International Journal of Cosmology, Astronomy and Astrophysics

Research Article Open Access

Derivation of the Existence of Elementary Particles from the Law of Creation

Dr. Zhi Gang Sha[1] and **Rulin Xiu**[2*]

[1]*Institute of Soul Healing and Enlightenment, 30 Wertheim Court, Unit 27D, Richmond Hill, Ontario L4B 1B9, Canada*
[2]*Hawaii Theoretical Physics Research Center, 16-266 E. Kipimana St, Keaau, HI 96749, USA*

Article Info

***Corresponding author:**
Rulin Xiu
Hawaii Theoretical Physics Research Center
16-266 E. Kipimana St, Keaau
HI 96749, USA
E-mail: rulin@htprc.org

Received: January 19, 2019
Accepted: January 24, 2019
Published: January 29, 2019

Citation: Sha ZG, Xiu R. Derivation of the Existence of Elementary Particles from the Law of Creation. *Int J Cosmol Astron Astrophys.* 2019; 1(2): 38-42.
doi: 10.18689/ijcaa-1000110

Published by Madridge Publishers

Abstract

In this paper, we derive the existence of elementary particles from the law of creation. This work confirms and derives from the fundamental principle Xiao Gang Wen's result that string-net condensation is a way to generate elementary particles and unify light and electrons. In our previous work, we proposed the law of creation. We derived string theory, M theory, and the wave function of our universe from this fundamental law. We show that one can explain the expanding universe, dark matter, dark energy, the large structure of the universe, inflation, and the laws of physics related to gravity, weak and strong forces, and electromagnetism. In this paper, we show how to derive the existence of elementary particles and how to explain the wave-particle duality of elementary particles from the law of creation. We show that a string-like action creates the vibrational field of our universe. Due to the Poincaré invariance in the string-like action, elementary particles emerge from the vibrational field of our universe. As the different representations of Poincaré symmetry, elementary particles have specific still mass and spin. This explains the wave-particle duality of elementary particles.

Keywords: Universal Wave function Interpretation of String theory, Elementary particles, Grand unification theory, String theory, M theory, Law of creation.

Introduction

Elementary particles are the most basic constituents of matter discovered since the 1930s [1]. They are composed of particles with integer spin, elementary bosons and particles with half-integer spin, elementary fermions. Currently discovered elementary fermions include electrons, muons, and quarks. Elementary bosons consist of gauge bosons and Higgs bosons. Gauge bosons, such as photons, W and Z bosons, and gluons, mediate electromagnetic, weak and strong interaction. The Higgs boson has been discovered to be responsible for the intrinsic mass of particles.

All of the elementary particles and fundamental forces, except for gravity, are currently described by the standard model in particle physics [1]. The standard model is considered the most experimentally successful theory because it gives a consistent description of the elementary particles discovered to date.

There are major reasons to go beyond the standard model. First, one would like not only a description but also to know where the elementary particles come from. Second, one would prefer to have a unified theory for all fundamental particles and forces including gravity. Third, one wants to unify Einstein's relativity theory with quantum physics based on one mathematically consistent formulation derived from one fundamental principle.

Many are seeking the grand unification theory to accomplish these goals. The grand unification theory, also called the theory of everything or grand unified theory, is the attempt to use one mathematical formula to explain all the fundamental forces and matter discovered so far and to integrate quantum physics with general relativity. String theory is a promising candidate for the grand unification theory. String theory incorporates gravity and other gauge forces in one mathematically consistent formulation [2, 3]. It also has the potential to generate all of the elementary particles and all interactions including gravity, and thus to unify all the forces and fundamental particles. However, with all of this great promise, string theory has not yet made many testable predictions. Something is still missing in current string theory.

There have been other attempts to unify all matter and forces. In recent years, Xiao Gang Wen and his colleagues proposed and demonstrated [4-7] that light, electrons, and other fermions may come from the qubits that form a string-net condensed state. Light is basically collective motions of strings, and fermions are ends of open strings in the string-net condensed state. However, it is unknown how to explain this interesting result from a fundamental principle or law.

In this paper, we derive the existence of elementary particles from the law of creation. This work confirms Xiao Gang Wen's result and deduces it from the fundamental law of creation.

