

## THE COSMIC ORGANISM THEORY

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The cosmic organism theory is described in which all visible and invisible matter has different cosmic genetic expressions. The cosmic gene includes codes for the object structure and the space structure. The cosmic digital code for the object structure consists of full object (1, 2, and 3 for particle, string, and membrane, respectively) and empty object (0) as anti de Sitter space (AdS). The tessellation lattice of empty objects is tessellattice. The decomposition of a full object in tessellattice results in the AdS/CFT (conformal field theory) duality. The digital code for the object structure accounts for the AdS/CFT duality, the dS/bulk duality, and gravity. The digital code for the space structure consists of 1 and 0 for attachment space and detachment space, respectively. Attachment space attaches to object permanently at zero speed or reversibly at the speed of light. Detachment space detaches from the object irreversibly at the speed of light. The combination of attachment space and detachment space results in miscible space and binary lattice space. Miscible space represents special relativity. Binary lattice space corresponds to the nilpotent universal computational rewrite system (NUCRS) by Diaz and Rowlands. The gauge force fields and wavefunction are in binary lattice space. With tessellattice and binary lattice space, 11D brane is reducing to 4D particle surrounded by gravity and the gauge force fields. The cosmology model and dark energy developed in the present work are in agreement with predictions of the Santilli isodual theory and the Dirac hole theory.

*Keywords:* Nucleons, nuclear forces, space structure, tessellattice, inertons, quantum mechanics

### 1. INTRODUCTION

In the cosmic organism theory (Chung, 2002a), different universes are different cosmic organs for the cosmic organism that is the multiverse. Different universes are the different expressions of the common cosmic gene. The cosmic gene is the cosmic digital code (Chung, 2002b) in the cosmic dimension. The cosmic digital code includes the codes for the object structure and the space structure.

In the analysis of the multiverse (Ellis, Kirchner, and Stoeger, 2004) state that there is a definite causal connection, or “law of laws”, relating all the universes in these multiverses. Law of laws can be described as the ultimate law of fundamental laws, which include relativity, quantum mechanics, and the laws for the existence of different physical constants, dimensionality, particle content, and the size of universe in the multiverse. The ultimate law connects fundamental laws. In the cosmic organism theory, the ultimate law is the cosmic gene. The cosmic organism theory follows the Alfred North Whitehead’s philosophy of organism. According to Whitehead (Whitehead, 1929), the actual world is a process, and the process is the becoming of actual entities. An actual entity is not an inert and permanent substance, but a relational process of becoming. Its ‘being’ is constituted by its ‘becoming’. Michel Bounias (2002) applied the Hamiltonian concept to living organism in the evolutionary process.

The paper is divided into seven sections: the introduction, the cosmic digital code for the object structure, the digital code for the space structure, the cosmic dimension, cosmology, force fields, and the summary.

## 2. THE DIGITAL COSMIC CODE FOR THE OBJECT STRUCTURE

In terms of the current hypothesis, which is still shared by the majority of physicists, fundamental principles of the world are associated with so-called strings and membranes – abstract entities that are treated as primary elements of the world. Then the cosmic digital code for object structure can be presented by the full object, which involves particle, string and membrane (1, 2, and 3, respectively), and the empty object (0) as anti de Sitter space (AdS). Full object occupies space fully, while empty object is originally as the gap among full objects.

An empty cell (or topological ball, or superparticle), as a primary element, was first proposed by Bounias and Krasnoholovets (2003a,b) in the tessellattice theory. A tessellation lattice of empty cells with the size of the Planck is the tessellattice. A particle is treated as a local deformation of the tessellattice. The behavior of a moving particle in a cellular space studied by Krasnoholovets (1993,1997,2002) is characterized by a submicroscopic mechanics that discloses the particle's hidden dynamics behind the formalism of conventional quantum mechanics. It is important that in submicroscopic mechanics a moving particle interacts with coming cells of the space. Considering space in terms of the tessellattice, Bounias and Krasnoholovets (2003a,b,c) concluded that a moving canonical particle experiences a fractal decomposition into a core particle surrounded by its inerton cloud (the notion of an *inerton* as a carrier of inert properties of the particle, which thus becomes a substructure of the particle's matter waves, was introduced in works by Krasnoholovets and Ivanovsky (1993) and Krasnoholovets (1997)). The decomposition generates the gravitational mass, and inerton carries the inertial of gravitational mass of particles. Gravity comes from the continuous generation of inerton clouds by the continuous interaction of a moving particle and the empty cells in the tessellattice.

Empty object as AdS is the active empty cell that can decompose a full object. In AdS, the cosmological constant ( $\Lambda < 0$ ), indicating a negative expansion. Such negative expansion can reduce space dimension from non-zero to zero. Empty object as AdS, therefore, can detach one of the space dimensions of a D dimensional full object by reducing the space dimension from non-zero to zero. Losing one space dimension, the D dimensional full object becomes the D – 1 dimensional core object. The detached one-dimensional space becomes the radial space transverse to the D – 1 dimensional core object. The D – 1 dimensional core object with the transverse radial space constitutes the D – 1 dimensional conformal field theory (CFT).

$$D \text{ dim full object} + D \text{ dim empty object (AdS}_D) \xrightarrow{\text{the decomposition}} D-1 \text{ dim core object with 1 dim transverse radial space} \quad (1)$$

Therefore, this decomposition has the AdS/CFT duality (Maldacena, 1998; Gubser, Klebanov and Polyakov, 1998; Witten, 1998), though this occurs in tessellattice as AdS. In the decomposition theory for the AdS/CFT duality, D – 1 dimensional CFT is the decomposition product from a D dimensional full object in tessellattice as AdS<sub>D</sub>.

Furthermore, tessellattice decomposes not only the D dimensional background space-time but also internal dimensional space-time. The internal dimension numbers for brane, string, particle, and empty object are 3, 2, 1, and 0, respectively. In the D dimensional background space-time, they are denoted as 3<sub>D</sub>, 2<sub>D</sub>, 1<sub>D</sub>, and 0<sub>D</sub>. The decompositions for them are as follows

$$\begin{aligned}
 3_D + 0_D &\xrightarrow{\text{the decomposition}} 2_{D-1} 1_1 \\
 2_D + 0_D &\xrightarrow{\text{the decomposition}} 1_{D-1} 1_1
 \end{aligned}
 \tag{2}$$

The object in  $1_1$  (the transverse radial space) is a virtual particle corresponding to the inerton surrounding the core object. A  $D$ -dimensional full object in AdS is decomposed into a  $(D - 1)$  dimensional core object surrounded by a virtual particle.

One example of the degenerate state of tessellattice is the universe before the big bang or a series of small big bangs, which will be treated in detail in the other work. As shown later, the most primitive part of the multiverse is the primitiverse (Chung, 2002a). The primitiverse consists of closely pack 10D strings, denoted as  $2_{10}$ . There is no gap among 10D strings in the primitiverse. It is the same everywhere. The primitiverse is flat with  $\Lambda = 0$ .

