CHAPTER 14

CREATION OF MATTER & ENERGY

We are ready now to discuss one of the most interesting and probably most controversial topics of 3D-SST, the creation of the prime elements of matter and energy, the toryces, and their offspring, the elementary and composite particles. But what is the meaning of the term *the prime elements of matter and energy*? The answer largely depends on our understanding of the process of the creation of the universe. For instance, according to the Big Bang Theory, our universe was born out of a very hot and dense fireball some 15 billion years ago. But the theory says nothing about the origin of the fireball. Nowadays some scientists begin to believe in the creation of matter out of *Nothingness*, a primordial entity that possesses neither spacetime nor any physical properties familiar to us. The same idea is adopted by 3D-SST, but with one principal addition underlined in our definition of Nothingness:

> Nothingness is a primordial entity that possesses neither spacetime nor any physical properties familiar to us, but has a propensity to be polarized.

3D-SST sets up an extremely ambitious goal to explain various phenomena of physics by using two principal mechanical models for the toryx and the helyx described in Chapter 13. Among the problems are:

- Creation of toryces, the constituents of the elementary mass particles, by a spontaneous polarization of Nothingness.
- Unification of subluminal and superluminal velocities.
- Unification of positive and negative infinities.
- Sustaining the existence of toryces.
- Formation of elementary particles and ether from toryces.
- Unification of forces holding the prime elements and the elementary particles together
- Formation of composite particles from the elementary particles.
- Formation of helyces, the constituents of the elementary radiation particles.
- Unification of the prime elements of the universe and the elementary particles that make up the ordinary matter, dark matter and dark energy.

Besides employing the spacetime models of the spiral elements, the toryx and the helyx, 3D-SST absorbs many valuable ideas of current theories. Among them are the Heisenberg's uncertainty principle, the concept of maximum velocity in the universe, the relativistic character of mass, the concept of quarks, the idea of strong and superstrong (color) forces, the quantum energy states of atomic electrons, etc.

At the same time, 3D-SST modifies and further extends these ideas by outlining the process of the polarization of Nothingness, the consequent formation of the prime elements of the universe, the unified character of subluminal and superluminal velocities, the concept of cyclic absorption and release of energy by the elementary particles, the relativistic character of electric charge, the unified nature of strong, superstrong, gravitational, and electric forces, and the unified structure of the prime elements of the entire universe, including ordinary matter, dark matter and dark energy.

The application of a purely mathematical model of the toryx and the helyx to a physical world requires establishing certain correlations between the spacetime parameters "invented" by nature and the physical parameters "invented" by human beings. Understandably, this exercise would involve making some daring assumptions.

PHYSICAL PROPERTIES OF TORYCES

In the spacetime model of a toryx, the toryx parameters are the functions of three constants: the ultimate string velocity c, the radius of the real inversion string r_i, and the frequency of the real inversion string f_i. We will now express these three constants in physical terms.

The ultimate string velocity c is assumed to be equal to the velocity of light:

$$c = \textit{velocity of light} \tag{14-1}$$

When the effects of gravity are negligibly small in comparison with the effects of electric forces, the radius r_i and the frequency f_i are equal to:

$$r_i = \frac{Ze_0^2}{8\pi\varepsilon_0 m_0 c^2} \tag{14-2}$$

$$f_i = \frac{4\varepsilon_0 m_0 c^3}{Ze_0^2} \tag{14-3}$$

The idea of existence of a correlation between spacetime and physical properties of matter is not novel. In Chapter 8, we described a principal idea of the Einstein's general theory of relativity that gravity is associated with a curved spacetime surrounding a body. 3D-SST applies a similar concept for defining the toryx gravitational mass and electric charge, but, instead of considering a curved spacetime surrounding the toryx, it considers a curved spacetime created by the toryx strings. This allows us to relate the toryx electric charge e and its gravitational mass m_g directly to the toryx curvature factor q by making the two fundamental assumptions.

