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The Fine Structure Constant

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Abstract

Today's Physics has acquired Constants, but it is interesting to study how these Constants were forged and what uses they have in the tool bag of Quantum Mechanical.

We show that physicists have been misled for a century by not having understood the meaning of this coefficient, and have lost their time in useless, even scabrous, speculations.

Résumé

Les Physiciens d'aujourd'hui utilisent quelques Constantes et il est intéressant d'étudier comment ces Constantes ont été forgées et quel usage elles ont dans leur boite à outils.

Nous montrons que de n'avoir pas compris la signification de ce coefficient, les Physiciens se sont fourvoyés depuis un siècle dans des spéculations inutiles, voire scabreuses.

Keywords: Bohr's atom, Electrical Coupling, atom's orbits, fine structure constant, space density, Einstein's formula.

Fine Structure Constant

This *constant* is constructed in a completely empirical way. It is related to electromagnetic interaction, but its interpretation remains a challenge for current physics. Proposed in 1916 by Sommerfeld, the formula for this constant is such that all its components have been chosen to obtain a dimensionless quantity.

It is not my intention to discuss the choice of the parameters of this formula but only its interpretation.

Physicists found that the electromagnetic interaction between the proton and the electron in the atom could not take the simple form defined by Coulomb's law. This formula did not explain the appearance of multiple and close lines in the spectral analysis of atoms. By trial and error, the physicists mixed up all the physical quantities of their knowledge and stubbornly stirred so as to obtain a dimensionless number of approximately equal value to the observed deviation.

If physicists have correctly interpreted the meaning of this coefficient because it is indeed the value of ***coupling*** between the electron and the proton, they have not understood that the value of this coupling cannot have a constant value, that it depends on the conditions in which these two particles are in the atom.

For the Mechanics of the Atom imposed by Bohr does not allow such an approach. For Bohr, and for a century, the constituents of the atom are inseparable pebbles with characteristics engraved in marble. This rigidity, imposed by Bohr and the founding fathers of the new physics, is at the basis of the inadequacy of Quantum Mechanics to explain the functioning of atoms.

Indeed, a more flexible and detailed intellectual approach could have made the physicists of the time understand that something happens when two particles meet, that the two particles together become an entity with characteristics different from those of the parent particles. A water atom (H_2O), for example, does not have the properties of hydrogen or oxygen. Alas, this misunderstanding still persists and it is this evidence that has led me to formulate a new definition of the value of the Coefficient α.

Because it is indeed a coefficient and not a Constant.

Let us imagine a spherical system in which the proton is in the center surrounded by a bubble, like a soap bubble, made up of the charge of the electron. The farther away the coupling between these two particles, the greater the radius of the system, the more apparent the electrical properties of the electron will be. Conversely, if the two particles are very close together, the electric field of the system, seen from the outside, will be weak. In other words, the greater the radius of the electron-proton system, the more apparent the electrical properties of the electron will be, the more intimately related these particles are, the more material they take on an appearance.

Thus, the electric field of the electron-proton system takes the form: $\mathbf{e^2\alpha}$. where is a function of the degree of intimacy between the proton and the electron.

However, current physicists express **α** according to formula (1) based only on the value of the estimated deviation on the fundamental Bohr' orbit of radius: $a = 5.29 \times 10^{-11}\ m$. and so:

$$\alpha = \frac{e^2}{4\pi\varepsilon_0\hbar c} = \frac{1}{137} \qquad (1)$$

which can only give a fixed result. I have therefore taken as a reference the value adopted by Quantum Mechanics on this orbit and I propose a calculation method that allows to give a variable result according to the radius of the electron:

$$\alpha_i = \sqrt{\sum_1^n i^{-2}} \qquad (2)$$

Expression in which the i's are the indices of the orbits according to the calculation below:

$$\begin{aligned} \alpha_1 &= (1^2)^{-0.5} \\ \alpha_2 &= (1^2+2^2)^{-0.5} \\ \alpha_3 &= (1^2+2^2+3^2)^{-0.5} \\ \alpha_n &= (1^2+2^2+3^2+\ldots n^2)^{-0.5} \end{aligned} \qquad (3)$$

The smaller the subscript ***i,*** the greater the radius of the orbit and the more apparent the electrical properties of the system will be.

The measurements made at the time took the results calculated with the radius of the Bohr orbit. However, this orbit is an inner orbit and therefore has a small radius. According to Bohr's proposal, I have admitted that this radius is the first inner radius, that the other radius, on which the electron is less bound to the proton, were outside.