The combination of  $n$  units of strings forms a loop, which then obtains additional space dimension to form 11D brane, assigned as  $3_{11}$ . The additional space dimension for both background space-time and internal space-time is in the form of de Sitter (dS) space. dS space has a function of space expansion ( $\Lambda > 0$ ) that can expand one of the space dimension in both the background space-time and the internal space-time from zero to non-zero. Empty space as AdS space with a function of negative expansion ( $\Lambda < 0$ ) is generated to balance dS, resulting in  $\Lambda = 0$

$$(2_{10})_n + dS_{10} \xrightarrow{\text{the composition}} 3_{11} + AdS_{11} = (0_{11})_n$$

*tessellattice*

(3)

The duality in Eq. (3) is the dS/bulk duality. In the composition theory for the dS/bulk duality, a  $D + 1$  brane as bulk in  $AdS_{D+1}$  is the composition product from  $D$  dimensional strings in  $dS_D$ .

Normally, the decomposition of  $3_{11}$  results in  $n$  units of  $2_{10}$  to complete the reversible process of the composition and the decomposition. In some abnormal cases, the decomposition leads to the AdS/CFT duality

$$3_{11} + (0_{11})_n \xrightarrow{\text{the decomposition}} (2_{10})_n (1_1)_n$$

(4)

The full object,  $3_{11}$  in AdS decomposes into the core object,  $(2_{10})_n$ , surrounded by the virtual object,  $(1_1)_n$ . The virtual object is “pregravity” before a big bang. Pregravity is the combination of the dS/bulk duality for the composition in Eq. (3) and the AdS/CFT in Eq. (4) for the decomposition.

When the critical mass for the AdS/CFT duality reaches, the AdS/CFT duality propagates in the primitiverse, and a universe is generated out of the primitiverse as shown later.

As shown later, in the present light universe after the big bang, the object structure is 4D particle, denoted as  $1_4$ .  $(2_{10})_n (1_1)_n$  in Eq. (4) becomes  $(1_4)_n (1_1)_n$  in the present (observable) light universe

$$(2_{10})_n (1_1)_n \xrightarrow{\text{bang}} (1_4)_n (1_1)_n = (1_4)_n g$$

(5)

The transverse radial space from  $1_1$  (virtual particle) is added to the flat space in  $1_4$ , resulting in the curved space for gravity in general relativity. Thus, gravity as  $1_1$  is the origin of the Riemann tensor to indicate the curved space wrapping around the flat core object.

### 3. THE DIGITAL COSMIC CODE FOR THE SPACE STRUCTURE

The cosmic digital code for the space structure consists of 1 and 0 for an attachment space and a detachment space, respectively. Attachment space attaches to object permanently with zero speed or reversibly at the speed of light. Detachment space irreversibly detaches from the object at the speed of light. Special relativity deals with the propagation speeds, particularly, between zero and the speed of light.

As shown later, the universe starts with only attachment space without detachment space (Chung, 2002a). The cosmic origin of detachment space is the cosmic radiation that initiates big bangs. Some objects in 4D-attachment space, denoted as  $1_4$ , convert into the cosmic radiation in 4D-detachment space, denoted as  $0_4$

$$\text{some objects in } 1_4 \xrightarrow{\text{bang}} \text{the cosmic radiation in } 0_4 \quad (6)$$

Being massless particle, the cosmic radiation is on detachment space continuously, and detaches from its own space continuously. The emergence of the cosmic radiation allows the combination of  $n$  units of attachment space and  $n$  units of detachment space. The combination results in miscible space, binary partition space or binary lattice space.

$$\begin{aligned} & \binom{1}{4}_n \text{ attachment space} + \binom{0}{4}_n \text{ detachment space} \xrightarrow{\text{combination}} \\ & \text{miscible space, } \binom{1}{4} \binom{0}{4}_n \text{ binary lattice space, or } \binom{1}{4}_n \binom{0}{4}_n \text{ binary partition space} \end{aligned} \quad (7)$$

In miscible space, attachment space is miscible to detachment space, and there is no separation of attachment space and detachment space. Binary lattice space consists of repetitive units of alternative attachment space and detachment space. Thus, binary lattice space consists of multiple quantized units of attachment space separated from one another by detachment space. Binary partition space consists of separated continuous phases of attachment space and detachment space.

In miscible space, attachment space contributes zero speed, while detachment space contributes the speed of light. A massless particle is on detachment space continuously, and detaches from its own space continuously. For a moving massive particle consisting of a rest massive part and a massless part, the massive part with rest mass,  $m_0$ , is in attachment space, and the massless part with kinetic energy,  $K$ , is in detachment space. The combination of the massive part in attachment space and massless part in detachment leads to the propagation speed in between zero and the speed of light.

To maintain the speed of light constant for a moving particle, the time ( $t$ ) in moving particle has to be dilated, and the length ( $L$ ) has to be contracted relative to the rest frame

$$\begin{aligned} t &= t_0 / \sqrt{1 - v^2 / c^2} = t_0 \gamma, \\ L &= L_0 / \gamma, \\ E &= K + m_0 c^2 = \gamma m_0 c^2 \end{aligned} \quad (8)$$

where  $\gamma = 1 / \sqrt{1 - v^2 / c^2}$  is the Lorentz factor for time dilation and length contraction,  $E$  is the total energy and  $K$  is the kinetic energy.

Binary lattice space consists of multiple quantized units of attachment space separated from one another by detachment space. Binary lattice space slices an object into multiple quantum states

separated from one another by detachment space. Binary lattice space corresponds to nilpotent universal computational rewrite system (NUCRS) by Diaz and Rowlands (2003). NUCRS starts with “nothing”, and add new symbols, which must results in “a zero sum” again. The addition of new symbols involves the sequential iterative path from nothing (nilpotent) through conjugation, complexification, and dimensionalization. Nilpotent corresponds to detachment space detached from object.

In this paper, the universe starts with attachment space filled with objects (information). The addition of detachment space results in binary lattice space consisting of attachment space and detachment space. Detachment space detaches from object. Detachment space contains no object that carries information. Without information, detachment space is outside of the realm of causality. Without causality, distance (space) and time do not matter to detachment space. Thus, detachment space contains nothing (zero information), so detachment space is non-local in terms of space-time. Detachment can have any space and time. The non-locality of detachment space in binary lattice space leads to the complete non-locality of binary lattice space. Because detachment space contains no information, the non-locality of binary lattice space cannot result in net new information. The changes of objects in binary lattice space can only be expressed through conjugation, complexification, and dimensionalization, which must result in zero sums, indicating nothing (zero information) in detachment space (nilpotent) as in NUCRS.

Basically, detachment space (nilpotent) de-localizes space-time in binary lattice space. The non-local property of detachment space provides the violation of Bell inequalities (Bell, 1964) in quantum mechanics in terms of faster-than-light influence and indefinite property before measurement. The non-locality in Bell inequalities does not result in net new information.

In binary lattice space, for every detachment space, there is its corresponding adjacent attachment space. Thus, no part of the object can be irreversibly separated from binary lattice space, and no part of a different object can be incorporated in binary lattice space. Binary lattice space represents coherence as wavefunction. Binary lattice space is for coherent system.

