Clarifying the origin of the fine-structure constant

Ichiro Nakayama
Yazucho Yazugun Tottoriken Japan

1. Overview

The fine-structure constant is generally considered to be a coupling constant that represents the strength of the electromagnetic interaction of elementary particles, but its origin is unknown. Using the electron and proton model of energy body theory, I clarified the origin of the fine-structure constant from the relationship between Coulomb's law and Planck's constant.

2. Derivation

2.1 Fine structure constant

The fine structure constant is:

$$\alpha = \frac{\mu_0 c e^2}{2h} = \frac{e^2}{4\pi\varepsilon_0 \hbar c}$$

The fine structure constant was introduced by Sommerfeld in 1916 to explain the fine structure that appears in the spectral lines of hydrogen-like atoms. It is now considered to be a coupling constant that describes the strength of electromagnetic interactions between elementary particles in a more general sense, independent of atomic structure. However, it is not known why this value appears.

2.2 Particle model of energy body theory

First, let me briefly explain what the elementary particle model based on the energy body theory is. The elementary particle model of the energy body theory is a locally excited state of space. In the energy body theory, it is considered that space is made up of energy cell bodies of the Planck length. The restoring force when energy cell bodies expand, or contract is the source of energy. In other words, if one energy cell body contracts, the adjacent energy cell body will expand, and overall equilibrium is maintained. When the energy cell bodies receive pressure from all directions of the celestial sphere, they contract to the limit. However, if the pressure is greater than this, the energy has nowhere to go and starts to rotate. On the other hand, the energy cell bodies that have contracted to the limit expand because the pressure is deflected. In this way, the pressure that was moving toward the center is instantly converted into rotational energy, so the expansion and contraction rotate as vibrations. It is important to note here that the entire elementary particle does not rotate around like a top. This rotation

of energy appears as the crests and troughs of a wave like wrinkles extending radially from the center, and the phase shifts in the direction of rotation. This rotation of the wave is a de Broglie wave. This is the cause of the spin of elementary particles. Due to the balance with this gravitational field and their own spin, elementary particles such as electrons and protons can continue to exist.

