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Quantum Behavior of 10D Planck Unit: Stationary Electron, Compton Photon and Gravitational Field

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Abstract

This work focuses on the origin of electrons, Compton photons and a gravitational field. Based on the discovered 10D Planck units, the physical behavior of these units was further studied in isolated systems. Investigation shows that a 10D Planck unit in the in situ state has the same properties as a stationary electron, while its non-in situ state shares the same physics with a Compton photon. Results indicate that photons' potential exists between any two Compton photons, with their strength being determined by the distance between the two photons. Finally, the potential field was proved to be the gravitational field of a proton.

Keywords: Planck unit; symmetry; quantum gravity; electron; Compton photon

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1. Introduction

For a scientist specializing in fundamental physics, today might be an era fraught with deadlocks, progress, crises and hopes. It is widely acknowledged that the two issues about gravity, namely its non-incorporation with the Standard Model and non-unification with quantum mechanics, constitute the most serious deadlocks that current theoretical physics is confronted with [1–5]. Meanwhile, experimental physics has developed relatively smoothly and achieved remarkable results, including the observation of new elemental particles and the detection of the gravitational waves [6,7]. But these advances do not seem to have brought decisive breakthroughs in the corresponding field of theories, in view of the increasing number of approaches coexisting here [8–15]. Furthermore, an annihilating paradox about mass and anti-mass in a gravitational field is leading to a catastrophic crisis upon modern physics for its apparently unbalanced energy. Nevertheless, during the decades when scientists are seeking solutions in fundamental physics, two key factors of geometry and symmetry have gradually stood out and become recognized as sources of hope [16–20].

Carrying geometry and symmetry both, 10D Plank unit ${}^{10}\hat{p}$ has been established to open up a different path for quantization of gravity [21]. As briefed, the Planck length λ_P in the generalized Euclidean space determines that the space is a quasi-Euclidean space $\hat{\boldsymbol{P}}$, comprising uncertainty, UV cutoff $\overline{\lambda}_P$ ($\overline{\lambda}_P = \frac{\lambda_P}{2\pi}$), IR cutoff $\frac{{}^{n}\hat{p}}{\overline{\lambda}_P{}^{(n-1)}}$ and the most important structure of Planck unit with the minimum nD measure ${}^{n}\hat{p} = \overline{\lambda}_P^{n}$. Under control of symmetries, a Planck unit ${}^{n}\hat{p}$ should be in situ or on the nD flattened surface of an $(n+1)$D

Planck sphere ($r = \overline{\lambda}_P$), and these two states are usually separated by infinite potential barrier V_r^∞ (which forbids an object from any radial displacement to satisfy the rotational symmetry) until the special case about a 10D Planck unit $^{10}\hat{p}$ occurs in 10D space. Geometrical investigation demonstrates that $^{10}\hat{p}$ presents the inaugural instance wherein these dual states achieve topological connectivity and mutual transformability. Then, quantum mechanics proves that two dimensionless constants, including $\alpha_1 = \frac{(^{10}m)^{\frac{1}{4}}}{(2\pi)^4/9} = \frac{1}{137.036\ 082}$ and $\alpha_2 = \prod_1^6 \frac{1}{(2\pi)^n} \cdot \prod_7^{10} \frac{^n m}{(2\pi)^n/(n-1)} = \frac{1}{1.628 \times 10^{38}}$ (where ^{10}m is generalized 10D volume of a 10D sphere, and $^n m$ is nD measure of a generalized nD sphere in a system normalized by $\overline{\lambda}_P = 1$), dominate the transformation and result in two long-range interactions, which are consistent with the electromagnetism interaction and the gravity, respectively.