Any destruction of the coherence by the addition of a different object to the object causes the collapse of binary lattice space into binary partition space.

$$\begin{array}{ccc}
 \left( \binom{0}{4} \binom{1}{4} \right)_n & \xrightarrow{\text{collapse}} & \left( \binom{0}{4} \binom{1}{4} \right)_n & \xrightarrow{\text{mixing}} & \text{miscible space} \\
 \text{binary lattice space} & & \text{binary partition space} & & 
 \end{array} \tag{9}$$

After the collapse, in binary partition space, attachment space attaches to an object at any one location according to its probability without absolute certainty, while detachment space separately detaches from all probability density. By introducing a different object into an observed object, experimental observation causes the collapse of binary lattice space. All observations bring about binary partition space. Binary partition space is the space immediately after the collapse of binary lattice space, and binary partition space then changes to miscible space by mixing attachment space and detachment space.

Binary lattice space can slice small object into quantum states, but binary lattice space cannot slice a large object into quantum states due to gravity. The difference between a small and a large object might be associated with the comparison between the object’s de Broglie wavelength and the object size. Penrose (2000) pointed out that the gravity of large object pulls different quantum states into one location. On the other hand, the gravity of a small object is not strong enough to pull different states into one location. Therefore, a large object is always in miscible space, while a small object without outside interference is always in binary lattice space.

The conventional explanation of the hidden extra space dimensions is the compactification of the extra space dimensions. For example, six space dimensions become hidden by the compactification, so space-time appears to be four dimensional.

Bounias and Krasnoholovets (2003c) propose another explanation of the reduction of > 4 D space-time into 4D space-time by slicing > 4D space-time into infinitely many 4D quantized units surrounding

the 4D core particle. Such slicing of  $> 4D$  space-time is like slicing 3-space D object into 2-space D object in the way stated by Michel Bounias as follows: “You cannot put a pot into a sheet without changing the shape of the 2-D sheet into a 3-D dimensional packet. Only a 2-D slice of the pot could be a part of sheet”.

This slicing of space-time dimension is done by detachment space indirectly. As shown later, the direct slicing is the slicing of “mass dimension” derived from space-time dimension. The indirect slicing of  $> 4D$  attachment space by 4D detachment space is as follows

$$\begin{array}{ccc} \binom{1}{4+k}_m & \xrightarrow{\text{slicing}} & \binom{1}{4}_m + \sum_{k=1}^k \left( \binom{0}{4} \binom{1}{4}_{n,k} \right) \\ >4D \text{ attachment space} & & 4D \text{ core attachment space} \quad k \text{ types of } 4D \text{ units} \end{array} \quad (10)$$

*k types of gauge force fields in lattice space*

The two products of the indirect slicing are the 4D-core attachment space and 4D quantized units of attachment space separated by detachment space, corresponding to binary lattice space. They are  $k$  types of 4D quantized units, representing the total number of space dimensions greater than three-dimensional space. For example, the indirect slicing of 10D attachment space produces 4D core attachment space and six types of 4D quantized units. The value of  $n$  approaches to infinite for infinitely many 4D quantized units.

The core attachment space surrounded by infinitely many 4D quantized units corresponds to the core particle surrounded by infinitely many small 4D particles. The gauge force fields are made of such small 4D quantized virtual particles surrounding the core particle.

Unlike tessellattice, binary lattice space for gauge force fields has no boundary. It corresponds to the quantized asymptotically flat S-matrix with  $\Lambda = 0$ . Unlike tessellattice, binary lattice space for gauge force fields is in low-density region. The gauge force fields (Chung, 2002a) include electromagnetism, the strong force in the low-density pions, two parity-nonconservation interactions, and two CP-nonconservation interactions.

The transformation from 11D brane to 4D particle is  $AdS_5 \times S^6$  where  $AdS_5$  is in tessellattice for gravity,  $S^6$  is in binary lattice space for gauge force fields, and there is no compactification of extra space dimensions. In other words, one extra space dimension in the seven extra space dimensions from 11D brane is reduced by tessellattice (AdS) for gravity, and six extra space dimensions are reduced indirectly by binary lattice space for the gauge force fields. With tessellattice and binary lattice space, 11D brane is reduced to 4D particle surrounded by gravity and the gauge force fields.

#### 4. THE COSMIC DIMENSION – VARYING DIMENSION NUMBER

The cosmic digital code is in the cosmic dimension, which is in the framework of varying dimension number. Varying dimension number is derived from varying speed of light (VSL) theory (Amelino-Camelia, 2001,2002; Barrow, 2003; Ellis and Uzan, 2005; Magueijo, 2003). The constancy of the speed of light is the pillar of special relativity. It is believed the constancy of the speed of light takes place in the four dimensional space-time whose space-time dimension number (four) is constant. In the model of cosmology (Albrecht and Magueijo, 1999; Barrow, 1999, 2003) that belongs to the VSL model, the speed of light varies in time. The time dependent speed of light varies as some power of the expansion scale factor  $a$  in such way that

$$c(t) = c_0 a^n \quad (11)$$

where  $c_0 > 0$  and  $n$  are constants. The increase of speed of light is continuous.

This paper posits quantized varying speed of light (QVSL), where the speed of light is invariant in a constant space-time dimension number, and the speed of light varies with varying space-time dimension number from 4 to 11. In QVSL, the speed of light is quantized by varying space-time dimension number

$$c_D = c / \alpha^{D-4}, \tag{12}$$

where  $c$  is the observed speed of light in the 4D space-time,  $c_D$  is the quantized varying speed of light in space-time dimension number,  $D$ , from 4 to 11, and  $\alpha$  is the fine structure constant. Each dimensional space-time has a specific speed of light. The speed of light increases with the increasing space-time dimension number  $D$ . In the VDN model of cosmology, the universe as the dual chiral universe that has the speed of light in 11D space-time.

In special relativity,  $E = M_0 c^2$  modified by Eq. (12) is expressed as

$$E = M_0 \cdot (c^2 / \alpha^{2(D-4)}) \tag{13a}$$

$$= (M_0 / \alpha^{2(d-4)}) \cdot c^2. \tag{13b}$$

Eq. (13a) means that a particle in the  $D$  dimensional space-time can have the superluminal speed  $c / \alpha^{D-4}$ , which is higher than the observed speed of light  $c$ , and has the rest mass  $M_0$ . Eq. (13b) means

that the same particle in the 4D space-time with the observed speed of light acquires  $M_0 / \alpha^{2(d-4)}$  as the rest mass, where  $d = D$ . In Eq. (13a)  $D$  is the space-time dimension number defining the varying speed of light. In Eq. (13b),  $d$  from 4 to 11 is “mass dimension number” defining varying mass. For example, for  $D = 11$ , Eq. (13a) shows a superluminal particle in eleven-dimensional space-time, while Eq. (13b) shows that the speed of light of the same particle is the observed speed of light with the 4D space-time, and the mass dimension is eleven. In other words, 11D space-time can transform into 4D space-time with 11d mass dimension. QVSL in terms of varying space-time dimension number,  $D$ , brings about varying mass in terms of varying mass dimension number,  $d$ .