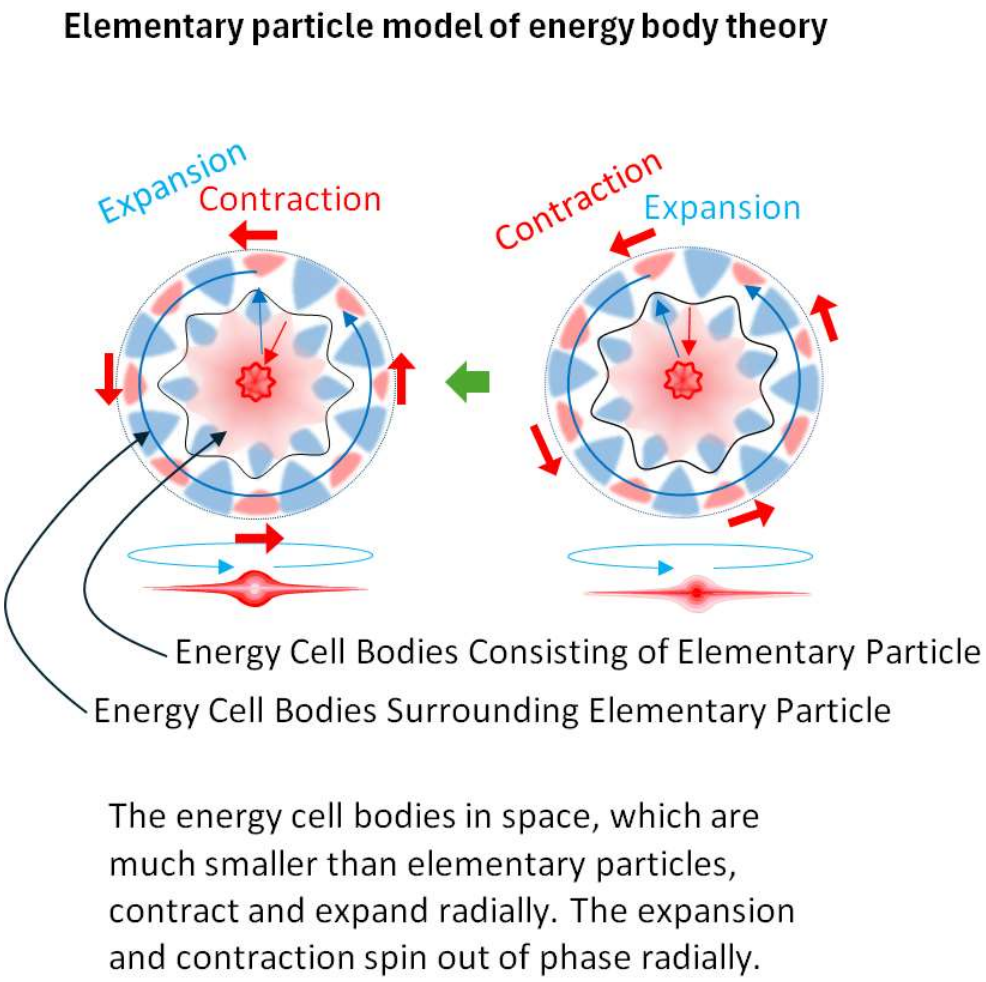

Fig.1

Elementary particles have a disk-like shape with the foot that spreads out into space. The particle in the center represents a particle, and the foot represents a field.

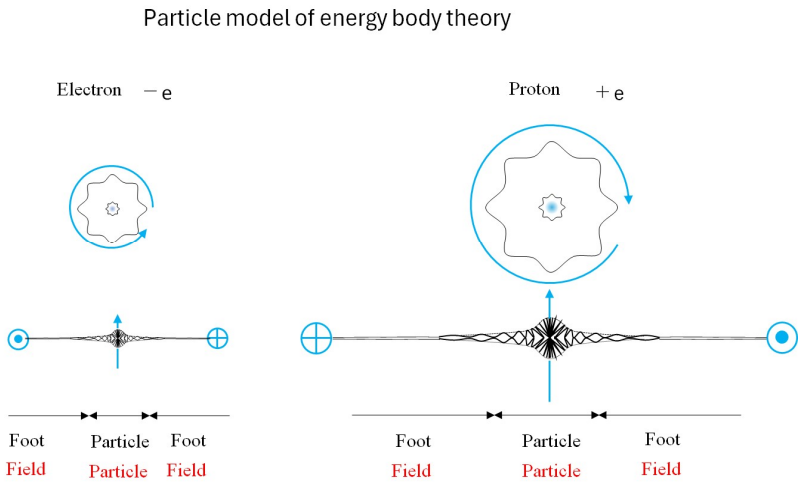

Fig.2

Electromagnetic interaction depends on the direction of the waves at the interaction; when the waves are in the same direction, an attractive force occurs, and when the waves are in opposite directions, a repulsive force occurs.