The above results distinguish the new path in three aspects. Firstly, no controversial hypotheses have been involved in the work, since its initial settings include only the Planck length and the symmetries of an nD Euclidean space. Obviously, both of the points come from experiments, instead of those coming from assumptions, such as a high-dimensional background space with a special structure, flat or curved. Secondly, no particle has been introduced into the system, since the minimum space structure behaves naturally as a particle. Besides the eternal contradiction between the background and the particles, such a presentation inherently leads to the unity of the space and the particle, guaranteeing the new method's philosophical consistence. Thirdly, and most crucially, the electromagnetic coupling constant and the gravitational constant are obtained as two geometrical ratios, indicating that the gravity has initially been quantized and unified with the electromagnetism interaction [21].

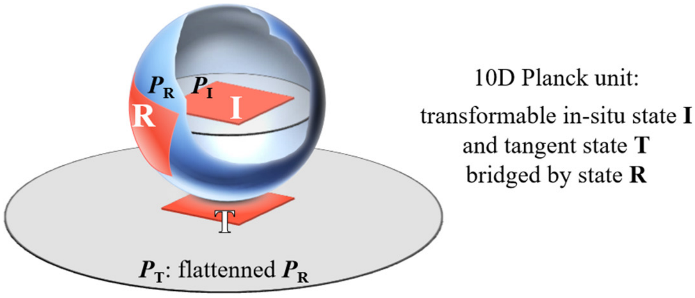
After the above investigation on geometry and quantum mechanics, here 10D Planck unit $^{10}\hat{p}$ has been further explored in isolated systems with conserved energy, and the obtained properties have been compared with those of an electron/Compton photon. Comparison identified them as the same and concluded the Compton photons' potential unexpectedly. Then, the field of the photons' potential was proved equal to the gravitational field of a proton.

2. Physical Behavior of 10D Planck Unit $^{10}\hat{p}$

2.1. $^{10}\hat{p}$: Doublet Candidates Due to the Incompatible Principles of RS↑ and E↓

As discovered, a 10D Planck unit $^{10}\hat{p}$ with rotational symmetry exists in three states, including in situ state **I**, revolving state **R** and tangent state **T** [21]. Geometry determines the space structures for these three states, including $\boldsymbol{P}_\mathbf{I}$ for state **I**, $\boldsymbol{P}_\mathbf{R}$ for state **R**, which is the 10D surface of 11D Planck sphere ($r = \overline{\lambda}_P$), and $\boldsymbol{P}_\mathbf{T}$ for state **T**, which is the flattened $\boldsymbol{P}_\mathbf{R}$ (Figure 1).

Among these spaces, $\boldsymbol{P}_\mathbf{I}$ and $\boldsymbol{P}_\mathbf{T}$ are of flatness, theoretically allowing the transformation $\mathbf{I} \rightleftharpoons \mathbf{T}$ when they are topologically bridged by state **R** [21]. To satisfy the two incompatible principles of the highest rotational symmetry (RS↑) and the minimum energy (E↓), $^{10}\hat{p}$ moves in two different ways inside $\boldsymbol{P}_\mathbf{I}$ or $\boldsymbol{P}_\mathbf{T}$ [21]. Therefore, there are doublet states (RS↑) and (E↓) for $^{10}\hat{p}$ (Figure 1). For $^{10}\hat{p}$ dominated by principle RS↑, it is of motion path measured as $x = (^{10}m)^{\frac{1}{4}}$ along each dimension of a 4D subspace when it is in state **I**, while it is of motion path of IR cutoff $L_\mathbf{T} = \frac{(2\pi)^4}{9}$ for its corresponding state **T**, and the wavelength ratio is $\alpha_1 = \frac{1}{137.036\ 082}$ during its transformation [21]. In addition, for $^{10}\hat{p}$ satisfying principle E↓, its IR cutoffs, which are $L_\mathbf{I} = \prod_7^{10} {^n m} = 1.613 \times 10^2$ and $L_\mathbf{T} = \prod_1^6 (2\pi)^n \cdot \prod_7^{10} \frac{(2\pi)^n}{n-1} = 2.626 \times 10^{40}$, are taken respectively as its motion paths for the ground states in $\boldsymbol{P}_\mathbf{I}$ and $\boldsymbol{P}_\mathbf{T}$, and it has a wavelength ratio $\alpha_2 = \frac{1}{1.628 \times 10^{38}}$ for its transformation [21].



