Forces, Hierarchy, Unification

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Abstract

Force or energy is both a relationship and a pulse between objects (relational physics). Based on this idea, I have succeeded in unifying the gravitational and electromagnetic forces, as well as the strong and weak forces, using the same framework. Through this verification work, I have also been able to determine the radius and mass of the neutrino. In my deep consideration of the background of the formation of the weak and strong forces, I also succeeded in unifying alpha and beta decay by combining radioactive decay with the vision of the pulse.

Keywords: Gravity Constant; Electromagnetic Force Constant; Junichi Constant; Fundamental Particle Constant; Neutrino; Radioactive Decay; Prime Element

Introduction

Four forces (gravity, electromagnetism, strong force, and weak force) are believed to exist in this natural world [1]. Attempts are being made by scientists to unify them, and the completion of the theory is considered the ultimate goal of physics. Physics has evolved remarkably to date. Newtonian mechanics and its development, general relativity, have sought to explain gravity, while quantum theory has sought to explain the strong and weak forces in atomic nuclei, not to mention electromagnetic forces. The efforts bore some fruit. However, unifying the four forces through such a conventional framework (proximity theory) has not yet been completed. In particular, there is a lack of consistency between gravity and electromagnetic forces. This is known as the hierarchy problem, and it has remained an insoluble conundrum for many years.
Therefore, I developed a new original framework to view forces and energies from the standpoint of remote theory (relational physics). Using that model, I have succeeded in solving the hierarchy problem and in unifying the four forces.

Methodology

With the progress of science, mankind has built a methodology that can describe the macro world, and on this basis has opened the door to the investigation of the micro world. However, scientists were faced with the reality that existing methodologies were not applicable there. When the electromagnetic and gravitational forces between microscopic objects were calculated and compared, it was discovered that there was a numerical error of nearly 40 orders of magnitude between the two. This is the hierarchy problem [2]. So why do such inconsistencies arise in the first place?

In this respect, Junichi Hashimoto's law, which I created, is the so-called "law of laws" and can be a barometer that can be used to examine how universal and systematic the scientific law chosen as the subject is [3]. The degree of universality and systematicity of the subject law is expressed by the number of parties (*n*), and the closer it is to "1", the more universal and solidly systematized the law is. With those points in mind, I would like to examine whether Newton's theory of gravity [4] is correct.

Newton's law of universal gravitation was created based on Kepler's law [5]. With that in mind, let us first apply Junichi Hashimoto's law to Kepler's second and third laws to see how stable and correct models they are. This is because it is the second and third laws that Newton referred to.

Junichi Hashimoto's law is expressed by the following equation.

$$Const = \frac{1}{i} \times p_{\mathrm{m}} \qquad \text{—①}$$

$1/i$ represents the degree of stability and p_{m} is a parameter for adjustment.

Kepler's second law is expressed by the following equation.

$$\frac{1}{2} lv = Const \qquad \text{—②}$$

l represents the distance between the sun and the planet. v is a quantity specific to this law called area velocity, which is composed of the product of velocity and unit time. Here, by assuming that its unit time is infinitesimal, v can be taken to be the product of velocity and infinitesimal time. In the concept of differentiation, such an operation would represent a velocity when the time interval is infinitesimal. In other words, v here represents, in effect, only velocity. Now, based on these assumptions, let us apply Junichi Hashimoto's law to Kepler's second law. Since the constant part in equation ② is 1/2 *lv,* substituting equation ① into equation ② gives the value of the number of parties in Kepler's second law by the following process.

$$\frac{1}{2} lv[\mathrm{m}^2 \cdot \mathrm{s}^{-1}] = \frac{1}{i}[\mathrm{m} \cdot \mathrm{s}^{-1}] \times l[\mathrm{m}] \times \frac{1}{2}$$

$$= nv[\mathrm{m} \cdot \mathrm{s}^{-1}] \times l[\mathrm{m}] \times \frac{1}{2}$$

$$n = \frac{1}{2} lv[\mathrm{m}^2 \cdot \mathrm{s}^{-1}] \times \frac{1}{\left(\frac{vl}{2}\right)[\mathrm{m}^2 \cdot \mathrm{s}^{-1}]}$$

$$= \frac{\left(\frac{vl}{2}\right)}{\left(\frac{vl}{2}\right)} \frac{[\mathrm{m}^2 \cdot \mathrm{s}^{-1}]}{[\mathrm{m}^2 \cdot \mathrm{s}^{-1}]}$$
$$= 1$$

Kepler's third law is expressed by the following equation.

$$\frac{T^2}{a^3} = Const \qquad \text{—③}$$

a represents the orbital length radius and T represents the orbital period of the planet. As before, let us apply Junichi Hashimoto's law to this. Substituting equation ① into equation ③, the following process gives the value of the number of parties in Kepler's third law.

$$\frac{T^2}{a^3}[\mathrm{s}^2 \cdot \mathrm{m}^{-3}] = \frac{1}{i}[\mathrm{m} \cdot \mathrm{s}^{-1}] \times T^3[\mathrm{s}^3] \times \frac{1}{a^4}[\mathrm{m}^{-4}]$$
$$= nv[\mathrm{m} \cdot \mathrm{s}^{-1}] \times \frac{T^3}{a^4}[\mathrm{s}^3 \cdot \mathrm{m}^{-4}]$$
$$= nv[\mathrm{m} \cdot \mathrm{s}^{-1}] \times \frac{T^3}{a^3}[\mathrm{s}^3 \cdot \mathrm{m}^{-3}] \times \frac{1}{vT}[\mathrm{m}^{-1}]$$
$$= n \times \frac{T^3}{a^3}[\mathrm{s}^3 \cdot \mathrm{m}^{-3}] \times \frac{1}{T}[\mathrm{s}^{-1}]$$
$$= n \times \frac{T^2}{a^3}[\mathrm{s}^2 \cdot \mathrm{m}^{-3}]$$
$$n = \frac{\left(\frac{T^2}{a^3}\right)}{\left(\frac{T^2}{a^3}\right)} \frac{[\mathrm{s}^2 \cdot \mathrm{m}^{-3}]}{[\mathrm{s}^2 \cdot \mathrm{m}^{-3}]}$$
$$= 1$$

As described above, it was confirmed that the number of parties is "1" in both the second and third laws. This implies that the sun and each planet are one ordered body, and this speaks to the accuracy and universality of Kepler's laws, which can describe this fact.
So what about Newton's law of universal gravitation? It is expressed by the following equation.

$$F = \mathrm{G}\frac{M_1 M_2}{l^2}[\mathrm{N}] \qquad \text{—④}$$

F represents the amount of force, G represents the universal gravitational constant (6.67×10^{-11} $[\mathrm{N} \cdot \mathrm{m}^2 \cdot \mathrm{kg}^{-2}]$), M_1 and M_2 represent the mass of the object, and l represents the distance. The unit is the newton (N). The constant part in Newton's law of universal gravitation is G. Let us take that out and apply Junichi Hashimoto’s law. The following process gives the equation relating the number of parties to the orderliness (stability) of Newton’s theory.