The QVSL transformation transforms both space-time dimension number and mass dimension number. In the QVSL transformation, the decrease in the speed of light leads to the decrease in space-time dimension number and the increase of mass in terms of increasing mass dimension number from 4 to 11,

$$c_D = c_{D-n} / \alpha^{2n}, \tag{14a}$$

$$M_{0,D,d} = M_{0,D-n,d+n} \alpha^{2n}, \tag{14b}$$

$$D, d \xrightarrow{QVSL} (D \mp n), (d \pm n) \tag{14c}$$

where  $D$  is the space-time dimension number from 4 to 11 and  $d$  is the mass dimension number from 4 to 11. For example, the QVSL transformation steps a particle with 11D4d to a particle with 4D11d. In terms of rest mass, 11D space-time has 4d with the lowest rest mass, and 4D space-time has 11d with the highest rest mass.

In such a way, the QVSL transformation is an alternative to the Higgs mechanism to gain rest mass. In the QVSL, the speed of light is constant in a specific space-time dimension number, such as 4 for our four-dimensional space-time. In different space-time dimension numbers (from 4 to 11), speeds of light are different. In our four-dimensional space-time, the speed of light is the lowest, so

according to special relativity ( $E = M_0 c^2$ ), with constant energy, the rest mass in our four-dimensional space-time is the highest. Thus, instead of absorbing the Higgs boson to gain rest mass, a particle can gain rest mass by decreasing the speed of light and space-time dimension number. The QVSL transformation also gains a new quantum number, “mass dimension number” from 4 to 11 to explain the hierarchical masses of elementary particles. Since the Higgs bosons have not been found experimentally, the QVSL transformation to gain rest mass is a good alternative. In terms of vacuum energy, the four-dimensional space-time has the zero vacuum energy with the highest rest mass, while  $D > 4$  have non-zero vacuum energy with lower rest mass than 4D. Since the speed of light for a particle with dimension  $> 4D$  is greater than the speed of light for a 4D particle, the observation of  $> 4D$  particles by 4D particles violates casualty. Thus, particles with dimension  $> 4D$  should be treated as hidden particles with respect to 4D particles. In general, particles with different space-time dimensions are transparent and oblivious to one another.

In the normal supersymmetry transformation, the repeated application of the fermion-boson transformation carries over a boson (or fermion) from one point to the same boson (or fermion) at another point at the same mass. In the “varying supersymmetry transformation”, the repeated application of the fermion-boson transformation steps a boson from one point to the boson at another point at different mass dimension number in the same space-time number. The repeated varying supersymmetry transformation carries over a boson  $B_d$  into a fermion  $F_d$  and a fermion  $F_d$  to a boson  $B_{d-1}$ , which can be expressed as follows

$$M_{d,F} = M_{d,B} \alpha_{d,B}, \quad (15a)$$

$$M_{d-1,B} = M_{d,F} \alpha_{d,F} \quad (15b)$$

where  $M_{d,B}$  and  $M_{d,F}$  are the masses for a boson and a fermion, respectively,  $d$  is the mass dimension number, and  $\alpha_{d,B}$  or  $\alpha_{d,F}$  is the fine structure constant that is the ratio between the masses of a boson and its fermionic partner. Assuming  $\alpha_{d,B}$  or  $\alpha_{d,F}$ , the relation between the bosons in the adjacent dimensions then can be expressed as

$$M_{d-1,B} = M_{d,B} \alpha_d^2. \quad (15c)$$

Eqs. (15) show that it is possible to describe mass dimensions  $> 4$  in the following way

$$F_5 B_5 F_6 B_6 F_7 B_7 F_8 B_8 F_9 B_9 F_{10} B_{10} F_{11} B_{11}, \quad (16)$$

where the energy of  $B_{11}$  is the Planck energy. Each mass dimension between 4d and 11d consists of a boson and a fermion. Eqs. (15) show a stepwise transformation that converts a particle with  $d$  mass dimension to  $d \pm 1$  mass dimension. The transformation from a higher dimensional particle to the adjacent lower dimensional particle is the fractionalization of the higher dimensional particle to the many lower dimensional particle in such way that the number of lower dimensional particles becomes  $n_{d-1} = n_d / \alpha^2$ . The transformation from lower dimensional particles to higher dimensional particle is a condensation. Both the fractionalization and the condensation are stepwise. For example, a particle with 4D (space-time) 10d (mass dimension) can transform stepwise into 4D9d particles. Since the supersymmetry transformation involves translation, this stepwise varying supersymmetry transformation leads to a translational fractionalization and translational condensation, resulting in expansion and contraction. At the same time it should be mentioned that research by Krasnoholovets (2000) points out to the fact that only fermions are true canonical particles, while bosons are rather combined particles consisting of fermions.

Another type of the varying supersymmetry transformation is not stepwise. It is the leaping varying supersymmetry transformation that transforms a particle with  $d$  mass dimension to any  $d \pm n$

mass dimension. The transformation involves the slicing-fusion of particle. The transformation from  $d$  to  $d - n$  involves the slicing of a particle with  $d$  mass dimension into two parts: the core particle with  $d - n$  dimension and the  $n$  dimensions that are separable from the core particle. Such  $n$  dimensions are denoted as  $n$  “dimensional orbitals”, which become force fields (Chung 2002a). The sum of the number of mass dimensions for a particle and the number of dimensional orbitals (DO’s) is equal to 11 for all particles with mass dimensions. Therefore,

$$F_d = F_{d-n} + (11-d+n)\text{DO's} \tag{17}$$

where  $11 - d + n$  is the number of dimensional orbitals (DO’s) for  $F_{d-n}$ . For example, the slicing of 4D9d particle produces 4D4d particle that has  $d = 4$  core particle surrounded by 7 separable dimensional orbitals in the form of  $B_5F_5B_6F_6B_7F_7B_8F_8B_9F_9B_{10}F_{10}B_{11}$ . Since the slicing process is not stepwise from higher mass dimension to lower mass dimension, it is possible to have simultaneous slicing. For example, 4D9d particles can simultaneously transform into 4D8d, 4D7d, 4D6d, 4D5d, and 4D4d core particles, which have 3, 4, 5, 6, and 7 separable dimensional orbitals, respectively.

Therefore, varying supersymmetry transformation can be stepwise or leaping. Stepwise supersymmetry transformation is translational fractionalization and condensation, resulting in stepwise expansion and contraction. Leaping supersymmetry transformation is not translational, and it is slicing and fusion, resulting possibly in simultaneous formation of different particles with separable dimensional orbitals.