Properties / States		Space structure											Quantum properties	
		x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	Common space $\boldsymbol{P}$	Motion path	I⇌T ratio: α
I	RS↑	1	1	1	1	1	1	$({}^{10}m)^{\frac{1}{4}}$	$({}^{10}m)^{\frac{1}{4}}$	$({}^{10}m)^{\frac{1}{4}}$	$({}^{10}m)^{\frac{1}{4}}$	${}^{10}m$	1.264	137.036
	E↓	1	1	1	1	1	1	${}^{7}m$	${}^{8}m$	${}^{9}m$	${}^{10}m$	1.613×10^2	1.613×10^2	1.628×10^{38}
T	RS↑	2π	2π	2π	2π	2π	2π	$\frac{(2\pi)^4}{9}$				$\frac{(2\pi)^4}{9}$	1.732×10^2	137.036
	E↓	2π	$(2\pi)^2$	$(2\pi)^3$	$(2\pi)^4$	$(2\pi)^5$	$(2\pi)^6$	$\frac{(2\pi)^7}{6}$	$\frac{(2\pi)^8}{7}$	$\frac{(2\pi)^9}{8}$	$\frac{(2\pi)^{10}}{9}$	2.626×10^{40}	2.626×10^{40}	1.628×10^{38}

Figure 1. Rotational symmetry requires that a 10D Planck unit exist in states of **I** (in situ state in $\boldsymbol{P}_{\mathbf{I}}$), **R** (revolving state in $\boldsymbol{P}_{\mathbf{R}}$) and **T** (tangent state in $\boldsymbol{P}_{\mathbf{T}}$). State **I** and state **T** both have two motion modes determined by the high rotational symmetry principle (RS↑) and the minimum energy principle (E↓). Accordingly, ${}^{10}\hat{p}$ has doublet states with different geometric and quantum properties (where ${}^{7}m$, ${}^{8}m$, ${}^{9}m$ and ${}^{10}m$ are generalized 7D, 8D, 9D and 10D spheres measured as $\frac{16\pi^3}{105} = 4.725$, $\frac{\pi^4}{24} = 4.059$, $\frac{32\pi^4}{945} = 3.299$ and $\frac{\pi^5}{120} = 2.550$ [21], respectively).

In short, under control of quantum mechanics only, 10D Planck unit ${}^{10}\hat{p}$ exists in doublet states (RS↑) and (E↓) in $\boldsymbol{P}_{\mathbf{I}}$ and $\boldsymbol{P}_{\mathbf{T}}$, and state **T** tends to be of lower energy compared to state **I** because it moves in a larger space.

2.2. ${}^{10}\hat{p}$: Singlet States Determined by Conservation of Energy

Generally, ${}^{10}\hat{p}$'s quantum doublet should be detected singly. And it should satisfy conservation of energy when acting as an isolated object.

Singlet state T. Being dominated by translational symmetry, state **T** with constant velocity v and action $S = h$ are always of mass $m_{\mathbf{T}} = 0$, which is required by $\frac{\mathrm{d}v}{\mathrm{d}k} = \frac{\hbar}{m_{\mathbf{T}}} = 0$ when $\mathrm{d}v = 0$ [21]. But **T**(RS↑) and **T**(E↓) have different energy $\varepsilon = \frac{hc}{2L}$ inside $\boldsymbol{P}_{\mathbf{T}}$, where the longest motion path L of them is different [21]. According to the principle of the minimum energy, ${}^{10}\hat{p}$ is observed in state in **T**(E↓) for **T**(E↓) has much longer L and much lower energy compared with **T**(RS↑).