$$\mathrm{G}[\mathrm{kg}\cdot\mathrm{m}\cdot\mathrm{s}^{-2}\cdot\mathrm{m}^{2}\cdot\mathrm{kg}^{-2}]=\frac{1}{i}[\mathrm{m}\cdot\mathrm{s}^{-1}]\times\frac{l^2}{mt}[\mathrm{m}^{2}\cdot\mathrm{kg}^{-1}\cdot\mathrm{s}^{-1}]$$
$$=nv[\mathrm{m}\cdot\mathrm{s}^{-1}]\times\frac{l^2}{mt}[\mathrm{m}^{2}\cdot\mathrm{kg}^{-1}\cdot\mathrm{s}^{-1}]$$
$$=\frac{nv^2 l}{m}[\mathrm{m}^{2}\cdot\mathrm{s}^{-2}\cdot\mathrm{m}\cdot\mathrm{kg}^{-1}]$$
$$n=\frac{\mathrm{G}m}{v^2 l}\ \frac{[\mathrm{kg}\cdot\mathrm{m}\cdot\mathrm{s}^{-2}\cdot\mathrm{m}^{2}\cdot\mathrm{kg}^{-2}\cdot\mathrm{kg}]}{[\mathrm{m}^{2}\cdot\mathrm{s}^{-2}\cdot\mathrm{m}]}\ (=[1]) \quad —⑤$$

Now, let us substitute each value into equation ⑤ and calculate the number of parties for specific objects. I would like to apply this to hydrogen atoms and the earth, one after the other. Please refer to my previous papers for details on each value to be substituted in the equation (for the mass of the earth, the latest value was determined to be 7.3223854×10^{24} [kg] due to a revised interpretation of the number of parties).

$$n_{\mathrm{hydrogen}}=\frac{6.67\times10^{-11}[\mathrm{m}^{3}\cdot\mathrm{s}^{-2}\cdot\mathrm{kg}^{-1}]\times1.674\times10^{-27}[\mathrm{kg}]}{299792458^2[\mathrm{m}^{2}\cdot\mathrm{s}^{-2}]\times3.90206\times10^{-11}[\mathrm{m}]}$$
$$=3.1838012\times10^{-44}$$

$$n_{\mathrm{earth}}=\frac{6.67\times10^{-11}[\mathrm{m}^{3}\cdot\mathrm{s}^{-2}\cdot\mathrm{kg}^{-1}]\times7.3223854\times10^{24}[\mathrm{kg}]}{463.596^2[\mathrm{m}^{2}\cdot\mathrm{s}^{-2}]\times6378137[\mathrm{m}]}$$
$$=356.2912966$$

As described above, the value of the number of members of the force depicted through Newtonian theory is found to be far from “1”. This tells us that his theory is valid only for certain areas and does not cover any other areas, especially with regard to the micro-world. It must be said that this theory is not a universal model.
This is also true for Coulomb’s law [6]. Let us examine its accuracy by applying Junichi Hashimoto’s law in the same manner as before.
Coulomb’s law is expressed by the following equation.

$$F=k\frac{Q_1 Q_2}{l^2}\ [\mathrm{N}] \quad —⑥$$

k represents the proportionality constant (9.0×10^{9} [$\mathrm{N}\cdot\mathrm{m}^{2}\cdot\mathrm{C}^{-2}$]), Q_1 and Q_2 represent the charge, and l represents the distance. The constant part here is k. The subjects used in the calculations are hydrogen atoms and their internal components. Hence, the amount of charge they carry is equal to the electric elementary quantity ($\mathrm{e}=1.6021766\times10^{-19}$ [C]). With this in mind, let us substitute equation ① into equation ⑥ to derive a relational expression for the number of members of the force drawn through Coulomb’s law. The process is as follows.

$$k[\mathrm{kg \cdot m \cdot s^{-2} \cdot m^2 \cdot C^{-2}}] = \frac{1}{i}[\mathrm{m \cdot s^{-1}}] \times m[\mathrm{kg}] \times l^2[\mathrm{m^2}] \times \frac{1}{t}[\mathrm{s^{-1}}] \times \frac{1}{\mathrm{e}^2}[\mathrm{C^{-2}}]$$

$$= nv[\mathrm{m \cdot s^{-1}}] \times m[\mathrm{kg}] \times l^2[\mathrm{m^2}] \times \frac{1}{t}[\mathrm{s^{-1}}] \times \frac{1}{\mathrm{e}^2}[\mathrm{C^{-2}}]$$

$$= \frac{nv \times vt \times l \times m}{t\mathrm{e}^2} \ [\mathrm{m^3 \cdot s^{-2} \cdot kg \cdot C^{-2}}]$$

$$= \frac{nv^2 lm}{\mathrm{e}^2} \ [\mathrm{m^3 \cdot s^{-2} \cdot kg \cdot C^{-2}}]$$

$$k\mathrm{e}^2[\mathrm{kg \cdot m \cdot s^{-2} \cdot m^2 \cdot C^{-2} \cdot C^2}] = nv^2 lm[\mathrm{m^3 \cdot s^{-2} \cdot kg}]$$

$$n = \frac{k\mathrm{e}^2}{v^2 lm} \ \frac{[\mathrm{kg \cdot m^3 \cdot s^{-2}}]}{[\mathrm{kg \cdot m^3 \cdot s^{-2}}]} (=[1]) \qquad —⑦$$

Now, let us substitute each specific value into formula ⑦ and calculate the value of the number of parties that make up the hydrogen atom. The process is as follow.

$$n = \frac{9.0 \times 10^9[\mathrm{kg \cdot m^3 \cdot s^{-2} \cdot C^{-2}}] \times (1.6021766 \times 10^{-19})^2[\mathrm{C^2}]}{299792458^2[\mathrm{m^2 \cdot s^{-2}}] \times 3.90206 \times 10^{-11}[\mathrm{m}] \times 1.674 \times 10^{-27}[\mathrm{kg}]}$$
$$= 3.9352513 \times 10^{-8}$$

As described above, the number of parties per hydrogen atom depicted by this law is also found to be far from “1”. Coulomb’s law also cannot be a universal law.

In this light, it can be said that the cause of the hierarchy problem lies precisely in this point. Neither law has a universal counterpart that can cover all physical phenomena. Therefore, it becomes apparent that the behavior of objects in the macro-world can be described to a point, but that of the micro-world cannot be addressed. Therefore, to solve this problem, we need to discard those old models and build a completely new framework.

That completely new framework is the relational physics I founded and its derivative, Junichi Hashimoto’s law.