In our previous work, we proposed the law of creation [8] and showed that it reveals the exact process for how all existence is created through the process "it from bit" as proposed by John Wheeler. We demonstrate that it could be the fundamental principle leading to the grand unification theory. This law 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. We show that two fundamental yin yang pairs, space and time yin yang pair and inclusion and exclusion yin yang pair, create our universe. From this insight, one can derive string theory, superstring or M theory, and the Universal Wave Function Interpretation of String Theory (UWFIST). Our work demonstrates that UWFIST has the potential to derive dark matter, dark energy, inflation, and the large structure of our universe consistent with observation [9-12].

In another work [13], we show that UWFIST also indicates that the equations of motion regarding electromagnetic force and gravity and other laws of physics are the result of Weyl invariance. In this way, quantum physics and general relativity is integrated in one unified mathematical framework.

In this paper, we explore how the elementary particles come about in UWFIST. First, we will review our previous work. Then we will show that the Poincaré Invariance, inherent in the action that creates our universe, suggests the existence of elementary particles. Elementary particles are simply a Poincaré invariant identity emerging from the 2-dimensional world sheet, corresponding to the "string net" mentioned in Xiao Gang Wen's work. This explains why one can find elementary particles no matter where one places a detector and why particles can be classified by mass and spin. This also explains the discovery by Xiao Gang Wen and his colleagues that elementary particles can come from string-net condensation in vacuum. Finally, we will explore the possible consequences of this work.

Review of the Law of Creation and Derivation of UWFIST

In our paper [8], we proposed the law of creation, which states that everything is created from emptiness through yin yang interaction. Yin and yang are two basic elements that make up everything. They are opposite, relative, co-created, inseparable, and co-dependent. The two elements in one bit of information is a yin yang pair. The law of creation basically tells us how information creates everything. It specifically describes the process of "it from bit" proposed by John Wheeler [14-16].

The universe we observe is determined by our measurement. Based on the law of creation, we propose that all human measurements are made of two basic yin yang pairs: space and time measurement and inclusion and exclusion measurement. Time is related to the measurement of movement and space relates to the measurement of non-movement. Space and time is a yin yang pair. The interaction of these two yin yang pairs, the space and time yin yang pair and the exclusion and inclusion yin yang pair, creates our universe.

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

$$A_1=\alpha\int\Delta\tau\Delta\sigma \quad (1)$$

Here we use the symbol σ to represent space and the symbol τ to represent time. We use Δσ and Δτ to represent the space and time duration to be measured. The symbol ∫ represents the summation over space and time from the beginning τ=0 and σ=0 till now τ=T and σ=L. Here T is the age of our universe and L is the horizon of our universe. The term α is a constant. In our recent work, we have shown that [9]:

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

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 these two yin yang pairs is:

$$A_2=\alpha\int\Delta\tau\Delta\sigma\Delta\theta_\tau\Delta\theta_\sigma \quad (2)$$

Here we use θ_σ and θ_τ to represent the fermion partner of space and time coordinates σ and τ. 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 ∫ is to represent 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. 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 a wave function. One can calculate the wave function of our universe using Feynman's path integral formulation of quantum physics [17]. According to this method, the wave function created by the action A_2 is of the form:

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

Here C is a constant. The symbol ∑ is to sum over all possible paths and states. The equation (3) is the universal wave function formulation of string theory. We call this the universal wave function interpretation of string theory.

In our previous work, we show [9-13] that UWFIST has the potential to predict dark matter, dark energy, and inflation. It can also explain the observed large-scale anisotropies, non-Gaussian distributions, and anomalous alignments of the quadrupole and octupole modes in the microwave background.

The wave function for our universe derived in UWFIST suggests that our universe consists of many possibilities and states. In this sense, it is a multiverse. UWFIST gives the mathematical formula of the multiverse. The multiverse nature of our universe suggests that when we make a measurement, there may not be a definite result. If this is the case, how can we explain the equations of motion discovered so far in nature, such as gravity, and electromagnetism? In our paper [13], we demonstrate that the observed laws of nature come about due to the Weyl symmetry inherent in the actions A1 and A2. Requiring the invariance of local Weyl symmetry, one can derive the equations of motion discovered in nature. In this way, quantum physics and classical physics including Einstein's relativity theory come together in formula (3). In this way, quantum physics and general relativity are unified in the one mathematical formula (3).