In summary, the QVSL transformation carries over both space-time dimension number and mass dimension number. The varying supersymmetry transforms varying mass dimension number in the same space-time number as follows (once again,  $D$  = space-time dimension number and  $d$  = mass dimension number).

$$\begin{aligned} D, d &\xrightarrow{QVSL} (D \mp n), (d \pm n) \\ D, d &\xrightarrow{\text{stepwise varying supersymmetry}} D, (d \pm 1) \\ D, d &\xrightarrow{\text{leaping varying supersymmetry}} D, (d \pm n) \end{aligned}$$

### 5. COSMOLOGY

The cosmic gene controls the maturation processes of different cosmic organs as different universes. The universal maturation process of our dual Vedic universe involves four stages: the primitiverse, the dual chiral universe, the dual achiral universe, and the dual Vedic universe. Different stages of the universal maturation process are different cosmic genetic expressions. The emergencies of empty object, achirality, and zero vacuum energy lead to the dual chiral universe, the dual achiral universe, and the dual Vedic universe, respectively as follows

$$\begin{aligned} \text{primitiverse} &\xrightarrow{\text{empty object}} \text{dual chiral universe} \xrightarrow{\text{achirality}} \text{dual achiral universe} \\ &\xrightarrow{\text{zero vacuum energy}} \text{dual expanding universe} \end{aligned}$$

The primitiverse consists of the closely packed 10D string-antistrings. The primitiverse with  $\Lambda = 0$  does not have empty object and detachment space. The dual chiral universe started from the combination of  $n$  units of 10D strings into 11D brane as in Eq. (3). Through symmetry, the combination of  $n$  units of antistrings forms 11D anti-brane. The combination of  $3_{11}$  and  $0_{11}$  brings

about  $2_{10} 2_1$ , where  $2_1$  is pregravity,  $g$ . In the same way, the combination of  $3_{-11}$  and  $0_{11}$  brings about  $2_{-10} 1_{-1}$ , where  $1_{-1}$  is anti-pregravity,  $g_-$ .

$$\begin{aligned}
 (2_{10})_n + dS &\xrightarrow{\text{composition}} 3_{11} + (0_{11})_n \\
 (2_{-10})_n + dS &\xrightarrow{\text{composition}} 3_{-11} + (0_{-11})_n \\
 3_{11} + (0_{11})_n &\xrightarrow{\text{decomposition}} (2_{11})_n (1_1)_1 = (2_{10})_n g \\
 3_{-11} + (0_{-11})_n &\xrightarrow{\text{decomposition}} (2_{-10})_n (1_{-1})_1 = (2_{-10})_n g_- \\
 (2_{10})_n g + (2_{-10})_n g_- &\longrightarrow (2_{10})_n g g_- (2_{-10})_n
 \end{aligned} \tag{18}$$

Pregravity is repulsive to anti-pregravity, so  $(2_{10})_n$  and  $(2_{-10})_n$  are separated from each other. When the critical mass of the AdS/CFT duality reaches, the AdS/CFT duality propagates in the primitiverse continuously, resulting in a large number for  $n$ .

Other than pre-gravity, there are two other forces: the pre-strong force and the pre-charged force, as the predecessor of the strong force and electromagnetism, respectively. Both of them are from the quantized vibration of the strings. The original force in the primitiverse is the short-ranged pre-strong force, “ $s$ ”, among strings. It is from the reversible process of the absorption and the emission of the massless particles among the strings. The pre-strong force also forms the bond between the primitiverse and the strings with gravity. The vibration of the string with gravity generates the long-ranged pre-charged force, “ $e$ ”, as the reversible process of the absorption and the emission of the massless particles among the strings with gravity. The string with gravity has the positive pre-charged force, and the antistring with anti-gravity has the negative pre-charged force. The positive pre-charged force is attractive to the negative pre-charged force.

The appearances of different forces follow the specific sequence. In the sequence, the pre-strong force exists first. Then, the emergence of the repulsive force between pregravity and anti-pregravity forces the string and the antistring to move away from each other. All of the strings go to one domain with pregravity, while all of the antistrings go to the opposite domain with anti-pregravity. Subsequently, the pre-strong force connects the newly formed strings or the antistring with the previously formed strings or antistrings. Finally, the pre-charged force emerges. The domain occupied by the strings is opposite from the domain occupied by the antistrings, so the strings and the antistrings are chiral. This specific sequence provides the formation of the dual chiral universe.

$$\text{primitiverse } s (2_{10} s 2_{10} s)_n \frac{g^+}{e^+} \frac{g^-}{e^-} (2_{-10} s 2_{-10} s)_n s \text{ primitiverse} \tag{19}$$

where  $g$  is the pregravity,  $e$  is the pre-charged force,  $s$  the pre-strong force and  $n$  numbers of repetitive units.

The dual chiral universe consists of two universes: 10D strings with positive energy and gravity and 10D antistrings with negative energy and anti-pregravity. The two universes are opposite (chiral) in CP, energy, and pregravity.

During the steady conversion from the primitiverse to the dual chiral universe takes place, the total volume of the primitiverse and the dual chiral universe remain constant. To maintain this constant volume, the attractive force ( $A$ ) between the positive and negative precharged forces is equal to the sum of the repulsive force ( $R$ ) between pregravity and anti-pregravity, and the special global short-ranged pre-strong force ( $C$ ) connecting the dual chiral universe and the primitiverse.  $A = R + C$  is a non-localized global relation for the constant total volume of the universes. If  $A > R + C$ , the total volume is smaller, and if  $A < R + C$ , the total volume is larger.

There is a small amount of the abnormal sequence of the appearance of force in the dual chiral universe. In the abnormal development sequence, the pre-strong force exists first. Then, the

emergence of pregravity occurs simultaneously with the attractive force from the pre-charged forces, drawing the string and the antistring together,

$$g^+(2_{10})_m e^+ e^-(2_{-10})_m g^- \quad (20)$$

The combined string-antistring units go impartially to either side of the dual chiral universe, resulting in the achiral string-antistring units. (Essentially, attractive force and repulsive force are the tools to form chirality and achirality.) In the universe, local interactions are either chirality-specific or achirality-specific. Unable to interact with the region inside the dual chiral universe, the achiral string-antistring units are separated from the dual chiral universe, and congregate in the area connecting the primitiverse and the dual chiral universe. They form the achiral domain next to the primitiverse.

$$\text{primitiverse } s \ g + (2_{10})_m e^+ e^-(2_{-10})_m g^- \ s \ \text{primitiverse} \quad (21)$$

where  $m$  is much smaller than  $n$  from Eq. (19).

Such achiral domain connects with the primitiverse, but does not connect with the dual chiral universe. The result is the decrease of the connection between the dual chiral universe and the primitiverse. However, as a non-localized global relation,  $A = R + C$  continues with the right amount of  $C$  contributed by the primitiverse as long as there is still connection between the primitiverse and the dual chiral universe.

As the dual chiral universe grows, the achiral domain also grows. Eventually, the dual chiral universe is disconnected completely from the primitiverse by the achiral domain. Without  $C$ , the excess attractive force ( $A > R$ ) between positive charged strings and negative charged antistrings causes the dual chiral universe to collapse, and the repulsive force between pregravity and anti-pregravity causes the dual chiral universe to invert. As the 10D-strings and the 10D-antistrings move toward each other, the 10D-strings and the 10D-antistrings turn inside, and pregravity and anti-pregravity turn outside. The “gulf” separates the dual chiral universe and the primitiverse forms. Eventually, the 10D-strings and the 10D-antistrings coalesce.

During the coalescence, the two chiral universes coexist in the same space-time, which is predicted by the Santilli isodual theory (Santilli, 2006). Antiparticle for our positive energy universe is described by Santilli as follows, “this identity is at the foundation of the perception that antiparticles “appear” to exist in our space, while in reality they belong to a structurally different space coexisting within our own, thus setting the foundations of a “multidimensional universe” coexisting in the same space of our sensory perception” (Santilli, 2006, p. 94). Antiparticles in the positive energy universe actually come from the coexisting negative energy universe. With chiral symmetry, the isodual theory describes the coexistence of the two chiral universes.