These frameworks stand on the idea that the relationship between objects is energy or force (remote theory). The following two equations were formulated based on such a concept.

$$F = \mathrm{k_b} \frac{\pi l^2}{nm} \ [\mathrm{N}] \qquad —⑧$$

$$F = \mathrm{k_a} \frac{1}{l\mathrm{c}^2} \ [\mathrm{N}] \qquad —⑨$$

Equation ⑧ is a model that can handle gravity, and equation ⑨ is a model that can handle electromagnetic forces, but both were unified in relational physics [7]. This tells us that gravity and electromagnetic force are the same force. This is because both have in common that they are relationships between objects. Now let us verify this with actual calculations. In the equations, $\mathrm{k_b}$ represents the gravitational constant (value is 10^{-13}, unit is $[\mathrm{kg^2 \cdot m^{-1} \cdot s^{-2}}]$), $\mathrm{k_a}$ represents the electromagnetic force constant (value is 1, unit is $[\mathrm{kg \cdot m^4 \cdot s^{-4}}]$), l represents distance, n

represents the number of parties, *m* represents mass and c represents the speed of light. Here, I would like to calculate the gravitational and electromagnetic forces between proton and electron in a hydrogen atom (please refer to my previous papers for details of each value). They are as follows.

$$
\begin{aligned}
F &= \mathrm{k_b}\frac{\pi l^2}{nm} \\
&= \frac{10^{-13}[\mathrm{kg^2 \cdot m^{-1} \cdot s^{-2}}]\times 3.14\times(3.90206\times10^{-11})^2[\mathrm{m^2}]}{1\times(1.674\times10^{-27})[\mathrm{kg}]} \\
&= 2.8560255\times10^{-7}\,[\mathrm{N}]
\end{aligned}
$$

$$
\begin{aligned}
F &= \mathrm{k_a}\frac{1}{l\mathrm{c}^2} \\
&= \frac{1[\mathrm{kg\cdot m^4 \cdot s^{-4}}]\times 1}{(3.90206\times10^{-11})[\mathrm{m}]\times 299792458^2[\mathrm{m^2 \cdot s^{-2}}]} \\
&= 2.851443\times10^{-7}\,[\mathrm{N}]
\end{aligned}
$$

As described above, both solutions agreed with a high degree of accuracy. The unification of gravitational and electromagnetic force, which had never before been seen by any human being, was realized here. It is all thanks to the universality and versatility of the relational model.
Now, let us apply Junichi Hashimoto's law to those models and see how close to "1" the number of parties can be. The first thing we must do is to establish a variant of the gravitational constant equation (gravity model) and a variant of the electromagnetic force constant equation (electromagnetic force model), respectively. To do so, it is sufficient to substitute the constant part of equation ⑧ and the constant part of equation ⑨ into equation ①, respectively.
First, let us establish the gravity model. The constant part of equation ⑧ is $\mathrm{k_b}$. The following process gives a variant of the gravitational constant equation.

$$
\begin{aligned}
\mathrm{k_b}[\mathrm{kg^2 \cdot m^{-1} \cdot s^{-2}}] &= \frac{1}{i}[\mathrm{m\cdot s^{-1}}]\times m^2[\mathrm{kg^2}]\times\frac{1}{l^2}[\mathrm{m^{-2}}]\times\frac{1}{t}[\mathrm{s^{-1}}]\times\frac{1}{\pi}[1] \\
&= nv[\mathrm{m\cdot s^{-1}}]\times m^2[\mathrm{kg^2}]\times\frac{1}{l^2}[\mathrm{m^{-2}}]\times\frac{1}{t}[\mathrm{s^{-1}}]\times\frac{1}{\pi}[1] \\
&= \frac{nvm^2}{\pi l^2 t}\ [\mathrm{kg\cdot m\cdot s^{-1} \cdot m^{-2} \cdot s^{-1}}] \\
n &= \frac{\mathrm{k_b}\pi l^2 t}{vm^2}\ [\mathrm{kg^2 \cdot m\cdot s^{-1} \cdot m^{-1} \cdot s\cdot kg^{-2}}]\ (=[1]) \qquad \text{—⑩}
\end{aligned}
$$

Next, let us establish the electromagnetic force model. The constant part of equation ⑨ is $\mathrm{k_a}$. The following process gives a variant of the electromagnetic force constant equation.

$$
\mathrm{k_a}[\mathrm{kg\cdot m^4 \cdot s^{-4}}] = \frac{1}{i}[\mathrm{m\cdot s^{-1}}]\times m[\mathrm{kg}]\times \mathrm{c}^2[\mathrm{m^2 \cdot s^{-2}}]\times\frac{l}{t}[\mathrm{m\cdot s^{-1}}]
$$

$$= nv[\mathrm{m \cdot s^{-1}}] \times m[\mathrm{kg}] \times \mathrm{c}^2[\mathrm{m^2 \cdot s^{-2}}] \times \frac{l}{t}[\mathrm{m \cdot s^{-1}}]$$

$$= \frac{nmv\mathrm{c}^2 l}{t} \ [\mathrm{kg \cdot m^4 \cdot s^{-4}}]$$

$$n = \frac{\mathrm{k_a} t}{mv\mathrm{c}^2 l} \ \frac{[\mathrm{kg \cdot m^4 \cdot s^{-3}}]}{[\mathrm{kg \cdot m^4 \cdot s^{-3}}]} \ (=[1]) \qquad \text{—⑪}$$

Thus, both models were established. The t in those equations is a physical quantity specific to those models and represents the relationship conclusion period (stability duration). It can almost be considered to represent the age of an object, although strictly speaking it is a different concept. Now, I would like to move on to specific calculations. First, let us calculate the number of parties of hydrogen atom using formula ⑩. Here, for convenience, the value of t is set to $1.7571712 \times 10^{-12}$. The following process gives the result of the calculation.

$$n_{\mathrm{hydrogen}} = \frac{\mathrm{k_b} \pi l^2 t}{vm^2}$$

$$= \frac{10^{-13}[\mathrm{kg^2 \cdot m^{-1} \cdot s^{-2}}] \times 3.14 \times (3.90206 \times 10^{-11})^2 [\mathrm{m^2}] \times (1.7571712 \times 10^{-12})[\mathrm{s}]}{299792458[\mathrm{m \cdot s^{-1}}] \times (1.674 \times 10^{-27})^2 [\mathrm{kg^2}]}$$

$$= 1.000000001$$

Next, let us calculate the number of parties of hydrogen atom using equation ⑪. Here, for convenience, the value of t is set to $1.7599953 \times 10^{-12}$. The following process gives the result of the calculation.

$$n_{\mathrm{hydrogen}} = \frac{\mathrm{k_a} t}{mv\mathrm{c}^2 l}$$

$$= \frac{1[\mathrm{kg \cdot m^4 \cdot s^{-4}}] \times (1.7599953 \times 10^{-12})[\mathrm{s}]}{(1.674 \times 10^{-27})[\mathrm{kg}] \times 299792458[\mathrm{m \cdot s^{-1}}] \times 299792458^2 [\mathrm{m^2 \cdot s^{-2}}] \times (3.90206 \times 10^{-11})[\mathrm{m}]}$$

$$= 1.000000006$$

Thus, using either model, it was derived that the number of parties constituting one hydrogen atom is “1”. This tells us that proton and electron form a stable relationship as one ordered body. At the same time, it suggests the versatility of relational physics, which can quantify it cleanly. This also convinces us through calculations on other objects. Please see Table 1 and 2 (the source of each number and the calculation method are detailed in my previous papers).

	Distance to Earth	Orbital speed	Mass of an ideal celestial body with distance to Earth as radius	Relationship conclusion period (common to gravity model electromagnetic force model)	Number of parties composed with the earth
Moon	384400000[m]	1022.625826[m/s]	1.6029545×10^{30}[kg]	5.6632109×10^{58}[s]	1

Table 1: Moon-Earth Relationship

	Distance to Sun	Orbital speed	Mass of an ideal celestial body with distance to the sun as radius	Relationship conclusion period (common to gravity model electromagnetic force model)	Number of parties composed with the sun
Earth	149597828677[m]	29780[m/s]	9.4481531×10^{37}[kg]	3.783017×10^{70}[s]	1
Neptune	4504450460604[m]	5440[m/s]	2.5792682×10^{42}[kg]	5.6803962×10^{75}[s]	1

Table 2: Solar and Planetary Relationships

As you can see, the relational model can be applied to any object, both in the macro and micro worlds. In the next section, we will examine whether it can be extended to strong and weak forces.

