

Derivation of the Existence of Two Kinds of Space and Time from the Law of Creation

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Abstract

In his development of a metaphysical theory of quantum physics, David Bohm proposed the theory of implicate and explicate order. He suggested that what we take for reality is an explicate order which emerges from an implicate order. However, the derivation and mathematical formulation of such a theory remained unclear. In this work, we show that from the Law of Creation we can derive the existence of two kinds of space and time. One is the usual observable spacetime, described by spacetime coordinates. It corresponds to explicate order. The other is the space and time that is related to the measurement of non-movement and movement. We call this internal spacetime. Internal space and time form the two-dimensional world-sheet in string theory and they correspond to the implicate order. The Observable spacetime is the projection from Internal spacetime. We show the mathematical formula expressing the relationship between these two spacetimes. This work leads to a deeper understanding about spacetime and the discovery of a new property of observed spacetime. We find that each of the observable spacetime coordinates consists of an infinite number of vibrations and is a vibrational field. This vibrational field is made of two independent sets of vibrations, oscillating or spinning in opposite directions. The movement or change of each coordinate in observable spacetime can interact with gravity and gauge interactions and result in the creation of information, energy, and matter.

Keywords: Law of Creation; Observable Spacetime; Internal Spacetime; Implicate order; Explicate order; Relationship between Observable Spacetime and Internal Spacetime

Introduction

Quantum physics is the most fundamental theory of physics. Quantum physics studies what everything is made of and how it behaves at the atomic and subatomic levels [1-4]. Although quantum physics has led to the most accurate predictions to date about the nature of matter and the universe, a metaphysical foundation of quantum physics has still not been fully established. To understand the intrinsic non-deterministic and subjective nature of quantum physics as well as the non-local phenomena such as quantum entanglement existing in quantum physics, David Bohm proposed the concepts of implicate and explicate orders [5]. Bohm suggests that what we take for reality is "surface phenomena, explicate forms that have temporarily unfolded out of an underlying implicate order". This means that the implicate order is the ground from which reality emerges.

To develop a mathematic formulation for explicate and implicate order, David Bohm and other physicists suggest that the implicate order is represented in the form of an appropriate algebra or pregeometry [6-10]. Spacetime is part of an explicate order that

is connected to an implicate order that they call pre-space. The locality and non locality observed in quantum physics all arise from an order in pre-space. A. M. Frescura and Hiley suggested that an implicate order could be carried by an algebra, with the explicate order being contained in the various representations of this algebra.

In our previous work, we used the Law of Creation to derive string theory, M theory, and the wave function of our universe [11-17]. We show that this new progress in string theory can lead to derivation and prediction of the expanding universe, dark matter, dark energy, the large structure of the universe, the derivation of the observed physics laws about fundamental interactions, and the existence of the elementary particles. The Law of Creation states that everything is created from emptiness through yin yang interaction. Yin and yang are the two basic elements that make up everything. Yin and yang are opposite, relative, co-created, inseparable, and co-dependent.

In this paper, we propose that the Law of Creation indicates the existence of two types of spacetime, the internal spacetime and the observed spacetime. They correspond to the implicate order and explicate order. We derive the relationship between these two spacetimes. We find that it reveals some interesting properties about the observable spacetime. It indicates that each coordinate in observable spacetime is a vibrational field. It is made of infinite oscillators spinning in the Minkowski spacetime in two different directions. Each point in observable spacetime contains the information of the whole universe. The changes in the observable spacetime coordinates can interact with gravity and other gauge interactions and create information, energy, and matter.

In the following, we will first review the Law of Creation and our previous work about how the Law of Creation gives us a new deeper insight about space and time. We suggest that there exists a deeper internal space and time, which relates to our consciousness and measurement of non-movement and movement. The interaction of the internal space and internal time contributes to the action that creates the information, energy, and matter of our universe. This internal spacetime forms the two-dimension world sheet in string theory. We propose that it corresponds to the implicate order that determines our observed physical world. The observable spacetime is a projection from this implicate order. We show mathematically that the internal spacetime is a hologram. The observed spacetime, or the physical world, is a projection from this hologram. It can be of higher dimensional spacetime.

Review of Law of Creation and Derivation of UWFIST

In our paper [11], we propose the Law of creation, which states that everything is created from the emptiness through the yin yang interaction. Yin and yang are two basic elements that make up everything. They are opposite, relative, co-created, inseparable, and co-dependent. For instance, change and unchanged are a yin yang pair.

In quantum physics, all phenomena are determined by measurement. Like everything else, measurement is made of yin yang elements. We suggest [11] at a deeper level, space is related to the consciousness and measurement of unchangingness or non-movement and time is related to the consciousness and measurement of changingness or movement. This space and time is a yin yang pair. Let's call it internal spacetime. All human measurement and consciousness are based on two yin yang pairs. One is the internal space and time yin yang pair. The other is the inclusion and exclusion yin yang pair. The interaction of these two yin yang pairs: space and time yin yang pair and exclusion and inclusion yin yang pair, creates our universe.

