New Quantum Relations

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Abstract

It is possible to deduce new quantum relations without putting in discussion the famous postulate of Planck

$$E = h\nu n. \qquad (1)$$

The said relations are not in conflict with Quantum Mechanics. They are consecutively found again in the work [1].In this work the formula (1) is interpreted as a more ample resonance condition, comparable in the daily and macroscopic experimentel reality. The first immediate relation alloys vibration amplitude Ψ of charge with the electromagnetic wave length λ to is associated

$$\lambda = 2\pi 137\Psi n.$$

The second one permits to establish a bond between de Broglie's wave length and the electromagnetic wave length

$$\lambda = 137\lambda_{dB} n.$$

That's in the case of non ionized dipoles.

1 The Formula

It's known that to individuate energy distribution law of the Black Body (B.B.) in function to the temperature and wave length, Planck had to formulate the hypothesis that during the interaction between the electromagnetic wave and the wall of the body, energy would be absorbed or emitted in accord to the known relation

$$E = h\nu n. \qquad (1)$$

Later, by the hypothesis of the quantum way, he admitted that

$$E = \frac{1}{2} h\nu n. \qquad (2)$$

If we desire to study what happens when energy package given by (2) is entirely absorbed from the material that constitutes the Black Body wall, we can make the following reasoning. We can imagine that an electromagnetic dipole would capture the said energy. If we indicate by e electron charge that constitutes the dipole (or the atom) and by Ψ the medium amplitude of this oscillating charge, we can write, in accord the Energy Conservation Principia that

$$Z\frac{e^2}{\Psi} = h\frac{C}{\lambda}n \qquad (3)$$

where Z is the proton charge that, from now on, for writing simplicity, will be temporary posed equal to 1 (we observe that, by simple steps, from (3), we directly obtain Bohr's relations).

Now if we know that electric charge, Planck's constant, light's velocity C and the fine structure constant 1/137 are alloyed by the known relation

$$2\pi 137 e^2 = hC \qquad (4)$$

by substituting the (4) in the (3) we obtain that electromagnetic length of the wave associated to the said dipole is given by the relation

$$\lambda = 2\pi 137 \Psi n, \qquad (5)$$

That is the wanted formula.

So it alloys charge medium vibration amplitude to the electromagnetic wave length associated to the same charge.

Later we'll verify the correctness of the (5) at least from a theoretical point of view. In some specified cases (when there's complete ionization or it refers of medium values) we'll write (5) in the following way

$$\lambda = 2\pi 137 \Psi n = 2\pi 137 \bar{\Psi}. \qquad (5')$$

2 1^{st} Verification – Bohr's hydrogen atom results

By multiplying both the members of (5) to the frequency we have

$$\lambda\nu = 2\pi 137\Psi\nu n = C \qquad (6)$$

that, by indicating with Ω the pulsation, it becomes

$$137\Psi\Omega n = C \qquad (7)$$

so the medium velocity of the oscillating charge is given from

$$v = \frac{C}{137n}. \qquad (8)$$

From this we deduce that medium energy of the oscillating dipole is

$$E = \frac{1}{2}mv^2 = \frac{1}{2}\frac{mC^2}{137^2}\frac{1}{n^2} \qquad (9)$$

that coincides with Bohr's stationary energy states. In fact by the insertion of the fine structure constant value of the (4) in this ultimate relation, we obtain the analogue but in addiction known Bohr's relation about hydrogen atom energetic levels

$$E = \frac{2\pi^2 me^4}{h^2}\frac{1}{n^2}. \qquad (10)$$

In addiction, if we consider that dipole energy is

$$E = \frac{1}{2}\frac{e^2}{\Psi}, \qquad (11)$$

by equalizing (11) and (9) we also have

$$\Psi = \frac{e^2}{mC^2}137^2 n^2 \qquad (12)$$

that says the dipole medium amplitude oscillation coincides with Bohr's atom rays. In fact, by substituting in (12) fine structure constant we obtain the analogue but in addiction known Bohr's rays relation

$$\Psi = R_B = \frac{h^2}{4\pi^2 me^2}n^2. \qquad (13)$$

Because we can write dipole movement equation that has captured the energy quantum this way

$$x = \Psi \cos(\Omega t) \qquad (15)$$

we can specialize this formula in basis to what said so it can also be written

$$x = \frac{\lambda}{2\pi 137 n} \cos(2\pi\nu t). \qquad (16)$$

It's known that if m is the mass of the oscillating charge, dipole energy is given by

$$\begin{aligned} E &= \frac{1}{2} m \Psi^2 \Omega^2 = \frac{1}{2} m \left(\frac{\lambda}{2\pi 137 n} \right)^2 (2\pi\nu)^2 = \frac{1}{2} m \left(\frac{\lambda\nu}{137 n} \right)^2 = \frac{1}{2} \frac{mC^2}{137^2} \frac{1}{n^2} = \\ &= \frac{2\pi^2 m e^4}{h^2} \frac{1}{n^2}. \end{aligned}$$