Singlet state I. Considering that ${}^{10}\hat{p}$ has $U = 0$ inside specific spaces of $\boldsymbol{P}_{\mathbf{I}}$ and $\boldsymbol{P}_{\mathbf{T}}$, which are surrounded by Vs^{∞}, let the observed **I** state be of total energy $E_{\mathbf{I}}$, kinetic energy $K_{\mathbf{I}}$, stationary energy $M_{\mathbf{I}}$, and the singlet **T**(E↓) be of corresponding $E_{\mathbf{T}}$, $K_{\mathbf{T}}$, $M_{\mathbf{T}}$. Then, the conserved energy $E_{\mathbf{I}} = E_{\mathbf{T}}$ during **I**⇌**T** requires

$$M_{\mathbf{I}} + K_{\mathbf{I}} = M_{\mathbf{T}} + K_{\mathbf{T}} \tag{1}$$

where it exists as $M_{\mathbf{T}} = 0$ for $m_{\mathbf{T}} = 0$, and let it be $K_{\mathbf{T}} = \varepsilon_0$.

For transformation **T**→**I**, let state **I** be of stationary mass $m_{\mathbf{I}}$ related to $M_{\mathbf{I}}$, then $M_{\mathbf{I}}$ with a real value should be $M_{\mathbf{I}} \in [0, \varepsilon_0]$, which leads to three possible scenarios.

The first is $M_{\mathbf{I}} = 0$ and $m_{\mathbf{I}} = 0$. Equation (1) requires $K_{\mathbf{I}} = K_{\mathbf{T}}$ when $M_{\mathbf{I}} = M_{\mathbf{T}} = 0$, but $\lambda_{\mathbf{I}} << \lambda_{\mathbf{T}}$ results in $K_{\mathbf{I}} >> K_{\mathbf{T}}$ when $m_{\mathbf{I}} = m_{\mathbf{T}}$. So, this scenario does not hold.

The second is $0 < M_{\mathbf{I}} < \varepsilon_0$ and $m_{\mathbf{I}} \neq 0$. Given $K_{\mathbf{T}} = \varepsilon_0 = \frac{hc}{2L}$ for state **T** in Equation (1), there exists

$$E_{\mathbf{I}} = m_{\mathbf{I}}c^2 + K_{\mathbf{I}} = \frac{hc}{2L} \tag{2}$$

where $K_{\mathbf{I}}$ contains n translational kinetic energies along n independent dimensions and angular kinetic energies in c_n^2 planes as

$$K_{\mathbf{I}} = \frac{h^2}{8m_{\mathbf{I}}}\left(\frac{1}{l_1^2} + \frac{1}{l_2^2} + \ldots + \frac{1}{l_n^2}\right) + \ldots = \frac{h^2}{8m_{\mathbf{I}}}\cdot\beta \tag{3}$$

where the summation of the coefficients for the $(n + c_n^2)$ terms is set to be β.

Then there exists

$$m_{\mathbf{I}}c^2 + \frac{\beta h^2}{8m_{\mathbf{I}}} - \frac{hc}{2L} = 0 \tag{4}$$

which equals to

$$m_{\mathbf{I}}^2\, c^2 - \frac{hc}{2L}m_{\mathbf{I}} + \frac{\beta h^2}{8} = 0 \tag{5}$$

where the discriminant of a quadratic equation is

$$\Delta = \frac{h^2c^2}{4}\left(\frac{1}{L^2} - \frac{\beta}{2}\right) \tag{6}$$

Given $\beta = (\frac{1}{l_1^2} + \frac{1}{l_2^2} + \ldots + \frac{1}{l_n^2}) + \ldots \geq \frac{1}{l_{max}^2} = \frac{1}{(\alpha L)^2}$ $(\alpha << \frac{1}{\sqrt{2}})$, there exists $\frac{1}{L^2} << \frac{\beta}{2}$ and Δ always satisfies

$$\Delta < 0 \tag{7}$$

which denies the real number solutions for $m_{\mathbf{I}}$. So, the second scenario does not hold, either.