Discussion

The relational model was originally created to formulate electromagnetic forces, gravity, and light. However, since strong and weak forces are also relationships between objects, the concept should be applicable. To achieve this, the relational model must be successfully operationalized to fit the characteristics of strong and weak forces and specific experimental values. The question is how to concisely model these forces, whose reality is still not well understand even in modern physics.

First, then, let us look at the strong force (nuclear force). According to the literature, it is the energy that causes subatomic particles to combine with each other in a very small region inside the nucleus (radius of about 10^{-15}[m]). For example, when four of them (two protons and two neutrons) are combined, they form a helium nucleus (represented as ^{4}He). An experiment to measure its combining energy yielded a value of -28.3[MeV] [8].

Based on these facts, I would like to consider nuclear force. From there, let us operationalize the relational model to be consistent with the experimental values. The form used for the calculation is a variant of equation ⑨. This is because the joule or electron volt is commonly used as the unit of measurement for the strength of nuclear force. The formula is as follows.

$$E = k_a \frac{L_H}{lc^2} \text{ [J]} \quad \text{—⑫}$$

E represents the combining energy, L_H represents the range of foundation of the nuclear force, and l represents the distance between particles (distance between midpoints). Now let us calculate the combining energy of ^{4}He . To do this, we must first derive both radii from the masses of both neutron and proton.

In relational physics, they can be calculated using the following equation.

$$m = \frac{\pi l^3 c^2}{Jn} \text{ [kg]} \quad —⑬$$

J represents the Junichi constant (the value is always 10^{13}, the unit is Sakura = [m^5・kg^{-1}・s^{-2}]). The neutron has a mass of $1.67492728 \times 10^{-27}$[kg] and the proton has a mass of $1.67262171 \times 10^{-27}$[kg] [9]. Let us calculate each of them after transforming equation ⑬. The radius value is given by the following process.

$$l^3_{\text{neutron}} = \frac{mJn}{\pi c^2}$$

$$= \frac{1.67492728 \times 10^{-27}[\text{kg}] \times 10^{13}[\text{m}^5 \cdot \text{kg}^{-1} \cdot \text{s}^{-2}] \times 1}{3.14 \times 299792458^2[\text{m}^2 \cdot \text{s}^{-2}]}$$

$$= 5.93505711 \times 10^{-32} \text{ [m}^3\text{]}$$

$$l_{\text{neutron}} = 3.90069177 \times 10^{-11} \text{ [m]}$$

$$l^3_{\text{proton}} = \frac{mJn}{\pi c^2}$$

$$= \frac{1.67262171 \times 10^{-27}[\text{kg}] \times 10^{13}[\text{m}^5 \cdot \text{kg}^{-1} \cdot \text{s}^{-2}] \times 1}{3.14 \times 299792458^2[\text{m}^2 \cdot \text{s}^{-2}]}$$

$$= 5.92688739 \times 10^{-32} \text{ [m}^3\text{]}$$

$$l_{\text{proton}} = 3.898901156 \times 10^{-11} \text{ [m]}$$

Thus, the radii of neutron and proton were determined. Those information are extremely important. This is because when four of them are combined, they form the range of foundation of the nuclear force. Figure 1 is a simplified schematic diagram of such a range at a glance.

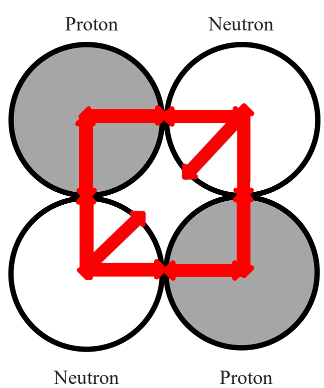

Figure 1: The Range of Foundation of the Nuclear Force (Helium)

The red arrows in the figure represent the relationship formed by the adjacency of both proton and neutron radii, while the number of them in the helium nucleus is 10. Why 10 and not 12? This is because, as can be seen in the diagram, there are no force arrows between the protons. Relational physics states that there is no attraction between objects with exactly the same individuality because they are in "unrelated space". Hence, since no nuclear force is generated between the protons and each other, that part is excluded from the range of foundation of the nuclear force. That is why there are 10 arrows.
Now, with these assumptions in mind, let us calculate the range of foundation of the nuclear force of the helium nucleus. The value is given by the following process.

$$
\begin{aligned}
L_{\mathrm{H}} &= \{6\times(3.90069177\times10^{-11})[\mathrm{m}]\}+\{4\times(3.898901156\times10^{-11})[\mathrm{m}]\} \\
&= 3.89997552\times10^{-10}\ [\mathrm{m}]
\end{aligned}
$$

Now, let us calculate the nuclear force in ^{4}He using equation ⑫. The value of l is defined as 9.57025837×10^{-16}[m] for convenience. The solution is given by the following process.

$$
\begin{aligned}
E &= \mathrm{k_a}\frac{L_{\mathrm{H}}}{l\mathrm{c}^2} \\
&= \frac{1[\mathrm{kg\cdot m^4\cdot s^{-4}}]\times(3.89997552\times10^{-10})[\mathrm{m}]}{(9.57025837\times10^{-16})[\mathrm{m}]\times299792458^2[\mathrm{m^2\cdot s^{-2}}]} \\
&= 4.5341597\times10^{-12}\ [\mathrm{J}] \\
&= 28.2998497\ [\mathrm{MeV}]
\end{aligned}
$$

Thus, the calculated result is in agreement with the experimental value. This is nuclear force as an attractive force. Although the experiment introduces the value as a repulsive force, the flip side of it is an attractive force, so the result of this calculation is a reasonable value. This proves that the electromagnetic and nuclear forces are the same force, since the nuclear force was successfully calculated using the model of the electromagnetic force.
Now, let us see if we can calculate the same value using a model of gravity. The formula used in the calculation is a variant of equation ⑧. The formula is as follows.

$$E = \mathrm{k_b}\frac{\pi l^2 L_{\mathrm{H}}}{nm}\ [\mathrm{J}] \qquad \text{—⑭}$$

The important question here is what object mass value should be applied to m in the equation. As it turns out, it is the mass value of the "prime element". An prime element is an ordered body made up of two even smaller fundamental particles that make up a proton or neutron (Figure 2).

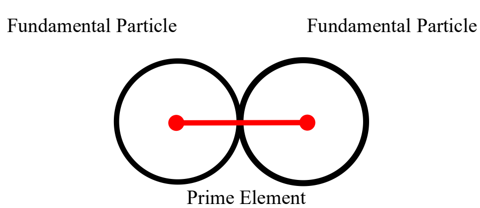

Figure 2 : One prime element composed of two fundamental particles

Before that can be determined, the mass value of the fundamental particle must first be established as a prerequisite. Determining its mass value is equivalent to creating a new physical constant. This is the "fundamental particle constant", so to speak. Only with this understanding is the unification of gravitational and nuclear forces possible. This concept of fundamental particle constant also allows for the unification of strong and weak forces. In that context, the value of the distance between midpoints used in the previous calculation, 9.57025837×10^{-16}[m], is equal to the diameter value of the "fundamental particle". Hence, the radius value (4.78512×10^{-16}[m]), which is half of it, is exactly the "fundamental particle constant". Therefore, the mass value of the fundamental particle is 3.09207×10^{-42} [kg], which is also one of the "fundamental particle constants".