The simplest action created by the interaction of the space-time yin yang pair is:

$$A_1 = \alpha \int \Delta\tau \Delta\sigma \tag{1}$$

Here we use the symbol σ to represent space and the symbol τ to represent time. We use $\Delta\sigma$ and $\Delta\tau$ to represent the space and time duration to be measured. The symbol \int represents the summation over space and time from the beginning $\tau=0$ and $\sigma=0$ till now $\tau=T$ and $\sigma=L$. Here T is the age of our universe and L is the horizon of our universe. And α is a constant. In our work [12], we show that:

$$\alpha = 1/(l_p t_p)$$

Here t_p is the Planck time. It is of the magnitude of 5.4×10^{-44} second. Here l_p is the Planck length. It is of the magnitude of 1.6×10^{-35} meter.

The simplest action created by the space and time yin yang pair and the exclusion and inclusion yin yang pair is:

$$A_2 = \alpha \int \Delta\tau \Delta\sigma \Delta\theta_\tau \Delta\theta_\sigma \tag{2}$$

Here we use θ_σ and θ_τ to represent the fermion partner of space and time coordinates σ and τ . The θ_σ and θ_τ can only take on the value 0 or 1 because they are repulsive and refuse to stay at the same place with another element. The symbol \int represents the summation over space σ and time τ and θ_τ and θ_σ .

One can easily see that the actions (1) and (2) are the actions for string theory and superstring theory or M theory [18]. In this way, one derives string theory and M-theory or superstring theory from the Law of Creation.

To calculate what is inside our universe, we propose to calculate the wave function created by the action (2) by summing over the range of the horizon of our observation. In Quantum physics, everything is mathematically represented by wave function. As we suggested in our previous work [19], a wave function describes the information, energy, and matter contained in an object. One can calculate the wave function of our universe using Feynman's path integral formulation of quantum physics [20]. According to this method, the wave function created by the action A_2 is in the form:

$$\Psi = \sum_{\text{sum over all possible states}} C \exp(i\alpha A_2) \tag{3}$$

where C is a constant. The symbol \sum is the summation over all possible paths and states. Equation (3) is the universal wave function formulation of string theory. We call this the universal wave function interpretation of string theory (UWFIST).

Notice in UWFIST, the derived string action is due to the interaction of the internal space-time. This internal space and time are related to the measurement of changing or unchanging. It forms the world sheet in string theory.

In our previous work, we show that the interaction of this space and time yin yang pair and the interaction of inclusive and exclusive yin yang pair create all the information, energy, and matter of our universe, including dark matter, dark energy, inflation, large structure of our universe, fundamental laws of physics such as gravity, electromagnetic, weak, and strong forces, and elementary particles [11-17].

Internal spacetime is represented by the world sheet space-time (σ, τ) . In addition to the internal space and time, there is the observable space-time, normally related to and expressed by the space-time coordinate X^μ . In string theory, they are a projection from the internal spacetime and expressed as $X^\mu(\sigma, \tau)$. $X^\mu(\sigma, \tau)$ defines a projection from the internal spacetime. We can see that the world sheet spacetime (σ, τ) corresponds to the implicate world and the observable spacetime $X^\mu(\sigma, \tau)$ belongs to the explicate order.

More accurately, the observable space-time $X^\mu(\sigma, \tau)$ and fermions $\Psi^\mu(\sigma, \tau)$ relating to elementary particles are a projection from the world sheet $(\sigma, \tau, \theta_\tau, \theta_\sigma)$. The two-dimensional super world-sheet $(\sigma, \tau, \theta_\tau, \theta_\sigma)$ is projected to the observable spacetime and particles $[X^\mu(\sigma, \tau), \Psi^\mu(\sigma, \tau)]$. The observable spacetime and particles $[X^\mu(\sigma, \tau), \Psi^\mu(\sigma, \tau)]$ correspond to explicate order. In terms of $[X^\mu(\sigma, \tau), \Psi^\mu(\sigma, \tau)]$ and integrating over θ_τ and θ_σ , the action A_2 becomes [18]:

$$A_2 = (1/|t_p t_p|) \int \Delta \tau \Delta \sigma \Delta \theta_\tau \Delta \theta_\sigma g^{1/2} g^{ab} [(G_{\mu\nu} + B_{\mu\nu}) \partial_a X^\mu \partial_b X^\nu + G_{\mu\nu}(X) (\Psi^\mu D \Psi^\nu + \Psi^{*\mu} D \Psi^{*\nu}) + 1/2 R_{\mu\nu\rho\sigma}(X) \Psi^\mu \Psi^\nu \Psi^{*\rho} \Psi^{*\sigma}] \quad (4)$$

Here $g^{\alpha\beta}$ is the metric tensor on the world-sheet and $g = -\det g^{ab}$; $G_{\mu\nu}$ and $B_{\mu\nu}$ are metric tensors on the observed space. The gravity and gauge interactions can be represented by $G_{\mu\nu}$ and $B_{\mu\nu}$.