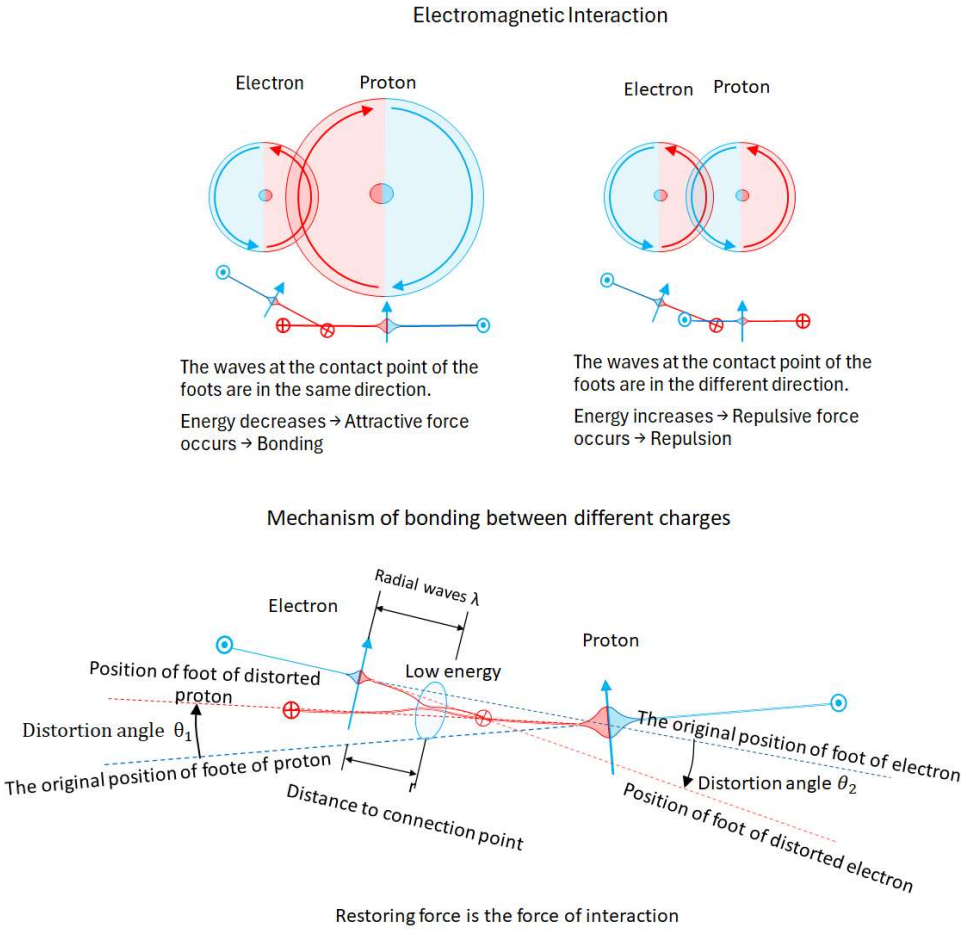

Fig.3

Coulomb's law and Planck's constant are the same thing as the restoring energy of the distortion of the foot of the rotating waves of electrons and protons, expressed from different perspectives.

Coulomb's law regards the energy decrease (or increase) caused by the wave directions of electrons or protons as an attractive or repulsive force $\pm e$.

In the space where an electron and a proton come into contact, the directions of the rotating waves of the electron and proton are the same. This increases the rotation speed and decreases the energy of the space at the contact point. As a result, restoring energy generates, and they attract each other. When the waves are opposite to each other, energy increases, and they repulsive each other.

Planck's constant regards the restoring direction of the distortion of the rotating waves caused by the wave directions of electrons or protons as angular motion h.

In the space where an electron and a proton come into contact, the directions of the rotating waves of the electron and proton are the same.
As a result, the rotation speed increases, and the wavelength of the rotating wave (de Broglie wave) extends.
Then, the foot of the rotating wave is distorted at an angle θ, and the energy of the space at the contact point decreases.
As a result, restoring energy generates and angular momentum 1/2 h comes into effect.
In other words, the restoring energy of Coulomb's law and the restoring energy of Planck's law are the same. By connecting these two laws with an equation, we can derive the fine structure constant α, which connects Coulomb's law of electromagnetism and Planck's law of quantum mechanics.

2.4 Derivation

The electron on the proton orbit is bound to the proton in a position as shown in Fig 4. At this time, the foot of the rotating wave of the electron and proton is distorted. Coulomb's law applies. When an electron in a ground state orbit moves to an excited state orbit and exceeds the excitation limit, kinetic energy is generated in front of the electron. At the same time, the excited state of the proton is released, and the electron transitions to the ground state orbit. When the electron stops in the ground state orbit, the distortion in the base of the electron's rotating wave is released, and the kinetic energy is emitted as a photon. The release of the

distortion (excitation) in the foot of the electron and proton and the generation of kinetic energy is the electron transition energy, and the Plan constant applies.