It is reasonable to calculate the mass of prime elements by treating them as "one coherent ordered body whose radius is the distance between midpoints", rather than by doubling the mass of the fundamental particles.

Now, let us substitute each value into equation ⑭ to calculate the nuclear force in ^{4}He. The process is as follows.

$$E = \mathrm{k_b}\frac{\pi l^2 L_{\mathrm{H}}}{n\left(\dfrac{\pi l^3 \mathrm{c}^2}{\mathrm{J}n}\right)}$$

$$= \frac{10^{-13}[\mathrm{kg^2{\cdot}m^{-1}{\cdot}s^{-2}}]\times3.14\times(9.57025837\times10^{-16})^2[\mathrm{m^2}]\times(3.89997552\times10^{-10})[\mathrm{m}]}{1\times\left(\dfrac{3.14\times(9.57025837\times10^{-16})^3[\mathrm{m^3}]\times299792458^2[\mathrm{m^2{\cdot}s^{-2}}]}{10^{13}[\mathrm{m^5{\cdot}kg^{-1}{\cdot}s^{-2}}]}\right)}$$

$$= \frac{10^{-13}[\mathrm{kg^2{\cdot}m^{-1}{\cdot}s^{-2}}]\times3.14\times(9.57025837\times10^{-16})^2[\mathrm{m^2}]\times(3.89997552\times10^{-10})[\mathrm{m}]}{1\times(2.47367159\times10^{-41})[\mathrm{kg}]}$$

$$= 4.5341597\times10^{-12}\ [\mathrm{J}]$$
$$= 28.2998497\ [\mathrm{MeV}]$$

As described above, the solution is consistent with the experimental values. This tells us that nuclear force and gravity are the same force.

Finally, let us consider weak forces. It is said to be the force that acts when the particles (neutrons or protons) that make up the nucleus of an atom in a material undergo beta decay to form another particle. For example, it is known that when a neutron undergoes beta decay, it emits one electron and one antielectron neutrino and turns into a proton [10]. The force that causes it is considered to be a weak force. The energy of the beta rays emitted by beta decay has been measured experimentally and averages 5.7 [KeV] [11]. Beta rays are the flow of electrons flying through space and can also be described as electron beams. In relational physics, a particle beam is interpreted as a phenomenon in which the relationship between the particle in question and the object to which it flies changes. In other words, the ability to do so can be quantified as energy. Therefore, the energy of beta radiation can also be calculated using the relational model.

Let us take tritium (^{3}H) as an example and calculate the energy of beta rays emitted from its nucleus. The model used for this is a variant of equation ⑧. It is expressed in the following form.

$$E = \mathrm{k_b} \frac{\pi l^2 L_\mathrm{T}}{n m_\mathrm{e}} \ [\mathrm{J}] \qquad —⑮$$

In the equation, l is the radius of the electron and m_e is the mass of the electron (each value is described in detail in my previous papers).

L_T represents the foundation range of the electron beam energy of tritium, but the question is how to make a decision about its value. Since it presents a force base range to determine the unique value of each nuclide, it must be considered that the range also changes depending on the number of nucleons gathered. It is exactly the same as it was in the determination of the range of foundation of strong forces. The nucleus of tritium is formed by two neutrons and one proton (one of those two neutrons turns into a proton). Hence, the schematic diagram for that nucleon is expressed as follows (Figure 3).

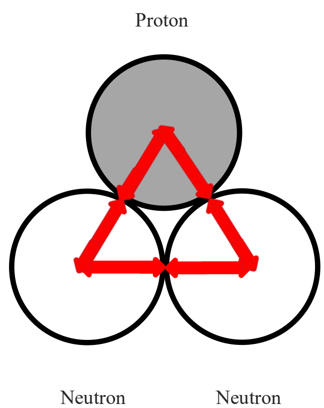

Figure 3: The Foundation Range of the Electron Beam Energy (Tritium)

By summing the number of red arrows in the figure, the value of the foundation range of beta-ray energy can be calculated. The formula is as follows.

$$\begin{aligned} L_\mathrm{T} &= \{4 \times (3.90069177 \times 10^{-11})[\mathrm{m}]\} + \{2 \times (3.898901156 \times 10^{-11})[\mathrm{m}]\} \\ &= 2.34005694 \times 10^{-10} \ [\mathrm{m}] \end{aligned}$$

Now each value is available. Let us substitute them into equation ⑮ and calculate the energy of beta radiation emitted as a result of beta decay of tritium. The process is as follows.

$$E = \mathrm{k_b} \frac{\pi l^2 L_\mathrm{T}}{n m_\mathrm{e}}$$

$$= \frac{10^{-13}[\text{kg}^2\cdot\text{m}^{-1}\cdot\text{s}^{-2}]\times 3.14\times(3.1858\times10^{-12})^2[\text{m}^2]\times(2.34005694\times10^{-10})[\text{m}]}{1\times(9.109\times10^{-31})[\text{kg}]}$$
$$= 8.18695469\times10^{-16}\ [\text{J}]$$
$$= 5.10989\ [\text{KeV}]$$

Thus, the calculated result is in close agreement with the experimental values.
Let us also calculate a variant of equation ⑨. The process is as follows.

$$E = \text{k}_\text{a}\frac{L_\text{T}}{lc^2}$$
$$= \frac{1[\text{kg}\cdot\text{m}^4\cdot\text{s}^{-4}]\times(2.34005694\times10^{-10})[\text{m}]}{(3.1858\times10^{-12})[\text{m}]\times 299792458^2[\text{m}^2\cdot\text{s}^{-2}]}$$
$$= 8.18695469\times10^{-16}\ [\text{J}]$$
$$= 5.10989\ [\text{KeV}]$$

Thus, it was confirmed that the values are the same in both models.
However, those values are only average beta ray energy values calculated for the average foundation range in tritium. In fact, it is known to take different energy values in different experiments.
So why do beta-ray energies have different energy values each time they are tested? To answer that question, we must have a deep understanding of the properties of the aforementioned fundamental particles and how they relate to the weak force and particle beam energy.
First, the fundamental particle is a common building block that exists inside both protons and neutrons. In this respect, it is believed that the strong force is formed because the outermost fundamental particles in the proton and the outermost fundamental particles in the neutron are attracted to each other. And it is the position of relational physics to see that in order for fundamental particles to attract each other, they must have different individual characteristics. If so, in view of the interaction of fundamental particles, it follows that there are theoretically more than two types of fundamental particles.
How they are distributed in neutrons and protons, and how many of them exist, is currently unknown. Theoretically, however, the two types of fundamental particles with opposite individuality are expected to be distributed evenly and tightly packed in both nucleons. This is because it is natural to think that such a longitudinal and transverse chain of fundamental particles forms the foundation range of the strong and weak forces across nucleons.
The energy that binds them together is the strong force and the weak force, but the two differ in the range of foundation from which they are spun. Strong forces are stable and less likely to disrupt the bonding state because it is wide. Weak forces, on the other hand, are unstable because of their narrow range and tend to disrupt the bonded state. This leads to the emission of beta radiation.
So, why does the same nuclide (e.g., tritium) have different beta-ray energy values each time it is tested? I say this because, ultimately, any force or energy, including weak forces, is a pulse. In relational physics, energy is considered to be a pulse [12].
Relationships between objects are pulsed by alternating “connection” and “disconnection” of energy with infinite transmission velocity. This cannot be explained by the proximity theory. It is a phenomenon that can only be understood from the standpoint of the remote theory.

