The Possible Meaning of Fine Structure Constant $1/\alpha = hC/(2\pi e^2) = 137.036$

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【Abstract】。Through making the analogous comparisons of Dirac's large number $1/L_n$ to the fine structure constant $1/\alpha$, and of gravitational force F_g to F_b, the better reasonable conclusion might be that, $1/\alpha$ could be 137.036 times or proportion of the strong force Fn to the electromagnetic force F_e in the atomic nucleus.

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【Key Words】: Dirac's large number 1/Ln; fine structure constant $1/\alpha$; gravitational force F_g; electromagnetic force F_e; strong force Fn in the atomic nucleus; analogous comparisons;

【1】. The fine structure constant $1/\alpha$ is defined to,

$1/\alpha = hC/(2\pi e^2) = 137.036$ (1a)

In formula (1a), $h=6.626\times10^{-27} g{*}cm^2/s$ =Planck constant; $C = 2.998\times10^{10}cm/s$ = light speed; $e = 4.80325\times10^{-10}esu = 1.6022\times10^{-19}C$; then, $1/\alpha == hC/(2\pi e^2) = 6.626\times10^{-27}\times2.998\times10^{10}/[2(4.80325\times10^{-10})^2] = 137{,}0368 \approx 137.036$.

Let's explore the possibly physical property of the fine structure constant $1/\alpha$ below.

【2】。Firstly, let's look back the origin of Dirac's large number L_n, According to the idea of Pual Dirac's "large number hypothesis", comparing the electromagnetic force F_e to the universal gravitational force F_g, taking the hydrogen atom as an example, the mass of proton $m_p=1.6727\times10^{-24}g$, the mass of electron $m_e = 9.1096\times10^{-28}g$, the capacity of electron $e = - e = 1.602\times10^{-19}$ C, r is the distance between two electrons, G = gravitational constant$=6.6726\times10^{-8}\ cm^3/s^2{*}g$, $k=9.0\times10^9\ N{\bullet}m^2/C^2$

$\mathbf{F_g} = Gm_pm_e/r^2 = 6.6726\times10^{-8}\times1.6727\times10^{-24}\times9.1096\times10^{-28}/r^2 = 101.67\times10^{-60}/r^2$ [1] (2a)

$\mathbf{F_e} = ke^2/r^2 = 9.0\times10^9\ N{\bullet}m^2/C^2\times(1.6022\times10^{-19}C)^2/r^2 = 9.0\times10^9\times10^5\times10^4\times(1.6022\times10^{-19}C)^2/r^2 = 23.10\times10^{-20}/r^2$ [1] (2b)

$\mathbf{F_e/F_g} = L_n = 23.10\times10^{-20}/101.67\times10^{-60} = 2.35\times10^{39}$ [1] (2c)

(2c) shows, that under the distance r, between two particles, the non-dimension constant $L_n = ke^2/Gm_pm_e = 2.35\times10^{39}$ is the times of the electromagnetic force F_e to the universal gravitational force F_g.

【3】。Since $L_n = F_e/F_g = ke^2/Gm_pm_e$ is equal to a constant 2.35×10^{39}, two patterns of $Gm_pm_e/e^2=1/L_n$ and $hC/(2\pi e^2) = 1/\alpha$ are analogous ; and $1/L_n$ and $1/\alpha$ are all non-dimension constants, $1/\alpha = hC/(2\pi e^2)$ might be guessed as a proportion of two different forces. Let's apply some formulas of black holes (BH) as analogous comparison. Suppose M_b is mass of any black hole, m_{ss} is a Hawking quantum radiation emitted from the radius of the Event Horizon R_b of BH M_b, so,

$\underline{\mathbf{m_{ss}M_b = hC/8\pi G}}$ [2] **(3a)**

Then,

$4G\mathbf{m_{ss}M_b = hC/2\pi}$ **(3b)**

$4G\mathbf{m_{ss}M_b/e^2 = hC/2\pi e^2}$ **(3c)**

Let $Gm_{ss}M_b/R_b^2 = F_b$, which is the gravitational force of M_b to its m_{ss}, and $F_e = e^2/r_n^2$, **if** r_n**= 2**R_b**,** then,

$\underline{\mathbf{Fn/F_e = hC/2\pi e^2 = 1/\alpha = 137.036}}$ **(3d)**

Correspondingly, Fn might be guessed as the strong force, i.e. acting forces between quarks in the atomic nucleus. Therefore, under $r_n = 2R_b$,

$Fn = hC/2\pi r_n^2 = 4F_b$ (3e)

How strong is the strong force Fn? 1*. Let $r_n \approx 10^{-13}cm$, $Fn = hC/2\pi r_n^2 = 6.626\times10^{-27}\times2.998\times10^{10}/2\pi\times10^{-26} = 0.316\times10^{10}$ dyne. And $F_e = e^2/r_n^2 = (4.80325\times10^{-10})^2/10^{-26} = 23.07\times10^6$dyne. Then, $\underline{\mathbf{Fn/F_e = 0.316\times10^{10}/23.07\times10^6 = 136.97 \approx 137.036 = 1/\alpha}}$. 2*. Let $= R_b = 10^{-13}cm$, as the calculated result from formula $2GM_b = C^2R_b$, $M_b = 10^{15}$ g, $m_{ss} = 1.76\times10^{-24}g \approx$ mass of a proton. It shows, in case of $r_n = 2R_b \approx 10^{-13}cm$. Thus, the strong force $F_n = 4F_b$, i.e. F_n is about equal to the gravitational force of a BH of $M_b = 10^{15}g$ to a $m_{ss} \approx 1$ proton on its R_b. **The reason why F_n is analogous to F_b on property and numerical values is both might accord with the quantum mechanics.**

【4】。Conclusion:

1*. Just as $F_e/F_g = 10^{39} = 1/L_n$, so, $Fn/F_e = 137 = 1/\alpha$ may be completely possible. Therefore, L_n and α may be considered as the coupling coefficients. Since $L_n = \mathbf{F_e}/F_g$ is the coupling coefficient of the electromagnetic force F_e to the universal gravitational force F_g, and analogously, $1/\alpha = Fn/F_e$ might be seen as the coupling coefficient of the strong force Fn to F_e. **Owing to**

that Fn has not been clearly recognized and calculated out right now, thus, some formulas of black holes are applied by author as analogous comparison. **I think, $Fn = hC/2\pi r_n^2$ as the strong force in atomic nucleus and $1/\alpha = Fn / F_e$ as a coupling coefficient are better reasonable.**

2*. Just as Dirac's large number $1/L_n$ has no general meaning tn the Universe; analogously, $1/\alpha$ may have no general meaning in the Universe; each of both may only be a special coupling coefficient between two different acting forces .

====The End====

【references】:

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