The coexisting chiral universes do not remain chiral. The mixing of the two chiral universes results in the two achiral universes. The mixing process follows the isodual hole theory that is the combination of the isodual theory and the Dirac hole theory. In the Dirac hole theory that is not symmetrical, the positive energy universe has an unobservable infinitive sea of negative energy. A hole in the unobservable infinitive sea of negative energy is the observable positive energy antiparticle. The isodual hole theory has two symmetrical sets of coexisting holes in the symmetrical coexisting seas of positive energy and negative energy.

In the dual chiral universe, one universe has positive energy, strings, and pregravity, and one universe has negative energy, antistrings, and anti-pregravity. During the mixing when two chiral universes coexist, a half of antistrings in the negative energy universe moves to the positive energy universe, and the process leaves the Dirac holes in the negative energy universe. The antistrings moved become positive energy antistrings in the positive energy universe. In the same way, a half of strings in the positive energy universe moves to the negative energy universe, and the process leaves the Dirac holes in the positive energy universe. The strings moved become negative energy strings in the negative energy universe. The result is that a half of antistrings moves from the negative energy universe to the positive energy universe to become positive energy antistrings, and a half of strings from the positive energy universe to the negative energy universe to become negative energy strings.

Both positive energy universe and negative energy universe have strings-antistrings. The universes become achiral in terms of strings and antistrings. With the odd number (9) of space dimension, 10D string has chiral symmetry. Chiral 10D string cannot survive in the achiral universes, so 10D strings-antistrings become 10D particles-antiparticles. 10D particles-antiparticles have the multiple dimensional Kaluza-Klein structure with flexible requirement for space dimension number, so they do not need to have a fixed space dimension number. Thus, the isodual hole theory converts the chiral universes into the achiral universes, and strings-antistrings with fixed space dimension number into particles-antiparticles with varying space dimension number.

The dual achiral universe consists of positive energy particles-antiparticles with pregravity and negative energy particles-antiparticles with anti-pregravity. The two coexisting universes are represented as below:

$$\begin{aligned} & \text{primitiverse [gulf] } 1/2g^+ (1_{10}1_{-10})_{n/2} 1/2g^+ \text{ [gulf] primitiverse} \\ & \qquad \qquad \qquad \text{coexisting with} \\ & \text{primitiverse [gulf] } 1/2g^- (1_{10}1_{-10})_{n/2} 1/2g^- \text{ [gulf] primitiverse} \end{aligned} \quad (22)$$

The dual achiral universe consists of four equal parts: two groups of achiral particle-antiparticles, pregravity, and anti-pregravity

The size of the dual chiral universe is determined by the ratio between the number of the chiral units and the number of the achiral units. The primitiverse and the dual achiral universe are different in the composition of objects and spaces, and are separated from each other permanently. Consequently, the two universes are completely transparent and oblivious to each other.

Without relation with the primitiverse, the dual achiral universe has its own vacuum energy that decreases from the non-zero in the primitiverse to zero. With decreasing vacuum energy and the Kaluza-Klein structure without a fixed number of space dimensions, the space-time dimension and the mass dimension of particle-antiparticles decrease to lower dimensional space-time and lower dimensional mass. The decrease to lower mass dimension results in the fractionalization of particle-antiparticles into lower mass particles, leading to the expansion of the universe. The result is the dual Vedic universe in the two different modes: the slow mode for the dark universe and the quick mode for the light universe. As the space energy decreases, the mass-energy is created, corresponding to the cosmology in the Vedas (Roy, 1999). In the cosmology described by the Vedas, the universe starts with the void, i.e. the web of space does not have energy, or force. The creation of mass-energy occurs on the surface of the void web, resulting in the expansion of space, or the universe. In dual Vedic universe, the universe starts with the high space energy, leading to the nearly void with nearly zero mass-energy. Thus, the dual universe is called the dual Vedic universe. As shown later, the dark universe without detachment space has no light, while the light universe with detachment space has light.

In the slow mode, the vacuum energy decreases to zero gradually, and the space-time dimension of the 10D particle-antiparticle with antigravity decreases from 10D to 4D, stepwise. In the dark universe, the 10D4d particles at high vacuum energy transform into 9D5d particles at low vacuum energy through the QVSL transformation. Through the varying supersymmetry transformation, 9D5d becomes 9D4d. Such varying supersymmetry transformation brings about the stepwise translational fractionalization, resulting in cosmic expansion. Further decrease in vacuum energy repeats the same process again until particles are the 4D particles at zero vacuum energy as follows

*The Slow Mode: The Hidden Dark Universe and the Dark Energy Universe*

$$\begin{aligned} & 10D4d \rightarrow 9D5d \rightarrow 9D4d \rightarrow 8D5d \rightarrow 8D4d \rightarrow 7D5d \rightarrow \bullet\bullet\bullet \rightarrow 5D4d \rightarrow 4D5d \rightarrow 4D4d \\ & \mapsto \text{the} \quad \text{hidden} \quad \text{dark} \quad \text{universe} \leftarrow \mapsto \text{dark energy} \leftarrow \end{aligned}$$

The dark universe consists of two periods: the hidden dark universe and the dark energy universe. The hidden dark universe composes of the > 4D particles. As mentioned before, since the speed of

light for > 4D particle is greater than the speed of light for 4D particle, the observation of > 4D particles by 4D particles violates causality. Thus, > 4D particles are hidden particles with respect to 4D particles. The universe with > 4D particles is the hidden dark universe. The 4D particles transformed from hidden > 4D particles in the dark universe are observable dark energy for the light universe, resulting in the accelerated expanding universe. The accelerated expanding universe consists of the positive energy 4D particles-antiparticles and dark energy that includes the negative energy 4D particles-antiparticles and the antigravity. Dark energy is in line with Santilli's (2005) isodual hole theory (the combination of the isodual theory and the hole theory), where two universes coexist. Since the dark universe does not have detachment space, the presence of dark energy is not different from the presence of the high vacuum energy.

The quick mode is used in the light universe. Through zero vacuum energy, 10D4d particle transforms through the quick QVSL transformation quickly into 4D10d particles. 4D10d particle then transforms and fractionalizes quickly through varying supersymmetry transformation into 4D9d, resulting in an inflationary expansion (Guth 1981; Linde, 1982; Albrecht and Steinhardt, 1982; Chung, 2002a). The inflationary expansion occurs between the energy for 4D10d =  $E_{\text{Planck}} \alpha^2 = 6 \times 10^{14}$  GeV and the energy for 4D9d =  $E_{10} \alpha^2 = 3 \times 10^{10}$  GeV.

At the end of the inflationary expansion, all 4D9d particles undergo simultaneous slicing to generate equally by mass and number into 4D9d, 4D8d, 4D7d, 4D6d, 4D5d, and 4D4d core particles. Baryonic matter is 4D4d, while dark matter consists of the other five types of particles (4D9d, 4D8d, 4D7d, 4D6d, and 4D5d). The mass ratio of dark matter to baryonic matter is 5 to 1 in agreement with the observation (Rees, 2003) showing the universe consists of 25% dark matter, 5% baryonic matter, and 70% dark energy. Dark matter contributes to the inhomogeneous structure of baryonic matter (Chung 2002a).

