Fine-Structure Constant as Pure Geometric Number among Physical Background

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According to B. Feng's theory, the Fine-Structure Constant is theoretically deducted as, $\alpha^{-1}=\frac{64}{3}2\pi k^{-1}$ $=137.0359970$ *, an accurate theoretical value.*

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I. INTRODUCTION

Fine-structure constant (α^{-1}) is a well-known natural constant in physics. It was beginning with an experimental discovery of fine spectrum of light (Michelson, 1887) and was first defined and theoretically explained by Sommerfeld in 1916. The measuring method by using Quantum Hall Effect has been recognized as advanced; the recent accurate value recommended by CODATA in 2014 is as 137.035999139(31).

Fine-structure constant is a combined dimensionless constant and appears in many physical occasions. Many physicists pay much attention to it mainly because of its dimensionless. Though Sommerfeld has given it a good explaination, still the physicists continuing their work for searching its deeper reason: wondering why the "hand of God" wrote down such a mystery non-integer number?

II. ANALYSIS

Believing it to be a mathematical combination of integer numbers and mathematical constant, the guess works appeared uninterruptedly ever since, as Wyler's $(9/16\pi^3)(\pi/5!)^{1/4} = 1/137.036$, Eddington's $(162 - 16)/2 + 16 = 136$, and others as $(9/8\pi^4)(\pi^5/2^45!)^{1/4} = 1/137.036082$, $(1 - 1/(30 \times 127))/137 = 1/137.035967$, $\cos(\pi/137)/137 = 1/137.036028$ and $29\cos(\pi/137)\tan(\pi/(137 \times 29))/\pi = 1/137.035999787$ *etc.* All of these are said to be mathematical games and can't give out any information of physical meaning.

The actual determined value would depart from its original theoretical one because of the influences from the measuring method, measuring interaction and relativistic effect. Here, the original theoretical value would be more effective than that of actual to us for revealing the essential law of things, like that in dealing with the gas state function; where the ideal gas is more attractive to us.

III. DEDUCTION

According to Sommerfeld's definition, the original theoretical form and value of α^{-1} is as follows:

$$\alpha^{-1}=\frac{c}{v_e}=\frac{2\varepsilon_0 hc}{e^2} \quad \text{......} \quad (1)$$

$$=\frac{2\times 8.85418781871\times 10^{-12}\times 6.626069934\times 10^{-34}\times 2.99792457982\times 10^{8}}{(1.6021766208\times 10^{-19})^2}$$

$$=137.0359970 \quad \text{......} \quad (1.1)$$

According to recent proposed B. Feng's theory [1], the charge value of an elementary particle can be expressed by other common physical constants. The deduction steps were as following:

Supposing the Universe to be a four-dimensional spherical space (five-dimensional Euclid space), its projection in four-dimensional Euclid space would produce *variable mode* effect.

Because there is the following relationship between the surface area (S) and volume (V) of the n-dimensional sphere:

$$\frac{V_n}{S_{n-1}}=\frac{R}{n}, \text{ and } \frac{S_{n+1}}{V_n}=2\pi R$$

So, the area of four-dimensional spherical space (S_4) and the volume of four-dimensional Euclid space (V_4) is $S_4 = 8\pi^2R^4/3$ and $V_4 = \pi^2r^4/2$ respectively. Where the radius R and r has a variable mode effect, their relation is as

$$R=\sqrt{\Omega^2+(ct)^2}=\sqrt{r^2+r^2}=\sqrt{2}\,r$$

It shows that the radius variable mode coefficient is $\sqrt{2}$.

The energy ratio of four-dimensional spherical space (E_S) to four-dimensional Euclid space (E_E) is equal to the corresponding area-volume ratio, we have

$$E_S=\frac{8\pi^2R^4/3}{\pi^2r^4/2}E_E=\frac{8\times2\times(\sqrt{2})^4}{3}E_E=\frac{64}{3}E_E \quad \text{(2)}$$

It shows the energy variable mode coefficient is 64/3.