The third is $M_{\mathbf{I}} = \varepsilon_0$ and $m_{\mathbf{I}} = \varepsilon_0$. There exist $K_{\mathbf{I}} = 0$ and $M_{\mathbf{I}} = K_{\mathbf{T}}$ as the single solution to Equation (1), indicating that the kinetic energy of state **T**(E↓) transforms completely into the stationary energy of state **I** during **T**→**I**. And $K_{\mathbf{I}} = 0$ requires that state **I** have no kinetic energy for either translation or rotation, showing that ${}^{10}\hat{p}$ is completely stationary whether in state **I**(RS↑) or **I**(E↓). Consequently, **I**(RS↑) and **I**(E↓) are physically indistinguishable for they share the same motion ($v = 0$) and the same rest ($m = \varepsilon_0$), resulting in a completely stationary ${}^{10}\hat{p}$ in state **I**.

Additionally, the conservation of space requires ${}^{10}\hat{p}$ to remain in the same dimensional space during transformation. Obviously, ${}^{10}\hat{p}$ with both transformability and observability should be inside the 4D space, which is the non-trivial subspace expanded by x_7, x_8, x_9, x_{10} and also the common space for state **I**(RS↑/E↓) and **T**(E↓), as shown in Figure 2.

States \ Properties	Space structures											Physical properties
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	Common space ***P***	Half wavelength
I	1	1	1	1	1	1	$({}^{10}m)^{\frac{1}{4}}$	$({}^{10}m)^{\frac{1}{4}}$	$({}^{10}m)^{\frac{1}{4}}$	$({}^{10}m)^{\frac{1}{4}}$	${}^{10}m$	—
	1	1	1	1	1	1	${}^{7}m$	${}^{8}m$	${}^{9}m$	${}^{10}m$	1.613×10^2	
T(E↓)	2π	$(2\pi)^2$	$(2\pi)^3$	$(2\pi)^4$	$(2\pi)^5$	$(2\pi)^6$	$\frac{(2\pi)^7}{6}$	$\frac{(2\pi)^8}{7}$	$\frac{(2\pi)^9}{8}$	$\frac{(2\pi)^{10}}{9}$	4.545×10^{23}	4.545×10^{23}

Figure 2. Geometrical and physical properties for an observed ${}^{10}\hat{p}$ transforming between in situ state **I** and tangent state **T** in the 4D subspace.

Briefly, as an isolated object with conserved energy and space, 10D Planck unit ${}^{10}\hat{p}$ transforms between massless **T**(E↓) and stationary **I** in the 4D subspace.

2.3. $^{10}\hat{p}$: Physical Behavior of **I/T**

Let stationary state **I** and massless state **T** (E↓) be abbreviated as **I**/**T**. The physics of $^{10}\hat{p}$ can be obtained in a monomer system and multi-body systems.

Monomer system. **T** takes normalized $L = \frac{(2\pi)^{7+8+9+10}}{6\times7\times8\times9} = 4.545 \times 10^{23}$ as its half wavelength, with the actual wavelength as $\lambda_{\mathbf{T}} = \frac{2\times(2\pi)^{34}}{3024} \cdot \overline{\lambda}_{\mathrm{P}} = 2.338\,243 \times 10^{-12}$ m (where $\overline{\lambda}_{\mathrm{P}} = 2.572\,326 \times 10^{-36}$ m [22]) and energy $\varepsilon_0 = \frac{hc}{\lambda_{\mathbf{T}}} = 0.530\,245$ MeV for its ground state. This corresponds with action $m_{\mathbf{T}} = 0$, $v_{\mathbf{T}} = c$ and $\lambda_{\mathbf{T}} = 2.338 \times 10^{-12}$ m for state **T**, and state **I** is $m_{\mathbf{I}} = 0.530$ MeV and $v_{\mathbf{I}} = 0$.

