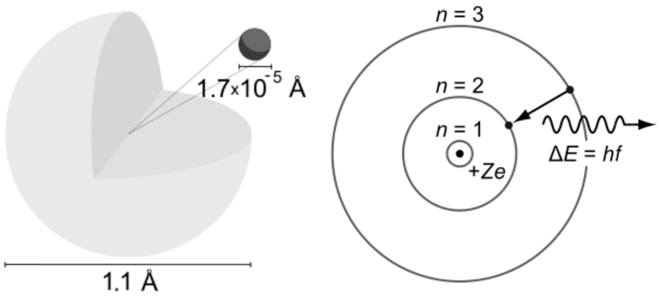
5 When, ń = 1, 2, 3, 4, 5, 6, 7 for lower frequency of Rydberg`s frequency

When, ń = 7, then, ν = $3.2873848x10^{15}$ Hz (13.59553 eV) ≈ $3.289841949x10^{15}$ Hz (13.60569 ev).
When, ń = 6, then, ν = $2.817758x10^{15}$ Hz (11.6533 eV)
When, ń = 5, then, ν = $2.348132x10^{15}$ Hz (9.71109 eV)
When, ń = 4, then, ν = $1.8785056x10^{15}$ Hz (7.7688 eV)
When, ń = 3, then, ν = $1.4088792x10^{15}$ Hz (5.8266 eV)
When, ń = 2, then, ν = $9.392528x10^{14}$ Hz (3.88443 eV)
(upper range of visible spectrum, 7.69 – 6.59 $x10^{14}$ Hz)
When, ń = 1, then, ν = $4.696264x10^{14}$ Hz (1.94221 eV)
(Frequency of range of Red, 4.82 – 3.87 $x10^{14}$ Hz).
The frequency ranges of visible spectrum & energy range given here to compare the results.

Spectrum of visible range		**Name of the Radiation**	**energy range (ń within the range)**
7.69 – 6.59 $x10^{14}$ Hz	= Violet	Radio frequency	0 – 10^{-5} eV
6.59 – 6.10 $x10^{14}$ Hz	= Blue	Microwave	10^{-5} – 10^{-3} eV
6.10 – 5.20 $x10^{14}$ Hz	= Green	Infrared	10^{-3} – 1.6 eV
5.20 – 5.03 $x10^{14}$ Hz	= Yellow	Visible	1.6 – 3.2 eV (1.94221 eV, ń = 1)
5.03 – 4.82 $x10^{14}$ Hz	= Orange	Ultraviolet rays	3 – $2x10^3$ eV (ń = 2, 3, 4..)
4.82 – 3.87 $x10^{14}$ Hz	= Red	X-ray	$1.2x10^3$ – $2.4x10^5$ eV
		Gamma rays	10^4 – 10^7 eV

This is the advantage of the equation – 3 that we are not getting from the equation – 1. The number ń may used to long numbers. When number will increase, we get different frequencies of the spectrum.
The perfect structure of Hydrogen has been drawn to use the equation – 3 and given here. By increasing number of ń, we can get different types of energies of different particles. Traditionally the structure of hydrogen stated here in short:

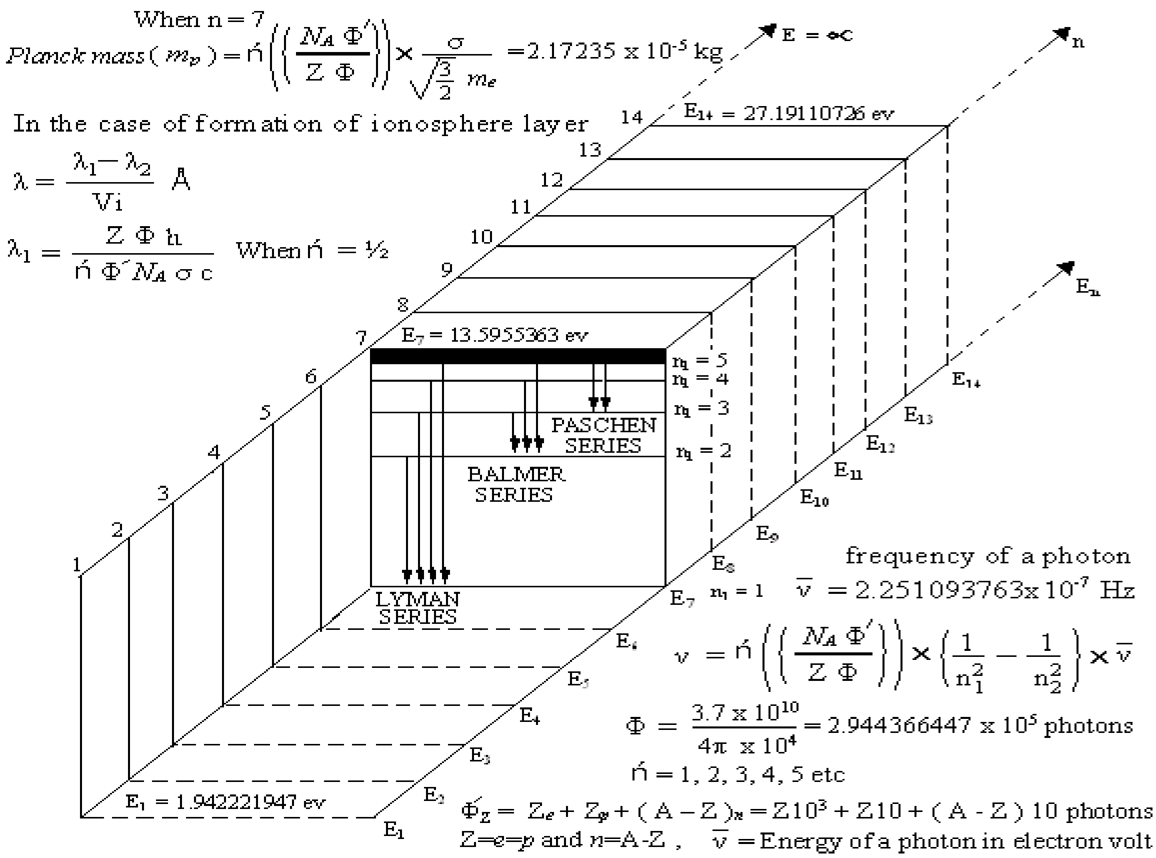
In atomic physics, the Rutherford–Bohr model or **Bohr model**, introduced by Niels Bohr in 1913, depicts the atom as a small, positively charged nucleus surrounded by electrons that travel in circular orbits around the nucleus—similar in structure to the solar system.