1. The toryx electric charge e is proportional to the toryx curvature factor q:

$$e = e_0 \frac{q}{2} \tag{14-4}$$

2. The toryx gravitational mass m_g is proportional to the absolute value of the toryx curvature factor q:

$$m_g = m_0 \left| \frac{q}{2} \right| \tag{14-5}$$

Table 14.1. Electric charge, mass, and energy of a toryx.

Toryx Parameter		Equations as a function of :	
		b_1	β_{2t}
Electric charge	E	$-e_0 \frac{b_1 - 1}{2b_1}$	$-\frac{e_0}{2}\sqrt{1-\beta_{2t}^2}$
Gravitational mass	m_g	$m_0 \left\lvert \frac{b_1 - 1}{2b_1} \right\rvert$	$\frac{m_0}{2}\left\lvert \sqrt{1-\beta_{2t}^2} \right\rvert$
Inertial mass	m_i	$m_0 \frac{b_1 - 1}{2b_1 - 1}$	$m_0 \frac{\sqrt{1-\beta_{2t}^2}}{1 \pm \sqrt{1-\beta_{2t}^2}}$
Toryx string energy	E_s	$m_0 c^2 \frac{b_1 - 1}{2b_1}$	
Toryx potential energy	E_p	$-m_0 c^2 \frac{(b_1 - 1)^2}{b_1^3}$	
Toryx kinetic energy	E_k	$m_0 c^2 \frac{b_1 - 1}{2b_1^2}$	
Toryx exchange energy	E_x	$m_0 c^2 \frac{(b_1 - 1)(2b_1 - 1)}{4b_1^3}$	

Based on the above two assumptions, one can derive the equations for the toryx principal physical parameters shown in Table 14.1. A toryx with the negative curvature factor q has a negative electric charge, while a toryx with the positive curvature factor q has a positive electric charge. In the toryx, gravitational and inertial masses are not equal to one another, in obvious contradiction with the famous Einstein's equivalence principle. The difference between these masses is most explicit when relative radius of the leading string b_1 is within the range of ± 1. But, as the absolute value of b_1 increases this difference decreases. For instance, for the toryces that make up an electron of a hydrogen atom in the ground state ($b_1 \approx 37560$), the difference is only 0.00133%.

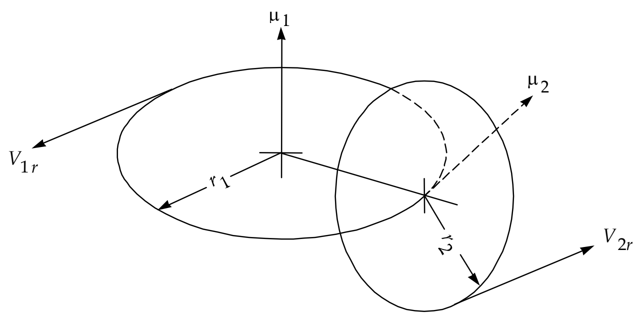

Figure 14.1. Toryx orbital and spin magnetic moments.

Table 14.2. Mechanical and magnetic properties of a toryx.

Toryx parameter		**Equation**
Angular momentum	P_a	$\frac{e_0^2}{4\varepsilon_0 c}\frac{b_1-1}{\sqrt{2b_1-1}}$
Density	P	$\frac{m_0}{4\pi^2 r_i^3 b_1^2}\frac{1}{\lvert b_1-1\rvert}$
Modulus of elasticity	Y	$\frac{m_0 c^2}{4\pi^2 r_i^3 b_1^4}\left\lvert\frac{2b_1-1}{b_1-1}\right\rvert$
Orbital magnetic moment	μ_1	$-\frac{e_0^3}{\varepsilon_0 m_0 c}\frac{(b_1-1)\sqrt{2b_1-1}}{32\pi b_1}$
Spin magnetic moment	μ_2	$-\frac{e_0^3}{\varepsilon_0 m_0 c}\frac{(b_1-1)^2\sqrt{2b_1-1}}{32\pi b_1^2}$