Two-body system. Given the non-conservative momentum built by state **T** in the above single-body system, a 2**I**/2**T** pair, which comprises two extremely close and synchronized **I**/**T** pairs and has the two **T** states be of opposite quantized momenta, is assumed to be one body to obtain a two-body system with legitimate transformation (Figure 3A). According to the sharing–coupling effects [21], any two 2**T** states are shared by the two 2**I** states, naturally resulting in coupling potential $\Delta U = \frac{hc}{\lambda'} - \frac{hc}{\lambda_0}$ (Figure 3B).

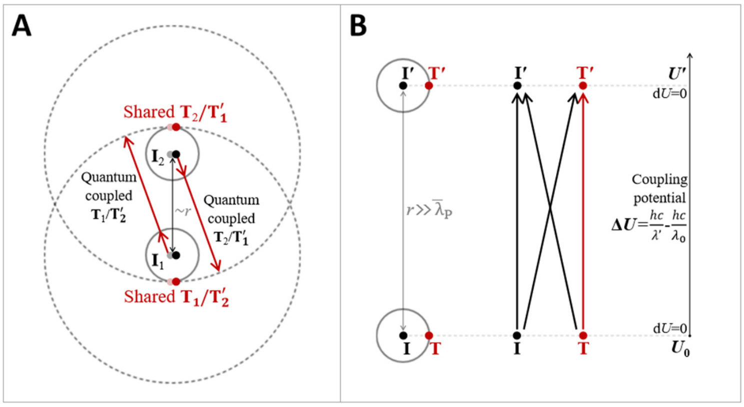


Figure 3. Two-body system of $^{10}\hat{p}$: quantum coupling (**A**) and the coupling potential (**B**).

Based on the geometrical constant α_2, which is responded to by **T**(E↓) here [21], there exists

$$\Delta U = \frac{\alpha_2 hc}{2\pi}\left(\frac{1}{r} - \frac{1}{r_0}\right) = 1.942 \times 10^{-64}\left(\frac{1}{r} - \frac{1}{r_0}\right)\text{ J} \tag{8}$$

where $\alpha_2 = \frac{1}{1.628008\times10^{38}}$ [21], $h = 6.62606896 \times 10^{-34}$ J·s and $c = 2.9979246 \times 10^8$ m/s [22].

As demonstrated by Section 2, $^{10}\hat{p}$ exhibits specific mass, wavelength and transformation, clearly pointing to two experimental particles.

3. I/T and Electron/Compton Photon

3.1. Comparison Between I/T of $^{10}\hat{p}$ and e/γof Electron/Compton Photon

Let a photon with Compton wavelength 2.426×10^{-12} m (0.511 MeV) of a stationary electron be defined as a Compton photon γ, then physical properties of **I/T** can be compared with e/γ from an ideal annihilation of a stationary electron–positron, as listed in Table 1.

Table 1. Comparison between **I/T** of $^{10}\hat{p}$ and e/γ of electron/Compton photon [22].

I/T	e/γ	Deviation
I: $v = 0$	e: $v << c$	–
$m = 0.530$ MeV	$m = 0.511$ MeV	3.7%
interacting constant 1/137.036 082 with unknown ±	interacting constant 1/137.035 999 with certain ±	<10^{-6}

Table 1. *Cont.*

I/T	e/γ	Deviation
T: wavelength 2.338×10^{-12} m	γ: wavelength 2.426×10^{-12} m	3.7%
$m = 0$	$m = 0$	0
constant velocity $v = c$	constant velocity c	–
interacting constant ~$1/(1.628 \times 10^{38})$ with unknown ±	Gravitational constant ~$1/(1.693 \times 10^{38})$ with certain +	3.8%
I/T: 2**I** ⟷ 2**T** process with conserved quantum momentum	e/γ: $(e^{+}+e^{-})$ ⟷ 2γ process with conserved momentum, charge, etc.	–

3.2. Hidden Properties of e/γ

The above comparison reveals that e/γ is equal to **I**/**T**, as they exhibit the same physics. And more has been revealed besides the origin of e/γ.