The world-sheet has Weyl symmetry, the local rescaling invariance of the world-sheet metric. The action (4) is invariant under the local rescaling of the world-sheet metric:

$$\begin{aligned} g^{\alpha\beta}(\tau, \sigma) &= \exp(2\omega(\tau, \sigma)) g^{\alpha\beta}(\tau, \sigma) \\ X^\mu_\tau(\tau, \sigma) &= X^\mu_\tau(\tau, \sigma) \\ G^{\mu\nu}(\tau, \sigma) &= G^{\mu\nu}(\tau, \sigma) \\ B^{\mu\nu}(\tau, \sigma) &= B^{\mu\nu}(\tau, \sigma) \\ \Psi^\mu(\tau, \sigma) &= \Psi^\mu(\tau, \sigma) \\ \text{for arbitrary } \omega(\tau, \sigma). \end{aligned}$$

The Weyl invariance of the world-sheet indicates that if we expand or contract or rotate internal spacetime, the implicate order, the action, and therefore all phenomena, will remain the same. In other words, the internal spacetime is a hologram. The observable space-time $X^\mu(\tau, \sigma)$, elementary particles, gauge and gravity interactions, and everything such as dark matter and dark energy in the observable world are projections from this hologram.

Derivation of the Relationship between the Observable Spacetime and Internal Spacetime and its Implications

To find the relationship between the internal spacetime (τ, σ) , the implicate order, and the observable spacetime $X^\mu(\tau, \sigma)$, the explicate order, one can obtain the solution for the action (2) [18]. Such a solution is in the form of:

$$X^i(\tau, \sigma) = x^i + p^i \tau / p + i \left(\frac{\hbar}{2}\right)^{1/2} \sum_{n \neq 0}^{\infty} \left\{ \frac{1}{n} \alpha_n^i \exp[-2\pi i n(\sigma + c\tau)/L] + \frac{1}{n} \tilde{\alpha}_n^i \exp[2\pi i n(\sigma - c\tau)/L] \right\} \quad (5)$$

Here x^i and p^i are center of mass coordinates and momentum. α_n^i and $\tilde{\alpha}_n^i$ are two independent sets of oscillators, corresponding to left-moving and right-moving waves in internal spacetime. This equation tells us the relationship between observed spacetime and the internal spacetime, which is the relationship between the explicate order and implicate order.

Equation (5) is expressed in Euclidean spacetime. To express the relation in Minkowski spacetime (σ, σ_0) , we introduce $\sigma_0 = i c \tau$ (here i is the imaginary number). The relationship (5) becomes:

$$X^i(\tau, \sigma) = x^i + p^i \tau / p + i \left(\frac{\hbar}{2}\right)^{1/2} \sum_{n \neq 0}^{\infty} \left\{ \frac{1}{n} \alpha_n^i \exp[-2\pi i n(\sigma - i\sigma_0)/L] + \frac{1}{n} \tilde{\alpha}_n^i \exp[2\pi i n(\sigma + i\sigma_0)/L] \right\} \quad (6)$$

We can see in Minkowski spacetime, the observed spacetime is made of two independent sets of oscillators spinning in opposite directions in the internal spacetime.

From equation (6), we can see that each coordinate in observable spacetime is a vibrational field. It is made of infinite vibrations. The vibrational field associated with each coordinate is made of two sets of independent "spinors" and oscillators spinning in two different directions in internal spacetime. From equation (4), we can see that the changes in the observable spacetime coordinates can interact with gravity and other gauge interactions and change the wave function, and thus create information, energy, and matter.

Conclusion

In this work, from the Law of Creation we derive the existence of two different kinds of spacetime. One is internal spacetime related to the measurement of non-movement and movement. It corresponds to the implicate order. The other is the observable spacetime expressed by the usual spacetime coordinates. It corresponds to the explicate order. We show that observable spacetime is a projection from internal spacetime. We present the mathematical relationship between observable spacetime and internal spacetime, which is part of the relationship between explicate order and implicate order. From this relationship, we find that each observable spacetime location consists of an infinite number of vibrations and is a vibrational field. This vibrational field is made of two independent sets of vibrations, corresponding to two opposite oscillating or spinning directions. The movement or change of each coordinate in observable spacetime can interact with gravity and gauge interactions and result in the creation of information, energy, and matter.

This research confirms David Bohm's theory about implicate order and explicate order. It gives a way to derive implicate order and explicate order and their relationship from fundamental principles. This work gives a deeper understanding of spacetime and its properties. It yields some interesting results that deserve further exploration.

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