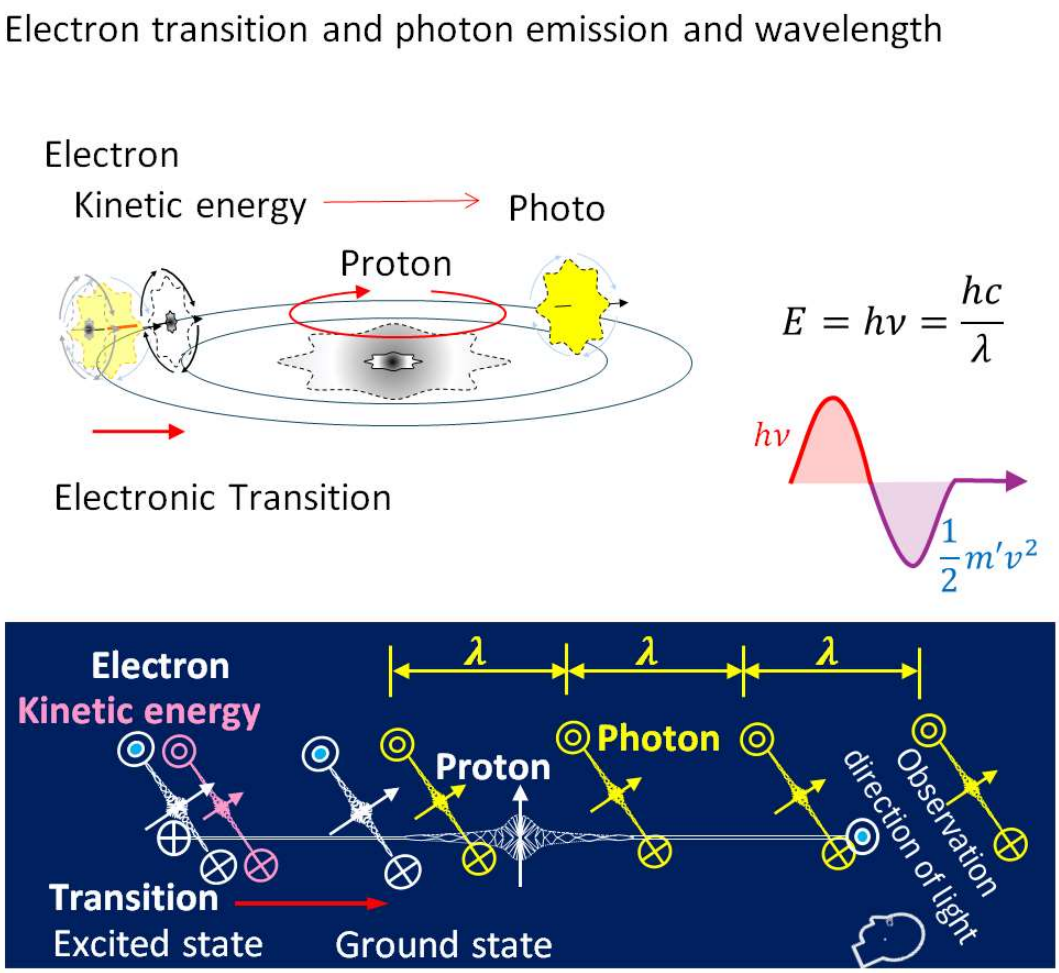

Fig.4

Planck's constant h, Coulomb's constant, and electromagnetic interaction are the restoration from the distortion generated in the electron's foot. Also, the speed of light is the ratio of the delay in time it takes for a photon's foot to reach an observer to the distance to the photon. This is because the arrival of the foot of light is delayed due to the photon's foot distortion observing the side perpendicular to the direction of travel of the photon. It is shown in Fig.5. The speed of the photon inherits the speed of the electron just before it is separated.