3 2^{nd} verification – Duane and Hunte's Results – spectral bottom limit

A more simple way to obtain (5) could be this. Let's consider dipole total energy we talked above (composed by a couple proton-electron)
it is given from

$$E = \frac{1}{2} \frac{e^2}{\Psi}. \qquad (17)$$

If we multiply numerator and denominator for the quantity $2\pi 137 n$ we have

$$E = \frac{1}{2} \frac{2\pi 137 e^2}{2\pi 137 \Psi n} n. \qquad (18)$$

For (4) we have

$$E = \frac{1}{2} \frac{hC}{2\pi 137 \Psi n} n. \qquad (19)$$

The last one coincides with Planck's experimental relation only and if only

$$2\pi 137 \Psi n = \lambda$$

so we find again (5).

In refrain radiations (bremsstrahlug) we verify that there is spectrum only when energy reaches some sills given by the known relation

$$Ve = \frac{hC}{\lambda} \qquad (20).$$

If in these cases we admit that dipole ionization only happens when the identity is true (by treating ionized energy)

$$Ve = \frac{e^2}{\Psi},$$

it is evident that, on the basis of what we first said, we can write

$$Ve = \frac{e^2}{\Psi} = \frac{2\pi 137 e^2}{2\pi 137 \Psi} = \frac{hC}{\lambda} \qquad (20')$$

so (20) is totally justified. In other terms we can think that only if the energy of a bullet that bangs the target has energy equal or superior to the one of the dipole bond (e^2/Ψ) we have electromagnetic emission. This phenomenon is notoriously specular with that one of the electronic emission caused by the absorbing of electromagnetic radiation from material (photoelectric effect).

But if, as we seen, Ψ is nothing else that Bohr's ray and if it's true that de Broglie pilot waves are alloyed to Bohr's orbits, it evident that must subsist an easy bond between de Broglie's waves and the electromagnetic wave length associated to the charge that generates. We'll see this bond now.

4 3^{rd} verification – Stefan's Law W=σT^4

It's well-known in the case of the black body, that thermodynamics succeeds to find the known formula $W = \sigma T^4$ but it's not determinable Stefan-Boltzman's constant value σ.

We also consider dipole energy and given it from

$$E = \frac{1}{2}\frac{e^2}{\Psi}.$$

If λ is the associated wave length we can say that the power is given by

$$P = \frac{1}{2}\frac{e^2}{\Psi}\frac{C}{\lambda}.$$

As seen and considered that dipole frequency coincides with that one of the radiation emitted from itself.

So radiation pressure will be given by

$$P_s = \frac{1}{2}\frac{e^2}{\Psi}\frac{C}{\lambda}\frac{1}{\lambda^2} = \frac{1}{2}\frac{e^2}{\Psi}\frac{C}{\lambda^3} = \frac{1}{2}\frac{hC}{\lambda}\frac{C}{\lambda^3} = \frac{1}{2}\frac{hC^2}{\lambda^4}. \qquad (21)$$

In accord to a thermodynamic regime we also have

$$\frac{1}{2}\frac{e^2}{\Psi} = \frac{1}{2}\frac{hC}{\lambda} = \frac{3}{2}kT$$

from that we obtain

$$\frac{1}{\lambda} = 3\frac{kT}{hC} \qquad (22)$$

that substituted in (19) gives

$$P_s = W = \frac{3^4}{2}\frac{k^4}{h^3C^2}T^4 \qquad (23)$$

so, in *c.g.s.* system, we have

$$\sigma = \frac{3^4}{2}\frac{k^4}{h^3C^2} = 5.63 \times 10^{-5} \quad \left[erg/(cm^2 sK^4)\right]$$

against the experimental value

$$\sigma = 5.66 \times 10^{-5} \quad \left[erg/s/cm^2 sK^4\right].$$

5 4th verification – Wien's Law $P_{V_{\max}} = BT^5$

Even in that case, again with the problem of B.B., through thermodynamics we obtain the expression of the said Wien's law but is not obtainable the value of the constant B.

We can write that volumic power is given, in accord to what said in the previous step, from the relation

$$P_V = \frac{1}{2}\frac{e^2}{\Psi}\frac{C}{\lambda}\frac{1}{\lambda^3} = \frac{1}{2}\frac{hC^2}{\lambda^5} \qquad (24)$$

that, considering (22), becomes

$$P_V = \frac{1}{2}\frac{hC^2}{\lambda^5} = \frac{1}{2}hC^2\left(\frac{3kT}{hC}\right)^5 = \frac{3^5}{2}\frac{k^5}{h^4C^3}T^5 \qquad (25)$$

from which we have

$$B = \frac{3^5}{2}\frac{k^5}{h^4C^3} = \frac{3^5}{2}\frac{\left(1.38 \times 10^{-16}\right)^5}{\left(6.62 \times 10^{-27}\right)^4\left(2.998 \times 10^{10}\right)^3} = 1.2 \times 10^{-4} \qquad (26)$$