Though the Universe is a four-dimensional spherical space, and we right live in such a complex space, however, in a condition of low velocity world, we more look like living in a simple four-dimensional Euclidean space. The work energy we do can only belong to the four-dimensional Euclid space's (E_E). In classical physics, the Euclid energy (E_E) can be calculated based on Biot-Savart Law and Lorenz force (F) Law of moving charge (e) in magnetic field intensity (B), we have

$E_E=l\times F=2\pi rF=2\pi r\times ecB=2\pi r\times ec\frac{\mu_0 ec}{4\pi r^2}$, (where, l is the charge moving distance in a circle) *i.e.*

$$E_E=\frac{\mu_0e^2c^2}{2r} \quad \text{(3)}$$

As elementary particles, electron and proton are indeed the confined movement of light (along the time axis) [2, 3], their energy belongs to four-dimensional spherical space (E_S). The classical Euclidean energy E_E in (3) ought to be converted by (2). Combining (2) and (3), we have

$E_S=\frac{64}{3}\frac{\mu_0e^2c^2}{2r}$. As frequency ($\nu$) has a relation of $\nu=\frac{c}{2\pi r}$, we can rewrite E_S as

$$E_S=\frac{64}{3}\pi\mu_0e^2c\nu \quad \text{(4)}$$

Because energy has the form as $E = h\nu$, we have

$$h\nu=\frac{64}{3}\pi\mu_0e^2c\nu, \quad h=\frac{64}{3}\pi\mu_0e^2c,$$

$$e^2=\frac{3}{64\pi}\frac{h}{c\mu_0} \quad \text{(5)}$$

$$=\frac{3}{64\pi}\frac{6.626069934\times10^{-34}}{2.99792457982\times10^8\times4\pi\times10^{-7}}=\frac{3}{256\pi^2}\frac{6.626069934\times10^{-35}}{2.99792457982}=2.624320399888\times10^{-38}$$

$$e=\pm1.6199754319\times10^{-19}\text{ C}$$

However, the measured charge of an electron is $1.6021766208 \times 10^{-19}$ C. In such a case, append a fitting factor k in (5), and in order to make them equal, let $k = 0.9781465420$, thus

$$e^2=\frac{3}{64\pi}\frac{hk}{c\mu_0}=(1.6021766208\times10^{-19})^2 \quad \text{(6)}$$

Substituting (1) with (6), we have

$$\alpha^{-1}=\frac{2\varepsilon_0hc}{e^2}=\frac{2\varepsilon_0hc}{\frac{3}{64\pi}\frac{hk}{\mu_0c}}=\frac{2\varepsilon_0hc\times64\pi\mu_0c}{3h}=\frac{64}{3}2\pi k^{-1}\varepsilon_0\mu_0c^2,$$

as $c^2=\frac{1}{\varepsilon_0\mu_0}$, we finally obtained

$$\alpha^{-1}=\frac{64}{3}2\pi k^{-1} \quad \text{(7)}$$

$$=\frac{64}{3}2\pi\times\frac{1}{0.9781465420}$$

$$=137.035\,9970$$

That's just the exact value that calculated theoretically in (1.1).

IV. DISCUSSION

From the expression in (7), one can see a perfect geometric character of α^{-1}. Where 64/3 is a geometric energy variable mode coefficient, 2π the common circumference ratio. And k is also a geometric circumference; outwardly, it plays as a fitting number in (6), however, it comes from a not considered factor in the theoretical deduction of electric charge in (5). The not considered factor would be the curved space coefficient, because, in the process of theoretical deduction in (2)-(5), we treat the space as a plane Euclid's; nevertheless, the mass density of electron is as high as 1.36512×10^{10} g/cm^3, where the curved space factor can't be neglected. In this way, the adding of k in (6) is necessary and reasonable, as a treating method which has ever been used in our previous work [4] when calculated the mass spectrum of elementary particles, where the same meaning of k was given a fitting number of 0.970624. They look almost to be equal.

From above theoretical deduction process, obviously, it shows us a strong physical background of α^{-1} rather than a mathematical game.

Another thing is that, to our surprising, the mystery number of α^{-1} is just the radius of proton which we predicted in literature [5].

V. CONCLUSION

α^{-1} is equal to $\frac{64}{3}2\pi k^{-1}$. It consists of pure geometric parameters of 64/3, 2π and spatial bending factor k.

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