Depiction of a hydrogen atom showing the diameter as about twice the Bohr model radius. (Image not to scale, Fig - L. H. S.), **Rutherford–Bohr model** (Fig – R. H. S.).
6
The **Rutherford–Bohr model** of the hydrogen atom (Z = 1) or a hydrogen-like ion (Z > 1), where the negatively charged electron confined to an atomic shell encircles a small, positively charged atomic nucleus and where an electron jump between orbits is accompanied by an emitted or absorbed amount of electromagnetic energy (hν). The orbits in which the electron may travel are shown as grey circles; their radius increases as n^2, where n is the principal quantum number. The 3 → 2 transition depicted here produces the first line of the Balmer Series and for hydrogen (Z = 1) it results in a photon of wavelength 656 nm (red light).

From the photonic idea, structure of the hydrogen gives more information on energy that how it interlinked to other states with quantum numbers. The descriptions are stated here through this diagram. The spectrum is not only a plane surface with length & height, when surface as like as very very thin paper, it must have breath also whatever the breath be negligible. We cannot ignore basically and omit the law of physics.

The information of various series in the HYDROGEN SPECTRUM



ENVERONMENT OF LYMAN, BALMAR, PASCHEN

When, ń = 7, then we get 13.5955 eV for hydrogen, when, ń = 14, then, 27.19 eV to use the
7 equation, ń x {[(N_A Φ'_H / Z Φ)] / √2} x ν̄ for hydrogen. On addition of Lyman series (n_1 = 1 and n_2 = 2, 3, 4, etc.), Balmer series (n_1 = 2, n_2 = 3, 4, 5, etc.), Paschen series (n_1 = 3, n_2 = 4, 5, 6, etc.) we reach to present results.

Determination of energy of Balmer series using equation - 156 for example:
For Balmer series, $n_1 = 2$ & $n_2 = 3$ to find the spectrum energy.
When, $(1/n_1^2 – 1/n_2^2) = (1/2^2 – 1/3^2) = 5/36 = 0.1388888$, then,
ν = 3.2873848x10^{15} Hz x 0.1388888= 4.56581219x10^{14} Hz =1.888 eV. When, ń =7.
ν = 2.8177584x10^{15} Hz x 0.1388888= 3.913553308x10^{14} Hz =1.6185 eV. When, ń =6.
ν = 2.348132x10^{15} Hz x 0.1388888 = 3.261294124 x10^{14} Hz = 1.3487 eV. When, ń =5.
ν = 1.8785056x10^{15} Hz x 0.1388888= 2.609035389x10^{14} Hz = 1.0790 eV. When, ń =4.
ν = 1.4088792x10^{15} Hz x 0.1388888= 1.956766541x10^{14} Hz = 0.8092 eV. When, ń =3.
ν = 9.392528x10^{15} Hz x 0.1388888 = 1.304517694x10^{14} Hz = 0.5395 eV. When, ń =2.
ν = 4.696264x10^{15} Hz x 0.1388888 = 6.522588847x10^{14} Hz = 0.2697 eV. When, ń =1.
For, Rybderg frequency, 3.289841949x10^{15} Hz x 0.1388888 = 4.569224637 x10^{14} Hz (1.889 ev).

The 1.889 eV almost equal to 1.888 ev obtained from the equation – 3, when, ń =7 and the **equation – 3 is producing more 6 result which we can't get from the equation – 1.**
Similarly, we can get other results when $[1/n_1]^2 – [1/n_2]^2) = [1/2]^2 – [1/4]^2 = 12/64 = 0.1875$ to follow the Balmer's series. Accordingly, we get,
(i) 2.5491 ev, when, ń = 7, (ii) 2.1849 ev, when, ń = 6, (iii) 1.8208 ev, when, ń = 5, (iv) 1.4566 ev, when, ń = 4, (v) 1.0924 ev, when, ń = 3, (vi) 0.7283 ev, when, ń = 2, (vii) 0.3641 ev, when, ń = 1. It is observed that when n increases in Balmer series, then energy increases with respect to ń. The equation - 3 is applicable to Lyman, Paschen, Pfund, Bracket series also.
This advantage certainly be developed the spectrum analysis in the microscopic fields. Therefore, Φ - photons and Φ′ - photons is very useful to find many unknown phenomena in particle physics.

II. Conclusion

This is very simple classification to get answer of many particles that how actually particles created? The structure of Hydrogen atom through photonic mechanism is proving that all matter is composed of photons. We know lot of things on particles though needs to enter into it for searching other microscopic mechanisms which we are in dark. Also it is possible to find the atomic mass of all elements from 1 to 118 and unknown element after this number 118 by using Φ′- photons to follow the equation (g) as $Φ′ = Ze + Zp + (A – Z)n = Z10^3 +Z10 + (A – Z)10$ photons. All these are listed in my book "Endless Theory of the Universe (Complete Unified Theory)", Published by Lap Lambert, Germany, August, 2014.

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