In relational physics, the force is viewed as an inter-individuality attractive force, which leads to the following formulation.

$$F = \mathrm{k_a}\frac{i^2}{l}\ [\mathrm{N}] \qquad ⑯$$

i^2 represents the individuality of both parties in harmony and can be replaced by $1/(nv)^2$. This is because individuality is inversely proportional to the speed of rotation of an object. Expressing this and further transforming it into an equation that can deal with energy, we get the following form.

$$E = \mathrm{k_a}\frac{L}{n^2 v^2 l}\ [\mathrm{J}] \qquad ⑰$$

The rotation of the two objects is synonymous with repeatedly showing their front and back sides to the other. It means that force is created when they show (relate to) each other's characteristics in a cyclical, front-to-back, front-to-back, and so on. In doing so, the relationship (energy) between the two also becomes pulsatile, as in dense, thin, dense, thin, and so on, pulled along by their rotational rhythmic motion. From here, the concept of "equivalence of rotation and pulse" is derived. If so, the concept of "equivalence between rotation period and pulse interval" is also derived logically and inevitably from this.
Now let us express this in the form of an equation. To do so, we must first understand the equivalence of rotation and revolution. This has already been proven in my past research.
We know that the solar system model and the atomic model operate by the same mechanism, and that one revolution of a hydrogen atom is equivalent to one revolution of an electron inside it around one proton [13]. These very facts prove the equivalence of rotation and revolution. Therefore, by incorporating the equation for the rotation law common to the solar system and atomic model into equation ⑰, we can derive an equation relating the pulse interval to the rotation motion. The following expression is used for substitution.

$$n = n_\mathrm{c}\frac{2\pi l}{vt} \qquad ⑱$$

n represents the number of parties, n_c represents the number of revolutions, $2\pi l$ represents the circumference length, v represents the rotational speed, and t represents the rotational period (this formula has already been validated by applying Junichi Hashimoto's law).
Now let us substitute equation ⑱ into equation ⑰. The following process gives an equation that can describe the pulse interval.

$$E = \mathrm{k_a}\frac{L}{\left(n_\mathrm{c}\times\frac{2\pi l}{vt}\right)^2 v^2 l}$$

$$= \frac{\mathrm{k_a} L}{\left(n_{\mathrm{c}}^2 \times \frac{4\pi^2 l^2}{v^2 t^2}\right) v^2 l} \quad \frac{[\mathrm{kg} \cdot \mathrm{m}^4 \cdot \mathrm{s}^{-4} \cdot \mathrm{m}]}{[\mathrm{m}^2 \cdot \mathrm{m}^{-2} \cdot \mathrm{s}^2 \cdot \mathrm{s}^{-2} \cdot \mathrm{m}^2 \cdot \mathrm{s}^{-2} \cdot \mathrm{m}]}$$

$$= \frac{\mathrm{k_a} L}{\left(\frac{4 n_{\mathrm{c}}^2 \pi^2 l^3}{t^2}\right)} \quad \frac{[\mathrm{kg} \cdot \mathrm{m}^5 \cdot \mathrm{s}^{-4}]}{[\mathrm{m}^3 \cdot \mathrm{s}^{-2}]}$$

$$= \frac{\mathrm{k_a} L t^2}{4 n_{\mathrm{c}}^2 \pi^2 l^3} \quad \frac{[\mathrm{kg} \cdot \mathrm{m}^5 \cdot \mathrm{s}^{-2}]}{[\mathrm{m}^3]}$$

$$4 E n_{\mathrm{c}}^2 \pi^2 l^3 [\mathrm{kg} \cdot \mathrm{m}^2 \cdot \mathrm{s}^{-2} \cdot \mathrm{m}^3] = \mathrm{k_a} L t^2 [\mathrm{kg} \cdot \mathrm{m}^5 \cdot \mathrm{s}^{-2}]$$

$$t^2 = \frac{4 E n_{\mathrm{c}}^2 \pi^2 l^3}{\mathrm{k_a} L} \quad \frac{[\mathrm{kg} \cdot \mathrm{m}^5 \cdot \mathrm{s}^{-2}]}{[\mathrm{kg} \cdot \mathrm{m}^4 \cdot \mathrm{s}^{-4} \cdot \mathrm{m}]}$$

$$t = \sqrt{\frac{4 E n_{\mathrm{c}}^2 \pi^2 l^3}{\mathrm{k_a} L}} \ [\mathrm{s}] \qquad -⑲$$

As described above, the equation for the pulse interval is now complete.
So what happens when an object is connected to an object by a pulse? The following can be said.
The weak force, as well as the strong capturing force of the nuclear force, is a pulse, which means that there will be a temporal and spatial gap, albeit momentary, in the energy connecting the objects. It is during the “disconnection” of the “connection” and “disconnection”.
If they were timed in unison over a certain area on the surface of the nucleus, the force that could hold a single particle in the nucleus would be lost.
Now, based on these assumptions, let us consider beta decay in detail. Radionuclides, grouped by binding energy, are supported by the fragility of pulse. Therefore, in some cases, “disconnection” states can emerge simultaneously over a certain area. This is the moment when beta decay occurs and the leaving particle is ejected. It is not easy to computationally clarify the timing of such a phenomenon because of the large number of particles involved, but unlike quantum theory, it is not impossible in principle to determine the timing of the phenomenon. Indeed, the pulses as binding energy are alternately “connection” and “disconnection” in cycles very close to zero seconds, so it is rare for many particles to be “disconnection” all at the same time. However, it is too early to assume that such phenomena can only be understood in terms of probability. There is room for them to be revealed deterministically by calculation. The reason for the variation in beta-ray energy values in each experiment is that the range of binding vacancies that occur simultaneously within the frame of the nucleus of a radionuclide (e.g., tritium) is different each time. In short, the foundation range that spins the weak force is, by its very nature, constantly changing, which is why various particle beam energy values are detected in each experiment. On the other hand, the foundation range that spins the strong force does not fluctuate much by its nature and can make the nucleus stable. This is why helium nuclei (alpha particles) do not decay further.
Alpha decay [14] is a phenomenon that occurs within the nuclei of elements in the heaviest category. Decay occurs, of course, because of the loss of the fragility-infused force coupling, but in addition, there are other causes of decay that are unique to alpha decay. It is the high proton content in the nucleus. The elements that decay all have protons exceeding 60 % of the total number of nucleons. Since the protons are electrically co-polar by nature, their bonding is no

longer a vulnerability, but a void itself. That, combined with the pulsatility of the weak force, is what causes alpha decay. The difference between alpha and beta decay lies in the difference in the foundation range of the binding energy that unites the emitted particles. The alpha particle itself does not decay because the alpha decay is broad in its scope and so strongly clustered together. Beta decay decays into electron and antielectron neutrino because the “leaving particle”, discussed below, has only a very small foundation range. That is the difference between alpha decay and beta decay. However, they are exactly the same in that the binding vulnerability of the pulse is the trigger for the decay.