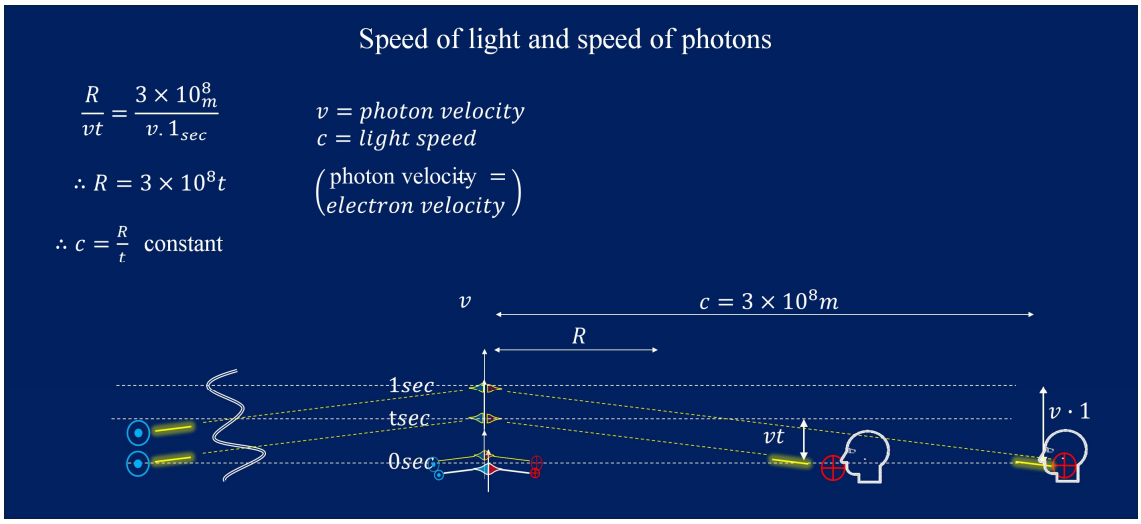

Fig.5

The following is explained with reference to Fig6.

Let the position of the foot of an electron bound to a proton be x, its strength be h, the position of an arbitrary interaction be r, its strength be f, the position of the Coulomb constant be c, and its strength be $10^{-7}/_2 \cdot e^2$.

The origin (derivation) of the fine structure constant is as follows:

The position of the foot of the electron bound to the proton is x, and its strength is h. Also, Coulomb's law is as follows (1).

$$f = k_0 \frac{e^2}{r^2} \quad (1)$$

Here, since $k_0 = 10^{-7}c^2$, (1) becomes (2).

$$f = 10^{-7}c^2 \cdot \frac{e^2}{r^2} \quad (2)$$

Transforming (2) gives us (3).

$$\pi r^2 f = \pi \times 10^{-7} ce \times ce \quad (3)$$

Therefore, the restoration energy E_k of the foots of the electron and proton due to their interaction is given by (4) below.

$$E_k = \pi \times 10^{-7} ce \times ce \quad (4)$$

The energy E_p at the bonding point of an electron and a proton is given by (5) using the equation for Planck's constant.

$$E_p = h\nu = h\frac{c}{\lambda} \quad (5)$$

Since E_k and E_p are the same, (4) and (5) become the following (6).

$$\pi \times 10^{-7} ce \times ce = h\frac{c}{\lambda} \quad (6)$$

Rearranging (6) gives (7).

$$\frac{\pi \times 10^{-7} ce \times ce}{hc} = \frac{1}{\lambda} \quad (7)$$

Here, $\mu_0 = 4\pi 10^{-7}$ *so multiplying both sides of (7) by 2 gives us (8).*

$$\frac{2\pi\mu_0 \times ce \times ce}{4\pi hc} = \frac{2}{\lambda} \quad (8)$$

Setting $\alpha = 2/\lambda$ gives the fine structure constant (9).

$$\frac{\mu_0 ce^2}{2h} = \frac{e^2}{4\pi\varepsilon_0 \hbar c} = \alpha \quad (9)$$