The Emergence of Elementary Particles as the Invariance of Poincaré Symmetry

The discovery of elementary particles suggests that one finds elementary particles no matter where one puts the detector. The mass and spin of an elementary particle remains unchanged no matter where you detect it and who detects it.

If our universe is a multiverse and the phenomena we observe depends on the measurement, how can we explain the existence of elementary particles? We propose that the appearance of elementary particles is due to Poincaré symmetry intrinsic in the action (1) and (2) that creates our universe.

In string theory, there are two sets of space-time: the 2-dimensional world-sheet (σ, τ, θ_τ, θ_σ) and the observed space-time [$X^\mu(\sigma, \tau)$, $\boldsymbol{\psi}^{\boldsymbol{\mu}}(\sigma, \tau)$]. The observed space-time $X^\mu(\sigma, \tau)$ and fermions $\boldsymbol{\psi}^{\boldsymbol{\mu}}(\sigma, \tau)$ are a projection from the world sheet (σ, τ, θ_τ, θ_σ). The introduction of θ_τ and θ_σ brings fermions into the observed space. In terms of [$X^\mu(\sigma, \tau)$, $\boldsymbol{\psi}^{\boldsymbol{\mu}}(\sigma, \tau)$] and integrating over θ_τ and θ_σ, the action A_2 becomes:

$$A_2 = (1/l_p t_p)\int \Delta\tau\Delta\sigma\Delta\,\theta_\tau\Delta\theta_\sigma g^{1/2}g^{ab}[(G_{\mu\nu} + B_{\mu\nu})\,\partial_a X^\mu\partial_b X^\nu + \mathbf{G}_{\mu\nu}(\mathbf{X})(\boldsymbol{\psi}^{\mu}\mathbf{D}\boldsymbol{\psi}^{\nu} + \boldsymbol{\psi}^{+\mu}\mathbf{D}\boldsymbol{\psi}^{+\nu}) + \tfrac{1}{2}\mathbf{R}_{\mu\nu\rho\sigma}(\mathbf{X})\boldsymbol{\psi}^{\mu}\boldsymbol{\psi}^{\nu}\boldsymbol{\psi}^{+\rho}\boldsymbol{\psi}^{+\sigma}] \quad (4)$$

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* $B_{\mu\nu}$. In this way, all elementary particles, including fermions, gravity, and gauge bosons, can appear in the action (4).

To see how the elementary particles can appear through the quantum measurement in the multiverse represented by the equation (3), one can see that the action (4) is invariant under the Poincaré transformation**:**

$X'_\mu(\tau, \sigma) = \Lambda_\mu{}^\nu X_\nu(\tau, \sigma) + a_\mu$

$\Psi'_\mu(\tau, \sigma) = \Lambda_\mu{}^\nu \psi_\nu(\tau, \sigma) + a_\mu$

$\mathbf{g'^{ab}(\tau, \sigma) = g^{ab}(\tau, \sigma)}$

$G'_{\mu\nu}(\tau, \sigma) = G_{\mu\nu}(\tau, \sigma)$

$B'_{\mu\nu}(\tau, \sigma) = B_{\mu\nu}(\tau, \sigma)$

From group theory, one knows that mass and spin are two invariants under Poincaré transformation. Elementary particles are different representations of Poincaré symmetry.

From this, one finds that the repeatable experiment of finding elementary particles with definite mass and spin no matter where and when one makes the measurement is due to the Poincaré symmetry. One can therefore confirm the emergence and observation of vibrations with definite mass and spin is due to the Poincarè invariance intrinsic to the string-like action that creates our universe (2). From this, we can conclude the existence of elementary particles and also the wave-particle duality of the elementary particles.

Discussion and Conclusion

In this paper, we derive the existence of elementary particles from the law of creation. We review our previous work, which shows that the interaction of space and time and inclusion and exclusion action creates our universe. We review our derivation of the wave function of the universe. We show that the wave function of our universe is created by two-dimensional string action. We demonstrate that elementary particles are the emergence from the vibrational field created by the two-dimensional string action due to Poincaré invariance. Our work can explain the discovery by Xian Gang Wen and his colleagues that elementary particles emerge from string-net condensation from a fundamental principle. It also explains the wave-particle duality of elementary particles.