Finally, let us consider the mechanism of repulsion. To explain this clearly, let us try a thought experiment. It is as follows. Two magnets are prepared and placed in series with the same poles facing each other. Place them in a vise, clamping them from both ends. The vise is made of ice. After a certain period of time, the ice melts. The magnets will then be released from both sides, and should pop out with great force. In a sense, this is “repulsion”. However, this was only possible because of the external force of the vise that held it down, and not because of the inherent power of the magnet. This is the view of relational physics. In other words, first of all, there are cases in which the same poles (objects with the same individuality) are held together from the surroundings for some reason, creating the appearance of an indirect bond between the two, and the apparent force generated by the release of the hold is the “repulsion”. Because of the attracting forces at work around them, originally unrelated objects are (indirectly) bound to each other, but when the binding is removed, they move away from each other in order to return to their original relationship. That just makes it look like a repulsion. The same is true for particle emissions associated with radioactive decay. Protons or fundamental particles of the same pole can be bound to each other because a strong nuclear force around them holds them all together. At the same time, however, somewhere in the nucleus, the binding fragility of the weak force is triggering the breaking apart of the bonds. Hence, depending on the timing, a decay will occur. Attraction and repulsion stand in such a relationship. Attraction can be converted to repulsion, but repulsion cannot be converted to attraction.

Well, by the way, given that the phenomenon of beta decay has the property of changing the mass of a particle, we can derive the radius and mass of the antielectron neutrino on that basis. When a neutron turns into a proton, there is a slight but significant mass difference. If we consider the difference to be a “leaving particle”, the electron and antielectron neutrino emitted in beta decay would be included there. In other words, they can be considered to be components of the leaving particle. If so, then from the mass and radius of the leaving particle, we can derive the radius and mass of the antielectron neutrino using equation ⑬. For leaving particle, mass value can be calculated using the following process.

$$\begin{aligned} m &= m_{\mathrm{N}} - m_{\mathrm{P}} \\ &= (1.67492728\times10^{-27})[\mathrm{kg}] - (1.67262171\times10^{-27})[\mathrm{kg}] \\ &= 2.30557\times10^{-30}\ [\mathrm{kg}] \end{aligned}$$

With the mass value known, the radius value can be calculated. The process is as follows.

$$\begin{aligned} l^3 &= \frac{m\mathrm{J}n}{\pi \mathrm{c}^2} \\ &= \frac{(2.30557\times10^{-30})[\mathrm{kg}]\times10^{13}[\mathrm{m}^5\cdot\mathrm{kg}^{-1}\cdot\mathrm{s}^{-2}]\times1}{3.14\times299792458^2[\mathrm{m}^2\cdot\mathrm{s}^{-2}]} \end{aligned}$$

$$= 8.16972162 \times 10^{-35}\ [\text{m}^3]$$

$$l = 4.33912758 \times 10^{-12}\ [\text{m}]$$

From this, let us find the diameter of the leaving particle. The process is as follows.

$$2l = 2 \times (4.33912758 \times 10^{-12})\ [\text{m}]$$
$$= 8.67825516 \times 10^{-12}\ [\text{m}]$$

Thus, the diameter of the leaving particle was determined. If the length of one electron (electron diameter) is subtracted from that length, then the remaining length is the diameter of the antielectron neutrino. Relational physics defines the diameter of an electron as 6.3716×10^{-12}[m]. Therefore, the following calculation process gives the values of the diameter and radius of the antielectron neutrino.

$$2l = (8.67825516 \times 10^{-12})[\text{m}] - (6.3716 \times 10^{-12})[\text{m}]$$
$$= 2.30665516 \times 10^{-12}\ [\text{m}]$$

$$l = 1.15332758 \times 10^{-12}\ [\text{m}]$$

This is the radius value of the antielectron neutrino. Let us also derive the mass value from it. The process is as follows.

$$m = \frac{\pi l^3 \text{c}^2}{\text{J}n}$$
$$= \frac{3.14 \times (1.15332758 \times 10^{-12})^3 [\text{m}^3] \times 299792458^2 [\text{m}^2 \cdot \text{s}^{-2}]}{10^{13} [\text{m}^5 \cdot \text{kg}^{-1} \cdot \text{s}^{-2}] \times 1}$$
$$= 4.3294137 \times 10^{-32}\ [\text{kg}]$$

This is the mass value of the antielectron neutrino.

In this regard, there is also a pattern of beta decay in which a proton decays and turns into a neutron, emitting one positron and one electron neutrino in the process. However, the size, mass, and energy of the leaving particle and its two constituent particles in that case can be considered to be exactly the same as those described above, only the signs are reversed. This is because the positions of the proton and neutron in the equation are simply reversed.

Now, as mentioned earlier, it was found that the relational model can be applied to the calculation of particle beam energies associated with beta decay. However, it is only the energy of the electron beam, which is a different concept from the weak force itself.

So what exactly is a weak force? To answer that question, we must consider both strong and weak forces. In other words, it is important to understand the weak force in relation to the fundamental particles (fundamental particle constant), which were also introduced in the nuclear force calculation scene. Fundamental particles are even smaller particles that make up protons and neutrons. Relational physics takes the view that the nuclear force is generated by the attraction between the fundamental particles in the outermost shell of the proton and the fundamental particles in the outermost shell of the neutron to each other. In other words, there, the fundamental particles are involved in the formation of strong force. If so, we can assume that fundamental particles are also involved in the formation of weak forces.

Now, based on these ideas, let us express the weak force (binding energy of prime elements) interwoven by two fundamental particles in terms of calculation, using a variant of equation ⑧. The process is as follows.

$$E_{\mathrm{f}} = \mathrm{k_b}\frac{\pi l_{\mathrm{f}}^2 L_{\mathrm{f}}}{n m_{\mathrm{f}}}$$
$$= \frac{10^{-13}[\mathrm{kg}^2\cdot\mathrm{m}^{-1}\cdot\mathrm{s}^{-2}]\times 3.14\times(9.57025837\times10^{-16})^2[\mathrm{m}^2]\times(9.57025837\times10^{-16})[\mathrm{m}]}{1\times(2.47367159\times10^{-41})[\mathrm{kg}]}$$
$$= 1.11265\times10^{-17}\ [\mathrm{J}]$$

This is the quantitative degree of weak force. As can be seen from the above equation, the difference between strong and weak forces lies exclusively in the foundation range of the force. The former is more than five orders of magnitude larger than the latter, but that is the only difference. More importantly, if we focus on the fact that the model used is the same, we can obtain the same value for the weak force even if the values substituted into the equation are different. Let us calculate the energies for intra-hydrogen atom, and earth-sun, respectively (the details of each value can be found in my previous papers).