The mechanism for the simultaneous slicing of mass dimensions requires detachment space that slices mass dimensions. The dual achiral universe consists of 10D particle-antiparticle. With the CP symmetry, 10D particle-antiparticle undergoes annihilation (implosion). Annihilation is the detachment of energy from the original position. The space is detachment space, and the detached energy is cosmic radiation. The particles with CP asymmetry remain as the particles (matter). The whole process becomes

The Quick Mode :The Light Universe

$$\begin{aligned}
 &10D4d \xrightarrow{\text{quick QVSL transformation}} 4D10d \xrightarrow{\text{stepwise varying supersymmetry, inflation}} \\
 &4D9d \xrightarrow{\text{simultaneous slicing}} \text{dark matter (4D9d + 4D8d + 4D7d + 4D6d + 4D5d)} \\
 &\quad + \text{baryonic matter (4D4d)} + \text{cosmic radiation} \rightarrow \text{thermal cosmic expansion (the big bang)}
 \end{aligned}$$

For baryonic matter, the slicing of mass dimensions is as follows:

$$\begin{aligned}
 &(1_{4+6})_m \xrightarrow{\text{slicing}} (1_4)_m + \sum_1^6 ((0_4)(1_4))_{n,6} \quad (23) \\
 &4D > 4d \text{ attachment space} \quad 4D4d \text{ core attachment space} \quad 6 \text{ types } 4D4d \text{ units}
 \end{aligned}$$

where 4 and 6 (for six gauge force fields) are d mass dimensions.

The two products of the slicing are the 4D4d-core attachment space and six types of 4D4d quantized units. The 4D4d core attachment space surrounded by six types of infinitely many 4D4d quantized units corresponds to the core particle surrounded by six types of infinitely many small 4D4d particles. The gauge force fields are made of such small 4D4d quantized virtual particles surrounding the core particle.

The six > 4d mass dimensions (dimensional orbitals) for the gauge force fields and the one mass dimension for gravity are as in Figure 1.

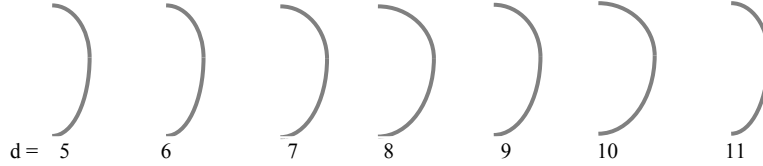


Figure 1. The force fields as  $> 4d$  mass dimensions (dimensional orbitals).

The dimensional orbitals form the base for the periodic table of elementary particles to calculate the masses for graviton, gauge bosons, quarks, and leptons (Chung, 2002a).

The summary of cosmology is shown in Figure 2.

### 6. FORCE FIELDS

The two types of force fields are the force fields in tessellattice and the force fields in binary lattice space. Tessellattice consisting of empty objects corresponds to AdS ( $\Lambda < 0$ ) in high-density region with boundary. The force fields derived from the AdS/CFT duality include the original gravity before the big bang and the strong force in nucleus.

Binary lattice space, consisting of alternative attachment space and detachment space corresponds to S-matrix ( $\Lambda = 0$ ) in low-density region without boundary. The force fields derived from the 4D quantized units of their respective mass dimensions include electromagnetism, the strong force in pion, and the weak interaction (Chung, 2002a).

The table below lists the two types of force fields.

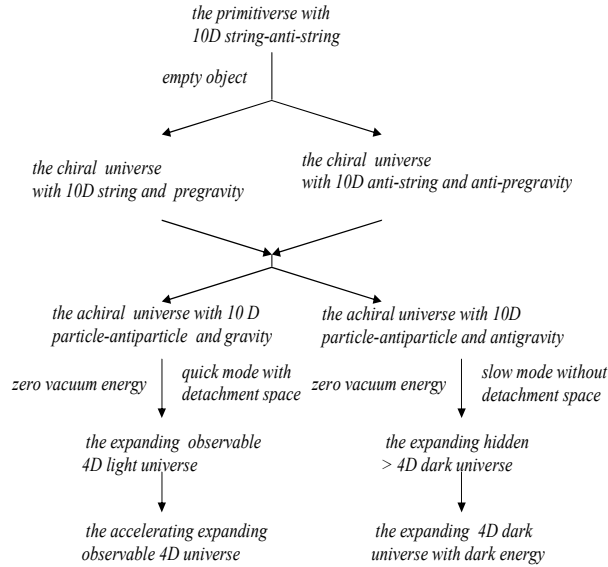


Figure 2. Cosmology.

In the high-density region such as nucleus, the compression as the reverse of the decomposition in Eq. (2) takes place. The compression theory is the reverse of the decomposition theory. In the compression theory, the  $D + 1$  dimensional string in  $AdS_{D+1}$  is the compression product of the CFT in the form of the  $D$  dimensional particle and its virtual particle. The duality in the compression theory is the CFT/AdS duality, the reverse of the AdS/CFT duality. It can be expressed as string/particle duality.

**Table.** Force fields.

<u>high density region with boundary</u>	<u>tessellattice (AdS) <math>\Lambda &lt; 0</math></u>
Original gravity before the big bang	The dS/bulk duality and the AdS/CFT duality
The strong force in baryon	The CFT/AdS duality, the AdS/CFT duality, and the AdS/SU(3) duality
<u>low density region without boundary</u>	<u>binary lattice space (S-matrix) <math>\Lambda = 0</math></u>
Electromagnetism	The 4D4d quantized units of the 5 <sup>th</sup> mass dimension
The strong force in pion	The 4D4d quantized units of the 6 <sup>th</sup> mass dimension
The weak interaction	The 4D4d quantized units of the 7 <sup>th</sup> mass dimension

One example is the big bang baryogenesis (the baryon formation) that occurred immediately after the big bang. Within one minute after the big bang before the big bang nucleosynthesis, when both density and energy were high, baryons, such as proton and neutron, were formed from pions. Pion is derived from the gauge force field as the 6<sup>th</sup> mass dimension (dimensional orbital) in binary lattice space (Chung, 2002a). The high density compressed massive quark and massive pion as the strong force (massive gluon) into the massive 5D string and tessellattice as AdS.

$$1_4 \pi = 1_4 1_1 \xrightarrow{\text{the compression in nucleus}} 2_5 + 0_5 \quad (24a)$$

Eq. (24a) shows the CFT/AdS duality for the compression. The 5D string is the string in the strong force as in the gauge particle/string duality proposed by Polchinski and Strassler (2003). At low energy, quarks and gluons are combined as the 5D strings. The different oscillations of this 5D string produce different particles. The string can also explain some aspects of masses and spins of the particles.

With the high-energy input after the big bang, the 5D string interacted with AdS, resulting in the decomposition

$$2_5 + 0_5 \xrightarrow{\text{decomposition of space dimension}} 1_4 1_1 = 1_4 i \quad (24b)$$

The result of the decomposition is  $1_4 1_1$  that was the quark-inerton. By carrying mass-energy of quark, inerton actually becomes the major part of the constituent masses and the binding energy of quarks. The inerton field is the “auxiliary dimensional orbital” as in Figure 3. During the simultaneous slicing, the particles-antiparticles with the CP symmetry between particle and antiparticle result in annihilation to become cosmic radiation. The particles that are not annihilated have asymmetrical charge-parity (CP asymmetry), in such way that the particle-antiparticle has two asymmetrical sets of dimensional orbitals. The two sets of dimensional orbitals are “principal dimensional orbital” and “auxiliary dimensional orbital”. The auxiliary set is dependent on the principal set, so the particle-antiparticle appears to have only one set of dimensional orbital. Auxiliary dimensional orbital is the hidden dimensional orbital.

