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Decoding the Information of Life

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Abstract: We link nuclear force with gravity. We use statistical entropy to link fine-structure constant (α) and cosmological constant, showing mystical number 137 (as reciprocal of increasing entropy of the universe) as negative entropy needed for life to exist. If our computational route applies to the physical universe, it should apply to life. Molecular biology is searching for the fundamental source of information that would link to the information in DNA.

Keywords: 3rd law of thermodynamics, fine-structure constant, cosmological constant, strong coupling, information.

1. Introduction

Strong coupling, like fine structure constant, is measured, but not derived. With a focus on the 2nd law of thermodynamics, we show increasing entropy of the universe by taking the natural log of the age of universe in Planck times using the Boltzmann formula. Science is looking for the source of negative entropy that makes life a possibility. The fine structure constant comes out to be a hidden candidate supplying that negative entropy, and also relate it to the missing fundamental information in DNA. The author debates a claim of the rigid constancy of the fine structure constant and other constants and tries to fill a void about the cause of Brownian motion as a conjecture.

Variations of the fine structure constant over a long period of time using different techniques are inconsistent with each other, calling for a logical and theoretical approach.

2. Inverse Square Law in Natural Units

Newton [1] delayed announcing the law of gravitation. He explained the reason in Book III, Proposition 8 of his Principia. He was in doubt about the duplicate reciprocal (inverse square law) [2]. A new concept is seen on the horizon. It postulates that the gravitational force between two interacting elementary particles does not change as a function of the classical continuous distance separating them. What changes is the probability of an interaction between elementary particles. What is perceived a continuous gravitational force is a result of probabilities of interactions between a large statistical aggregate of elementary particles that constitute massive bodies such as an apple. Classical distances are manmade units. The use of natural units of Planck lengths replaces the inverse square propagation implicit in Newtonian gravity with inverse square law of probabilities. Consistent with Newtonian gravity, it will be shown that the force between two interacting nucleons is the strongest, known as strong coupling (C_s) when two interacting nucleons are closest. The minimum distance per modern physics is one Planck length. It equals 10^{-35} m. Larger distances are integer multiples of a Planck length. The new concept states that the statistical probability function (P_i) that two nucleons interact is inversely proportional to the integer number of Planck lengths separating them, making the average effective gravitational force perceived between two interacting nucleons (F_p) equal to the product $C_s \cdot P_i$. Nucleons are the most massive elementary particles in an atom. Therefore, they are used in this example to link quantum physics, and Newtonian gravity in one equation.

The Newtonian expression of force between two

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nucleons separated by a distance r is

$$F(r) = Gm_n^2/r^2 \quad (1)$$

where, $F(r)$ is the force in Newton's, G is universal constant of gravity, 6.672×10^{-11} in Newton m^2/kg^2, m_n, the mass of a neutron in kilograms, and r is the separating distance in meters.

Conversion of separation distance from r in meters to L in Planck lengths(L), yields Eq. (2):

$$F(L) = k/L^2 \quad (2)$$

where, k (constant) = $10^{70}\, G{\cdot}m_n^2$.

For L = one Planck length, the force equals the known value of the strong nuclear force, giving Eq. (3):

$$F(L = 1) = k = C_s \quad (3)$$

Substituting $1/L^2 = P_i$ in Eq. (2), Eq. (4) is gotten:

$$F(L) = k/L^2 = k{\cdot}P_i = F_p \quad (4)$$

Eq. (4) recovers the Newtonian gravity. Its derivation shows that the strongest force between two adjoining nucleons (C_s) results naturally when their separation is minimum possible of one Planck length with the probability of interaction equal to one. Rearranging mathematical formulation yields Eq. (5):

$$(F_p) = C_s{\cdot}P_{i,} \quad (5)$$

where, the expression $(F_p) = C_s{\cdot}P_{i,}$ suggests that the force between two nucleons does not decrease as a function of the distance separating them. The probability of interaction decreases inversely as a function of their separation.

The synonymy of strong coupling and gravitation is elaborated [3, 4], with the later postulating that every particle has a quantum mouth with a limiting size of one Planck length, radiating mediating particles as shown in Fig. 1 for a nucleon; and the former citing a relativistic approach and Einstein's efforts. The later adds pertinent details to this paper.

The information is linked with entropy [5], here it is linked with Planck scale statistics. The quantum mechanics is interjected deeper by way of "OPEN" and "CLOSED" signal, one for each Planck time. Continuing step by step progression from there on naturally enables us to derive fine structure constant and relate it to cosmological constant and negative entropy for life to exist. The above derivation of strong coupling though formerly published [6], is retained here for easier understanding of the following.

3. Quantum Informatics

Consistent with binary information would be an unstable link (OPEN and/or CLOSED) between particles, capable of sending messages in terms of time-unique qubits (quantum bits) of information. The postulation of particles having quantum (Planck size) mouths, as shown in Fig. 1-3, for interaction with the rest of the universe explains their ability to send messages. A steady state condition of the mouth would not generate multiple signals. Underlying phenomenon in biology raises a question [7] as to how do quantum dots originate or where does the information in DNA originate. The answer is: Information originates from the quantum particles blinking ON and OFF.