This work provides a way to explain and derive from a fundamental principle where all the elementary particles come from. In our previous work, we show that this approach, also called UWFIST, has the potential to derive dark matter, dark energy, inflation, and the large structure of our universe consistent with observation. In UWFIST, the equations of motion regarding electromagnetic force and gravity and other laws of physics can be derived from the requirement of

Weyl invariance. In this way, quantum physics and general relativity are integrated in one unified mathematical framework. This paper provides further evidence that UWFIST may indeed be the grand unified theory we are searching for.

In our previous work [13] we suggest that combining the requirement of Weyl invariance with Poincaré invariance, one may derive and calculate the masses of elementary particles in UWFIST. We will explore this further in our future work.

References

1. Braiban S, Giacomelli G, Spurio M. Particles and Fundamental Interactions: An Introduction to Particle Physics. 2nd edition. Springer; 2012.
2. Green M, Schwarz JH, Witten E. Superstring Theory, Introduction, Loop amplitudes, anomalies and phenomenology. *Cambridge University Press*. 1987; 68(6): 258. doi: 10.1002/zamm.19880680631
3. Joseph P. String theory, Vol. 1: An Introduction to the Bosonic String, ISBN 0-521-63303-6.Vol. 2: Superstring Theory and Beyond. *Cambridge University Press*. 1998; 402. doi: 10.1017/CBO9780511816079
4. Lan T, Kong L, Wen XG. Classification of 2+1D topological orders and SPT orders for bosonic and fermionic systems with on-site symmetries. *Phys. Rev. B*. 2007; 95: 235140. doi: 10.1103/PhysRevB.95.235140
5. Chen X, Gu ZC, Liu ZX, Wen XG. Symmetry protected topological orders and the group cohomology of their symmetry group. *Phys. Rev. B*. 2013; 87: 155114. doi: 10.1103/PhysRevB.87.155114
6. Gu ZC, Wen XG. Emergence of helicity +/- 2 modes (gravitons) from qubit models. *Nuclear Physics B*. 2012; 863: 90-129. doi: 10.1016/j.nuclphysb.2012.05.010
7. Levin MA, Wen XG. Photons and electrons as emergent phenomena. *Rev. Mod. Phys*. 2005; **77**: 871-879. doi: 10.1103/RevModPhys.77.871
8. Sha ZG, Rulin Xiu. Law of Creation and Grand Unification Theory. *Sci Fed*. 2018.
9. Xiu R. Dark Energy and Estimate of Cosmological Constant from String Theory**.** *J Astrophys Aerospace Technol*. 2017; 5(1): 141. doi: 10.4172/2329-6542.1000141
10. Sha ZG, Xiu R. Inflation Scheme Derived from Universal Wave Function Interpretation of String Theory. *J Phy. Scie. App*. 2017; 7(4): 33-37. doi: 10.17265/2159-5348/2017.04.004
11. Sha ZG, Xiu R. String Theory Explanation of Large-Scale Anisotropy and Anomalous Alignment. *Reports in Advances of Physical Sciences*. 2017; 1(3): 1750012. doi: 10.1142/S2424942417500128
12. Sha ZG, Xiu R. Derivation of Galaxy Rotation Curve from the Universal Wave Function Interpretation of String Theory. *American Based Research Journal*. 2018; 7(1): 1-5. doi: 10.1051/epjconf/201612604055
13. Sha ZG, Xiu R. Derivation of Multiverse from Universal Wave Function Interpretation of String Theory. *J Phy. Scie. App*. 2017; 7(6): 1-5. doi: 10.17265/2159-5348/2017.06.001
14. Wheeler JA, Ford KW. Geons, Black Holes, and Quantum Foam: A Life in Physics. W. W. Norton & Company; 1998.
15. Zurek WH. Complexity, entropy and the Physics of Information. Addison-Wesley; 1990.
16. Wheeler JA. Hermann Weyl and the Unity of Knowledge. *American Scientist*. 1986; 74(4): 366-375.
17. Feynman, RP, Hibbs A. Quantum Mechanics and Path Integrals. 1st edition. McGraw Hill; 1965.