For the four-mass-dimensional particle (baryonic matter), the two sets of seven dimensional orbitals are principal dimensional orbital and auxiliary dimensional orbital. These hierarchical dimensional orbitals are the force and mass fields, including gravity, as shown in Figure 3.

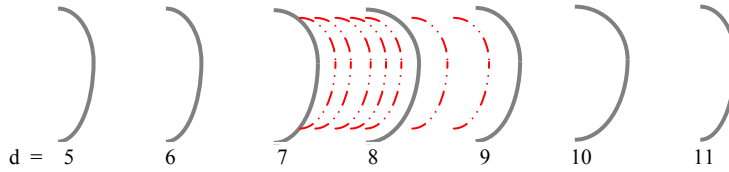


Figure 3. Dimensional orbitals in the four-mass dimensional (4d) particle (baryonic matter): principal dimensional orbital (solid line), and auxiliary dimensional orbital (dot line) as the inerton field;  $d$  is the principal dimensional orbital number

As shown in Figure 3, the seven orbitals of hidden auxiliary dimensional orbital as the inerton field are in the middle of the seven orbitals of principal dimensional orbital. The structure of the 4d particle with dimensional orbitals resembles to the structure of atomic orbital. Consequently, the periodic table of elementary particles is constructed to account for all leptons, quarks, gauge bosons, and hadrons. The calculation of the masses of quarks is the calculation of the masses in the inerton field (see preliminary studies in (Chung, 2002a)), resulting in a good agreement with the observable masses.

The requirement for the quark-inerton confinement confined  $1_4 i$ . The boundary of the confinement was dual to the boundary of AdS. Thus, AdS was also in  $1_4 i$ . At high energy, the high velocity of quark ( $1_4$ ) resulted in the repetitive interactions between quark and AdS to generate gluon, resulting in SU (3). The space dimension of quark,  $1_4$ , could not be decomposed further by AdS. Therefore, instead of the decomposition of space dimension, the repetitive interactions between quark ( $1_4$ ) and AdS led to the decomposition of massive quark into nearly massless quark, resulting in chiral symmetry of quark and asymptotic freedom between quark and gluon at high energy.

$$1_4 i + AdS \xrightarrow{\text{decomposition of mass}} \text{chiral symmetry and asymptotically freedom for massless } 1_4 g \quad (24c)$$

The strong force in baryon is the combination of the CFT/AdS duality, Eq. (24a), for the compression involving  $\pi$ , the AdS/CFT duality, Eq. (24b), for the decomposition of space dimension involving inerton, and the AdS/SU(3) duality, Eq. (24c), for the decomposition of mass involving gluon. These three dualities during the baryogenesis form the base for the mass calculation of hadrons (Chung, 2002a).

After the big bang baryogenesis, the universe was cool enough to form stable protons and neutrons. The density was high enough for the big bang nucleosynthesis, responsible for the formation of hydrogen, deuterium, helium, and lithium. It lasted three minutes. Afterward, the temperature and density of the universe fell below the condition for nuclear fusion.

## 7. SUMMARY

In the cosmic organism theory, different universes are the different cosmic organs for the cosmic organism that is the multiverse. Different universes are the different expressions of the common cosmic gene. Different stages in a universe, like an organ, have different cosmic genetic expressions.

The cosmic gene is the cosmic digital code in the cosmic dimension. The cosmic digital code includes the codes for the object structure and the space structure. The cosmic digital code for the object structure consists of full object (1, 2, and 3 for particle, string, and membrane, respectively) and empty object (0) as AdS (anti de Sitter space). The tessellation lattice of empty objects, which is constructed in the real space, is tessellattice. The decomposition of a full object in tessellattice results in the AdS/CFT duality. The digital code for the object structure accounts for the AdS/CFT duality, the dS/bulk duality, and gravity.

The digital code for the space structure consists of 1 and 0 for attachment space and detachment space, respectively. Attachment space attaches to object permanently at zero speed or reversibly at the speed of light. Detachment space detaches from the object irreversibly at the speed of light. The combination of attachment space and detachment space results in miscible space, binary lattice space or binary partition space. Miscible space represents special relativity. Binary lattice space consists of multiple quantized units of attachment space separated from one another by detachment space. Binary lattice space corresponds to nilpotent universal computational rewrite system (NUCRS) by Diaz and Rowlands. The gauge force fields and wavefunction are in binary lattice space. Binary partition space consists of separated continuous phases of attachment space and detachment space. The collapse of wavefunction results in binary partition space. With tessellattice and binary lattice space, 11D brane is reduced to 4D particle surrounded by gravity and the gauge force fields.

The cosmic dimension is in the framework of varying dimension number (VDN). In VDN, there are different speeds of light in different dimensional space-times. In the VDN transformation, the decrease in the quantized speed of light leads to the decrease in space-time dimension number (D) and the increase of mass in terms of increasing mass dimension number (d). In the same dimensional space-time, the varying supersymmetry transformation carriers over mass in terms of mass dimension number.

The four stages in the maturation of our universe are the primitiverse, the dual chiral universe, the achiral universe, and the dual Vedic universe. Each stage has different cosmic genetic expressions. The most primitive part of the multiverse is the primitiverse consisting of closely packed 10D strings in attachment space. The primitiverse does not have detachment space and empty object. The combination of two strings with additional space dimension results in 11D brane and AdS as empty object. The interaction of 11D brane and empty object forms 10D string and pregravity through the AdS/CFT duality. 10D strings and 10D antistrings are separated in the dual chiral universe separated by the repulsion between pregravity and anti-pregravity.

The collapse and the bounce of the dual chiral universe result in dual achiral universe with 10D particles in both domains separated by the repulsion between pregravity and anti-pregravity. The conversion from the chiral dual universe to the achiral universe is predicted by the Santilli isodual theory and the Dirac hole theory. With the different VDN transformations and varying supersymmetry transformations, the two domains become the light universe and the dark universe. The dark universe does not have detachment space. The light universe has detachment space that slices mass dimensions into 4D quantized units that are the origin of gauge force fields. The combination of attachment space and detachment space is the cosmic origin of quantum mechanics and gauge force fields. The hidden dark universe develops into dark energy later. In the light universe, dark matter has different mass numbers form baryonic matter.

The force fields in tessellattice for high-density region with boundary are the original gravity before the big bang and the strong force in baryon. One can correspond tessellattice to AdS space. The force fields in binary lattice space for low-density region without boundary are electromagnetism, the weak interaction, and the strong force in pion. Binary lattice space corresponds to  $S$ -matrix in gauge symmetry. The force fields in tessellattice are the original gravity before the big bang, or a series of small big bangs, which will be disclosed in a future paper under preparation, and the strong force in baryon. The force fields in binary lattice space are electromagnetism, the weak interaction, and the strong force in pion.

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