$$E_{\mathrm{hy}} = \mathrm{k_b}\frac{\pi l_{\mathrm{hy}}^2 L_{\mathrm{hy}}}{n m_{\mathrm{hy}}}$$
$$= \frac{10^{-13}[\mathrm{kg}^2\cdot\mathrm{m}^{-1}\cdot\mathrm{s}^{-2}]\times 3.14\times(3.90206\times10^{-11})^2[\mathrm{m}^2]\times(3.90206\times10^{-11})[\mathrm{m}]}{1\times(1.674\times10^{-27})[\mathrm{kg}]}$$
$$= 1.11443\times10^{-17}\ [\mathrm{J}]$$

$$E_{\mathrm{earth\text{-}sun}} = \mathrm{k_b}\frac{\pi l_{\mathrm{es}}^2 L_{\mathrm{es}}}{n m_{\mathrm{es}}}$$
$$= \frac{10^{-13}[\mathrm{kg}^2\cdot\mathrm{m}^{-1}\cdot\mathrm{s}^{-2}]\times 3.14\times 149597828677^2[\mathrm{m}^2]\times 149597828677[\mathrm{m}]}{1\times(9.4481531\times10^{37})[\mathrm{kg}]}$$
$$= 1.11265\times10^{-17}\ [\mathrm{J}]$$

As described above, the same energy values were obtained at different scales across the micro and macro worlds.

Those results tell us that the weak forces have a hierarchical structure at different scales. It is, so to speak, a self-similarity of weak forces. If such a feature is present in the weak force, it would be a nod to the fact that even if a particle decays and changes into another particle, the energy remains the same before and after. The law of conservation of energy holds true here as well. On the other hand, the mass value of the aforementioned leaving particle is different from the sum of the mass value of the electron and antielectron neutrino produced in beta decay. The latter is a smaller value than the former. This means that the law of conservation of mass does not hold here.

And all three calculations above were derived using the gravity model. This implies that gravity and the weak force are the same force.

Now let us move on to the verification process. Using equation ⑲, let us take a concrete object as an example and calculate the value of the pulse interval. For the subject matter, I would like to choose a weak force inside an prime element. The value is given by the following process.

$$
\begin{aligned}
t &= \sqrt{\frac{4En_c^2\pi^2 l^3}{\mathrm{k_a}L}} \\
&= \sqrt{\frac{4\times(1.11265\times10^{-17})[\mathrm{kg\cdot m^2\cdot s^{-2}}]\times1^2\times3.14^2\times(9.57025837\times10^{-16})^3[\mathrm{m^3}]}{1[\mathrm{kg\cdot m^4\cdot s^{-4}}]\times(9.57025837\times10^{-16})[\mathrm{m}]}} \\
&= 2.00476\times10^{-23}\ [\mathrm{s}]
\end{aligned}
$$

Next, let us calculate the pulse interval value of the strong force inside ${}^4\mathrm{He}$. The value is given by the following process.

$$
\begin{aligned}
t &= \sqrt{\frac{4En_c^2\pi^2 l^3}{\mathrm{k_a}L}} \\
&= \sqrt{\frac{4\times(4.5341597\times10^{-12})[\mathrm{kg\cdot m^2\cdot s^{-2}}]\times1^2\times3.14^2\times(9.57025837\times10^{-16})^3[\mathrm{m^3}]}{1[\mathrm{kg\cdot m^4\cdot s^{-4}}]\times(3.89997552\times10^{-10})[\mathrm{m}]}} \\
&= 2.004759\times10^{-23}\ [\mathrm{s}]
\end{aligned}
$$

As described above, the results of these calculations were in perfect agreement with the values. This provides evidence that the weak force and strong forces are the same force. The two are here the same in pulse interval, but they only manifest quantitative differences because of their different force foundation ranges.

Now, let us get into the total finish. I want to find the pulse interval value of the electromagnetic force between a proton and an electron in a hydrogen atom. The value is given by the following calculation process.

$$
\begin{aligned}
t &= \sqrt{\frac{4En_c^2\pi^2 l^3}{\mathrm{k_a}L}} \\
&= \sqrt{\frac{4\times(1.11265\times10^{-17})[\mathrm{kg\cdot m^2\cdot s^{-2}}]\times1^2\times3.14^2\times(3.90206\times10^{-11})^3[\mathrm{m^3}]}{1[\mathrm{kg\cdot m^4\cdot s^{-4}}]\times(3.90206\times10^{-11})[\mathrm{m}]}} \\
&= \sqrt{6.68137\times10^{-37}[\mathrm{s^2}]} \\
&= 8.17397\times10^{-19}\ [\mathrm{s}]
\end{aligned}
$$

This is the proton-electron pulse interval value. This value is found to be consistent with the rotation period value of the hydrogen atom (equivalence of rotation and pulse).

Now, it is time for the final calculation. The subject chosen was the pulse interval value of the visible light beam between the Sun and Earth. Here, I would like to take red light as an example for the calculation. For convenience, let us set its energy value to 2.82123×10^{-19} [J]. The following process gives the pulse interval values for red light.

$$\begin{aligned}
t &= \sqrt{\frac{4En_c^2\pi^2 l^3}{\mathrm{k_a}L}} \\
&= \sqrt{\frac{4\times(2.82123\times10^{-19})[\mathrm{kg\cdot m^2\cdot s^{-2}}]\times1^2\times3.14^2\times149597828677^3[\mathrm{m^3}]}{1[\mathrm{kg\cdot m^4\cdot s^{-4}}]\times149597828677[\mathrm{m}]}} \\
&= \sqrt{249005.6355[\mathrm{s^2}]} \\
&= 499\ [\mathrm{s}] \\
&= 8.3\ [\mathrm{min}]
\end{aligned}$$

This only means that light with an infinite speed of arrival will periodically cycle between continuous arrival for 8.3 minutes and continuous interruption for 8.3 minutes, not that red light needs 8.3 minutes to reach the earth from the sun. In this case, while the light is interrupted, other colors of light, strong or weak, are still connecting the Sun-Earth, so there is no energy vacuum at all. In other words, light with different pulse intervals forms the entire sunlight spectrum (difference in pulse intervals determine difference in color).

Also, as can be seen from the equation, even if the size of the universe expands with the Big Bang and the values of l^3 and L increase, their ratio (l^3/L) is constant, so the pulse interval values are not affected. To begin with, if the universe is expanding, the values of l^3 and L must also be expanding, but there are no such observed facts. What I have described so far and the results of my calculations provide a strong argument in support of the steady-state universe theory.

Results

As we have seen above, the weak force turns out to be the same force as the gravitational force between the sun and the earth, the gravitational force between the proton and electron in a hydrogen atom, and so on. In the previous section, gravity was unified with electromagnetic force. Hence, the weak force and the electromagnetic force are also unified. And it was confirmed that weak and strong forces are the same force. Thus, under the relational model, all four forces of nature were unified.

Conclusion

Through the operation of the relational model, I have succeeded in unifying the four forces. I have not only succeeded in unifying the four forces, but also in unifying the micro and macro worlds. Because force and energy are pulses, they can combine or disconnect this world. In this respect, the micro and macro worlds are the same, but the range of the foundation on which the forces take place differs between them. The micro world is small in its stage range, and disconnection between object members is likely to occur. Quantum theory tries to explain this using the idea of probability. The macro world, on the other hand, has a large foundation range of forces, and such separation rarely occurs. There is no place for probability.

The success of relational physics has made that clear. In the future, it will make a significant contribution to other academic disciplines.

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