Thus, in this calculation, the Bohr orbit has **38** as an index because:

$$\alpha_{38} = (1^2+2^2+3^2+\ldots 38^2)^{-0.5} = 1/137 \qquad (4)$$

Thus, it would be in the orbit of index 38 of the system that I propose that **α** would have this value. As can be seen, on the outer orbits of ranks 37, 36... The value of **α** increases to become equal to the unit in the orbit of rank 1.

The calculation of the modes of emission of electromagnetic radiation and the observable frequencies confirmed to me the validity of this method of calculation as it appears in my book *Atoms and Matter*. However, the ranks of the orbits used in the calculations do not mean that the value of the interaction varies by *quantum leaps*. It seems that **α** increases (or decreases) continuously along the curve below and that the numbers obtained are only milestones.

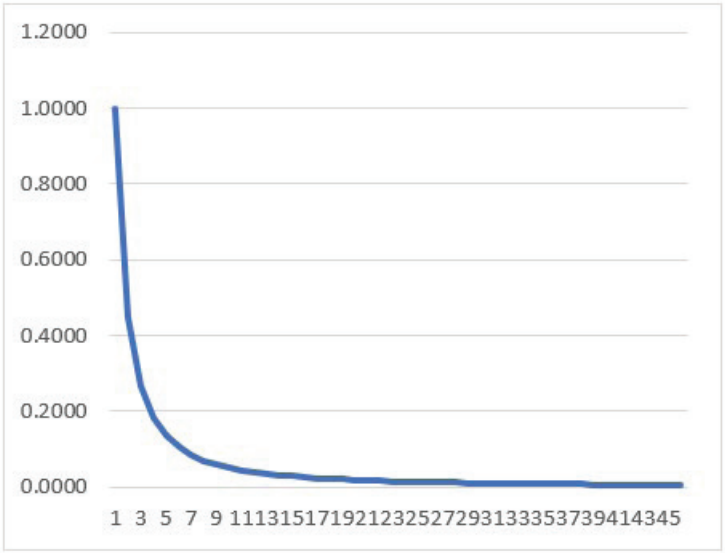

Fig. 1 – Values of « alpha » in regard to rank of orbit of the electron.

There is therefore no electron-proton system in the rank 1 orbit where the electron would volatilize at the speed of light. It is obvious that the stronger the coupling between the electron and the proton, the greater the material properties of the system. It is therefore the inner orbits that give the atom its material properties. Outer orbits have electrical properties that allow for electromagnetic interactions, chemical bonds, and the cohesion of material structures.

Thus, in the orbit of rank 2, the largest possible, the electron-proton system would have a radius:

$$r_2 = r_B \times \zeta^{38-2} \qquad (5)$$

where ζ is the coefficient of growth of the radius at each orbit jump. As we know, this electron-proton system is none other than the hydrogen atom. However, the vacuum of space cannot exist. The entire space of the universe is filled with hydrogen molecules. But each molecule occupies only the volume of one atom because the atoms pulsate and when one of the atoms of this molecule is expanding, the other is contracted and of negligible volume. Thus, the minimum density of space given by Einstein's formula:

$$\rho_{mini} = 3H^2q/8\pi G \qquad (6)$$

in which ***H*** is the Hubble Constant which is currently estimated at 60 km per second and per Megaparsec, ***q*** is a deceleration parameter that can be < 1/2 for hyperbolic space; equal to 1/2 for Euclidean space and > 1/2 for spherical space. G being the Constant of Gravitation. The calculation according to this formula gives us the minimum density of the Universe, i.e.:

$$\rho_{mini} = 3H^2q/8\pi G = 6.77.10^{-27}\ \text{Kg/m}^3 \qquad (7)$$

In a Universe of this density containing only hydrogen molecules, the radius of each molecule would be:

$$r_{maxi} = \left(\frac{3*2*1.67.10^{-27}}{4*\pi*6.77.10^{-27}}\right)^{1/3} = 0.49\ \text{m} \qquad (8)$$

And so, with equation (5), we obtain a factor for the growth of the radius of the orbits: ζ = 1.89. For other reasons that I cannot explain here, I have been led to take **ζ = 2**, which leads to a density of the Universe a little greater than that obtained with Einstein's formula for an expansion speed of 60 km/sec/Mpc. It should be noted that this calculation is based on the density of the Universe obtained by Einstein in a rather empirical way but with a still coherent result..

We see, on the Web page dedicated to this constant, that the editors followed Bohr's recommendations to the letter: *Don't try to understand*. Do the math! A dozen different formulas with a (ridiculous?) precision up to 10 digits after the decimal point… but not a single coherent explanation of the meaning of this constant.