against the experimental value of

$$1.28 \times 10^{-4} \quad \left[erg/(cm^3 s K^5)\right]$$

6 5th Verification

It's known that an electromagnetic radiation succeeds to extort electrons by a surface on which affects only when arrives at certain values. Infact if the electron is part of an atom it's clear that it is ionized, if energy is not polarized, only if we effectuate work equal to

$$E = \frac{e^2}{\Psi}$$

but that last relation, for what we said, can be written

$$E = \frac{e^2}{\Psi} = \frac{hC}{\lambda} = h\nu$$

7 Links with de Broglie pilot waves

Let's make some considerations. We start from de Broglie's relation

$$\lambda_{dB} = \frac{h}{mv} n.$$

Because $v = C/(137n)$ we have

$$\lambda_{dB} = \frac{h}{mC} 137 n^2.$$

Having on mind that $2\pi 137 e^2 = hC$ we still have

$$\lambda_{dB} = 2\pi \frac{e^2}{mC^2} 137^2 n^2 = 2\pi \frac{h^2}{4\pi^2 m e^2} n^2 = 2\pi R_n$$

so we find again, well-known result, that the umpteenth possible circumference length of Bohr is equal to n times de Broglie's wave length.
Let's start by this

$$\lambda = 2\pi 137 \Psi n,$$

having on mind that Ψ is Bohr's circumferences ray and that $2\pi\Psi$ are de Broglie's wave lengths we also have that electromagnetic wave associable to de Broglie's wave is equal to

$$\lambda = 137\lambda_{dB}n. \quad (27)$$

We also have, having on mind that $137n = C/v$, that

$$\lambda = \frac{C}{v}\lambda_{dB}.$$

We also have

$$\lambda = 2\pi 137\Psi n = 2\pi\frac{C}{v}\Psi$$

so the electromagnetic wave is inversely proportional to the medium velocity of the oscillating charge and directly proportional to the vibration amplitude of the same one.

8 A possible experimental verification

The new relation

$$\lambda = 2\pi 137\Psi n$$

is also susceptible by a direct experimental verification. The easer one would be to pose in vibration an electric charge imposing a known amplitude and frequency and then measuring the electromagnetic wave length emitted. This experiment could lead to create an apposite oscillating dipole so it would not be of immediate realization.

An experiment easy in realizing could be that to repeat the experience of electrons diffraction able to verify de Broglie's relation and to contemporaneously measure the electromagnetic wave length that they would emit because in a certain way, interacting with the target reticulum, they are refrained by this protection so thy would emit electromagnetic radiation in accford to the previous relation (27).

In this last case we have what follows. Let's consider de Broglie's relation

$$\lambda_{dB} = \frac{h}{mv}n.$$

from it we have

$$v = \frac{h}{m\lambda_{dB}}n$$

so the energy is equal to

$$E = \frac{1}{2}m\frac{h^2}{m^2\lambda_{dB}^2}n^2 = \frac{1}{2}\frac{h^2}{m\lambda_{dB}^2}n^2.$$

If the electronic panel by diffracting is also refrained, is also emitted contemporaneously electromagnetic radiation. Because it's about polarized energy, we also have

$$E = \frac{1}{2}\frac{h^2}{m\lambda_{dB}^2}n^2 = \frac{1}{2}h\nu n = \frac{1}{2}\frac{hC}{\lambda_e}n$$

from what we immediately see the bond between de Broglie's wave and the electromagnetic wave associated to the electron. Infact we have

$$\frac{1}{2}\frac{h^2}{m\lambda_{dB}^2}n = \frac{1}{2}\frac{hC}{\lambda_e}$$

from what we have

$$\lambda_e = \frac{mC}{h}\lambda_{dB}^2\frac{1}{n} = \frac{\lambda_{dB}}{\lambda_{Compton}}\lambda_{dB}\frac{1}{n}.$$

Having on mind (28), we also have

$$\lambda_e = \frac{mC}{h}\lambda_{dB}^2\frac{1}{n} = \frac{mC}{h}\lambda_{dB}\frac{h}{mv}n\frac{1}{n} = \frac{\lambda_{dB}C}{v}.$$

because it's known that

$$v = \frac{C}{137n}$$

we have, at the end, that

$$\lambda_e = 137\lambda_{dB}n.$$

So we can arrive to the formula written above independently on the previous deductions and so by following the physic process of the said experiment. In the work [4] its shown that a gas at a certain temperature can be seen as an entirety of electric charges agitated by thermal move and constricted to walk a certain free medium walk. We are in presence of charges that minutely go on and come back and so by their oscillation they are continually accelerated and decelerated. So Lamor's relation is valid, so those charges emit electromagnetic waves that we perceive under the form of heat. We can show that the free medium walk coincides with vibration amplitude of the said (5).

9 Remark

In the work [1] are refound both the old relations and the new one.

References

[1] C. Santagata, **Resonance frequencies and Planck's formula**

[2] C. Santagata, **Unsuspectable connections between Macrocosm and Microcosm**