Shared matter for *e*/γ. The process of electron–positron annihilation is fundamentally different from that of the spooky action caused by quantum entanglement [23], since the latter is regardless of the distance while the former occurs only in situ, showing that annihilation requires more than an account book of energy, momentum, charge, etc., and strongly implying that a common part in situ is necessarily demanded. As discovered by **I**/**T**, structure $^{10}\hat{p}$ itself is the shared matter bridging an electron (±) and its corresponding photon.

Photons' potential. A potential is unveiled to exist between any two centers in a multi-body system (Figure 3B). For a state **I** in one of the two centers, it takes the close photon as its own state **T** with transformability and the far away one as its state **T**′ without transformability. Thus, a potential field is created by the two photons with different relative potentials depending on their distances, whereas the interacting potential brings no observable influence on a single-body system, since its state **I** is protected by $v = 0$ and d$m = 0$, while its state **T** is protected by $m = 0$ and d$v = 0$. But photons' potential has an extremely significant effect on multi-body systems, considering the paradox about annihilating–creating in a gravitational field.

4. Compton Photons' Field and Gravitational Field of a Proton

4.1. Annihilating Paradox and Its Solution

A dual annihilating–creating process containing two proton–antiproton $(p^{+} + p^{-})$ pairs is shown in Figure 4A.

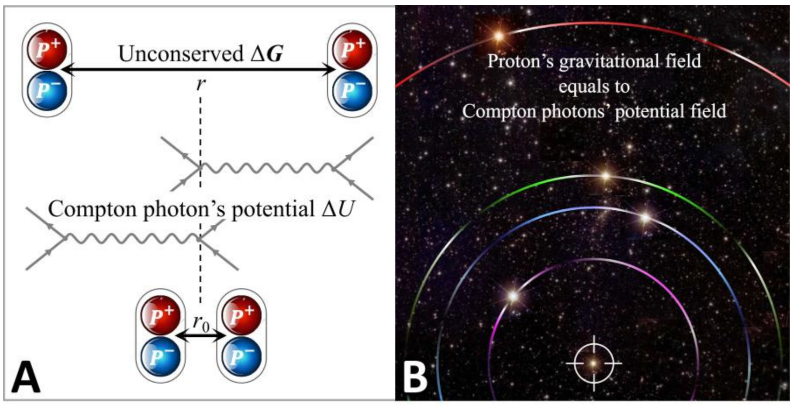


Figure 4. Annihilating paradox and photons' potential. For the unbalanced gravitational energy during the annihilating–creating process of $(p^{+} + p^{-})$ (**A**), Compton photons' potential caused by photons' red/blue shift (**B**) serves exactly as the gravity of a neutral proton–antiproton pair.

For an ideal annihilating–creating process,

$$2(p^{+} + p-) \text{ with } r_0 \rightarrow 2(p^{+} + p^{-}) \text{ with } r \quad (9)$$

where two extremely close ($p^+ + p^-$) pairs annihilate simultaneously with their photon pairs moving along the same dimension, which means the four photons are paired up closely into two groups with opposite directions. Then, the two groups of photons transform into ($p^+ + p^-$) pairs respectively at two positions farther apart. Given the local neutrality throughout the process, no electric field energy is involved. But unbalanced gravitational energy occurs in the system as

$$\Delta G = Gm_p^2\left(\frac{1}{r} - \frac{1}{r_0}\right) = 1.867 \times 10^{-64}\left(\frac{1}{r} - \frac{1}{r_0}\right) J \tag{10}$$

where $G = 6.6743 \times 10^{-11}$ N·m^2/kg^2, $m_p = 1.672621638 \times 10^{-27}$ kg [22].