Einstein is reported to believe that "a particle should know where and what it is, … , even if we do not, and it should certainly not receive signals more quickly than the speed of light" [8]. Noteworthy views of other great minds are pointed out [9].

Qubit is also a term used by computer scientists, including Seth Lloyd of MIT [10].The difference is that we are using it in terms of Planck times.

Fig. 1 shows the pictorial presentation of the idea showing a maximum of four continuous OPEN or CLOSED states. What a coincidence that our 2001 paper (physics/0110001) with the hidden concept of binary system of nature got a number from preprint organization which itself is a mirror image of a binary system.

Physics uses the universal constant of gravity G to determine Planck length. Nature must know the Planck length, a variable or not. Therefore, nature needs no G, making G the net effective resultant force created by all the partial ones by subatomic particles. G

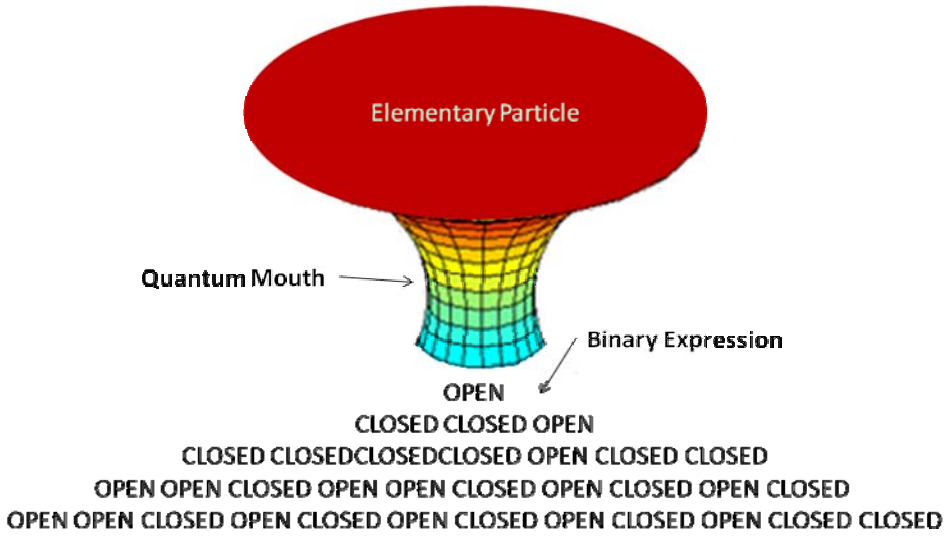

Fig. 1 Mental picture of a particle communicating with the universe via postulated quantum mouth

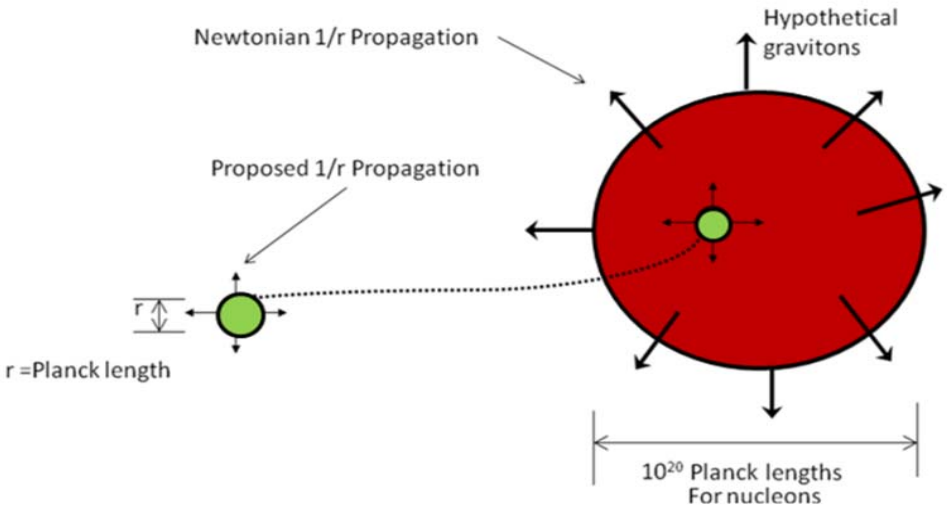

Fig. 2 Mental picture of a quantum mouth radiating hypothetical gravitons.

is only man's tool to probe the nature, helping him to overcome his otherwise ignorance of Planck length. Mediating particle of *G*, graviton, has never been observed, we predict: never will be. Fig. 2 depicts a Newtonianequivalent of Fig. 1 with gravitons as hypothetical.