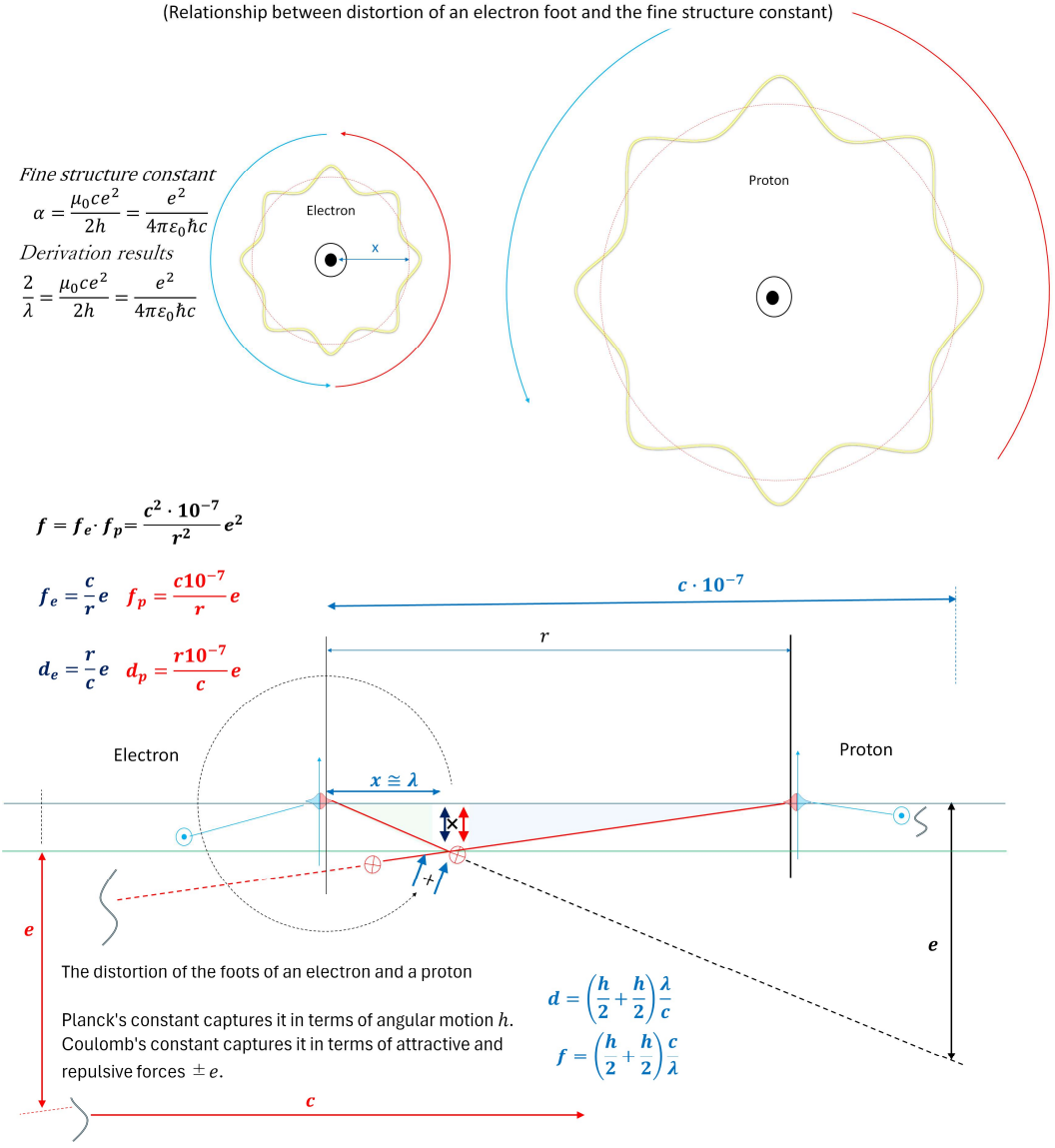

Fig.6

3. Conclusion

I have found that the fine structure constant originates from the distortion of the foot of the electron model of the energy body theory. It was then possible to show that the fine structure constant can be derived from Coulomb's law and Planck's constant.

4. Reference

Wikipedia; fine structure constant