Here, ΔG, the potential variation caused by the gravity between the two ($p^+ + p^-$) pairs, is extremely slight but unacceptable, bringing about the annihilating paradox. This paradox could not be solved by current physics, and its significance cannot be overestimated within the framework of modern physics, since it leads directly to such a deduction, in which a couple of mass and anti-mass dual planets (with theoretical possibility only) could be removed from their solar system without any work and just via emitting photons. Unlike those crises regarding dark energy or dark matter that require new physics, the annihilating paradox with unbalanced energy raises questions about a missing link in our current theories.

Now the annihilating paradox is solved by the Compton photons' potential field, which is equal to the gravitational field of a proton with deviation of 3.9%, as compared with Equation (8).

4.2. General Application of Compton Photons' Potential

As a result, all of the Compton photons are identical ones but are different in their relative colors. This is derived from their constant action $S = h$, which means that they present various wavelengths $\lambda = \frac{2\pi d}{\alpha_2}$ as far as an observer at distance of d is concerned. Consequently, a Compton photon always undergoes a blue shift when approaching the observer or a red shift when moving away from them (Figure 4B). These red or blue shifts cannot be directly detected because any state **T** is forbidden to undergo transformation non-in situ, denying that any distant photons have been observed so far. In fact, what can be measured for a photon is always its energy during in situ transformation, and it has never been proved that a photon maintains a constant color or energy regardless of its distance. However, these blue/red shifts can be detected indirectly, since the allochroic effect of Compton photons is precisely equal to the gravitational field of a proton (Figure 4B).

5. Conclusions and Discussion

Besides the two dimensionless constants equal to FSC and gravitational constant, this work also obtained a stationary electron, a Compton photon and a gravitational field for a proton based on 10D Planck unit $^{10}\hat{p}$.

After its properties have been revealed mainly by geometry and quantum mechanics, this work explores 10D Planck unit $^{10}\hat{p}$ via putting it in an isolated system with conserved energy and conserved spacial structure. The results indicate that $^{10}\hat{p}$ has a completely static in situ state with mass 0.530 MeV and a non-in situ state with wavelength 2.338×10^{-12} m and $m = 0$, which shows the consistency between $^{10}\hat{p}$ and electron/Compton photon. Moreover, the Compton photons' potential is revealed to exist between any two photons, with their intensity being determined by the distance between the two photons. Such a potential field is proved to be equal to the gravitational field of a proton in experiments. Briefly, e/γ is the quantum manifestation of a 10D Planck unit, and the potential field of Compton photons is equal to the gravitational field of a proton.

Therefore, a non-trivial scenario can be obtained in a 10D vacuum, where the physics is different from those trivial ones in lower-dimensional spaces. Inside their 4D subspace, 10D Planck units are always either completely stationary or moving at a constant speed. And the kinetic ones are always of wavelength $\overline{\lambda}_P = 2.338 \times 10^{-12}$ m, while the static ones are of mass $\varepsilon_0 = 0.530$ MeV after assuming $v = c$. Transformation freely occurs between a stationary one and a constant speed one when they satisfy those necessary principles, including the topological connection and the conservation of momentum. This scenario clearly depicts a universe containing electrons, Compton photons and their transformations. Additionally, it depicts a misplaced gravitational field, which arises from Compton photons of electrons, but serves for a proton experimentally. Disappointingly, it provides nothing else so far, such as the positive or negative nature of a particle, any other elemental particles, the more complex processes, let alone those complex systems, the macroscopic low-speed processes, and the high-speed processes (relativistic effects). And the ~4% deviation exists there stably and stubbornly, questioning whether it is derived from a systematic error.

Meanwhile, it almost solves the core part of our physical world, namely the origin of electrons and Compton photons. This solution has a significant implication for our understanding of some physical phenomena, such as the wave–particle duality of a photon.

So far, that is all $^{10}\hat{p}$ has provided us with, including the most elemental fermion e, the most elemental boson γ, and the most fundamental gravitational field of a proton. Despite unsolved issues, we are still convinced that we are moving in the right direction for theoretical physics.

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