4. Fine-Structure Constant

The maximum number of microstates (*W*), the electrons could have created and would be 3.3×10^{60}, one random location for each snapshot of the universe, per Hubble time H_t. Substitution of *W* in Boltzmann expression, yields the statistical entropy in the Boltzmann expression (on his tomb) $S = k \cdot \text{Log}_e W = 139.340$ when k =1 for natural units. Whether the system is binary or ternary, the maximum number of microstate per Hubble time is fixed, as a Planck time cannot be subdivided in 2, 3 or more subdivisions, giving the value of n=1 for substitution in the equation $\Omega = N!/(n!\ (N\text{-}n)!)$ [11], yielding Ω (notation *W*) equals to 3.3×10^{60} for $N = 3.3 \times 10^{60}$. The 10 dimensions of the string theory suggests that the quantum mouth stays OPEN or CLOSED for 10 Planck times, each of those groups of ten times would be one probability of nature. The author called this group as BIT [12], where BIT is equal to 10 bits. The

number of BITS in the age of the universe will be 3.3×10^{59}. The natural log of 3.3×10^{59} is 137.046. Since this is close to the reciprocal (137.036) of the fine structure constant. The reciprocal of the fine structure is called constant negative entropy and *S* as the positive entropy of the universe. Since their sum equals zero, which agree with the third law of thermodynamics.

Einstein's independent development of statistical mechanics led him to admire Boltzmann statistics [13]. Einstein considered thermodynamics as fundamental [14]. The universe must have some hidden candidate that reflects decrease in entropy without which we would not be here. If fine structure constant as a negative entropy can be linked to information, it may provide the qualitative source of missing information. The exact mechanism of the language of the physical universe, if and when invented, may explain the source quantitatively.

5. Cosmological Constant

Gamow saw a connection between cosmology and fine-structure constant [15]. Cosmological constant (λ) introduced by Einstein in 1917 is a function of the radius of the universe (R) [16]. He introduced the equation $\lambda = 1/R^2$. The age of the universe, 10^{60} Planck times, translates in the size of 10^{60} Planck lengths as light travels one Planck length per Planck time, yielding the following equation:

$$\text{Cosmological Constant } \lambda = 1/(10^{60})^2 \quad (6)$$

The size of the universe is common to the fine-structure constant as derived above and the cosmological constant.

Substituting one in the other gives:

$$1/\alpha = \ln \sqrt{\lambda} \quad (7)$$

The interpretation that entropy is non-decreasing and the fact that the particles used to test the fine-structure constant cannot be older than the age of the universe justifies the replacement of equality sign by the equal to or greater than signal, giving

$$\alpha \geq 1/\ln\sqrt{\lambda} \quad (8)$$

Einstein was made aware of the constancy of the fine structure constant in 1916 by his friend Arnold Sommerfeld [17], before he introduced the cosmological constant in 1917, whether or not his decision was influenced by the finding of the constancy of the fine structure constant.

6. Quantum Tunneling

An alpha particle can escape out of its potential well, because there is a probability that the effective quantum mouth (point of collective action of the quantum mouths of its nucleons) lies outside the central portion of the nucleus, on the downward slope as shown in Fig. 3. Such simple solutions do not spell incorrect solutions. Many times, the solutions to most complex problems lie in solutions with unthinkable simplicity.

7. Anthropic Principle

A claim [18] that if α were to change by 4%, stellar fusion will produce no carbon to form life. This claim, if it does apply, applies in the present universe. According to our theory, 4% change in the value of α will take enormous time (924 million years). In this duration multiple coupling constants are subject to simultaneous change. The originating concept long before the publication of Ref. [6] was that the gravity is a cumulative effect of quantum mechanical forces. Distribution of quantum mechanical particles in the universe is not the same, implying that the universal

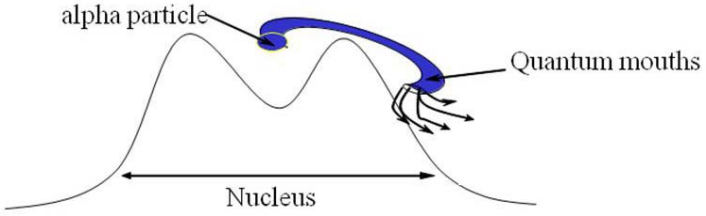

Fig. 3 Postulated mouths on the right lifting the alpha particle.

constant of gravity *G* is subject to change. Variation of fine structure constant may have its own effect on the constancy of the speed of light. Simultaneous variation of multiple coupling constants will support life [19].

8. The Cause of Brownian Motion

Particles in any liquid are constantly in motion because they are constantly bombarded by surrounding particles. According to our theory, all particles are interacting with the other particles of the universe on a probabilistic basis. All those interactions causing attractions or repulsions are liable to create Brownian motion of liquid particles.

9. Conclusions

The hidden candidate creating the negative entropy and making life and order possible in the universe is the fine structure constant. This is mutually consistent with the 3rd law of thermodynamics. Brownian motion could be just a consequence of the computational universe. The computational universe could provide the fundamental information for life that molecular biology is searching.

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