Based on the toryx fundamental equations, it is possible to derive the equations for some mechanical and magnetic properties of the toryx shown in Table 14.2. Figure 14.1 helps to explain that the toryx orbital magnetic moment μ_1 depends on the rotational velocity of the leading string V_{1r}, while the toryx spin magnetic moment μ_2 depends on the rotational velocity of the trailing string V_{2r}. Once we established a correlation between spacetime and the physical parameters of a toryx, we may proceed with outlining the proposed initial phases of the creation of matter and energy.

QUANTUM STATES OF TORYCES

According to 3D-SST, the toryces change their dimensions in quantum steps. These dimensions depend on a type of the toryx quantum energy state that, according to 3D-SST, can be either the *excitation quantum energy state* or the *oscillation quantum energy state* (Fig. 14.2). In the excited toryx, the radius of the real inversion string r_i remains constant, but the radius of its leading string r_1 changes. During oscillation, both the radius r_i and the radius r_1 change proportionally.

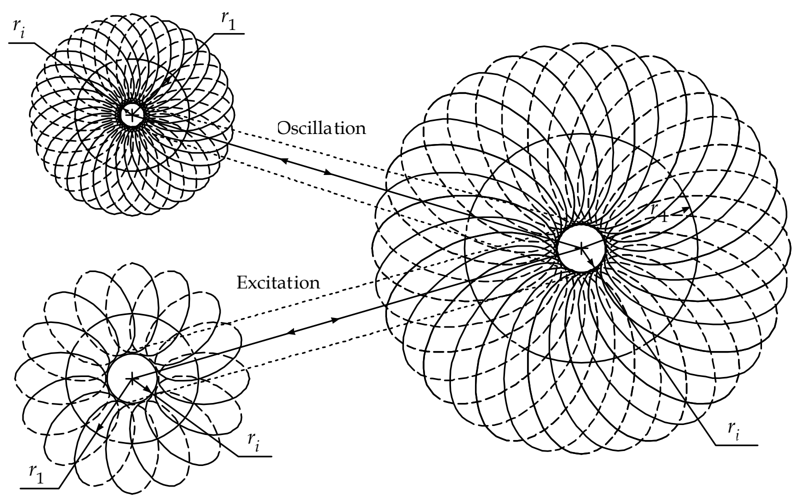

Figure 14.2. Excitation and oscillation of toryces.

The toryx quantum energy states are defined by the quantization equations that satisfy three principal requirements. Firstly, the toryx parameters calculated from these equations shall yield the expected parameters of the known elementary particles made up of the toryces. Secondly, the calculated frequencies of the helyces emitted by the toryces shall yield the expected frequencies of the known radiation particles made up of the helyces. Finally, the quantization equations shall predict the properties of the unknown elementary particles, including the elementary particles of exotic dark matter and dark energy.

EXCITED TORYCES

There are two kinds of the excitation quantum energy states of the toryces, *linear*, and *exponential*. In 3D-SST, the quantization equations express the relative radii of the toryx leading strings b_1 as a function of the parameter z^m:

$$z^m = (nU)^m$$
$$n = 0, 1, 2\ldots \quad (14\text{-}6)$$
$$m = 0, 1, 2\ldots$$

where

z = toryx quantization parameter
n = toryx linear quantum energy state
m = toryx exponential quantum energy state
U = 1/α = universal spiral string constant
α = fine structure constant.

Table 14.3. Excitation quantum energy states of the matched toryces.

Elementary particle	Matched toryces		
	Name		Quantization equations
Electron $e^{-1}_{m,n,N}$	Real $(-)$	$E^{-}_{m,n,N}$	$b_1 = 2z^m$ (14-7a)
	Imag. $(-)$	$\breve{E}^{-}_{m,n,N}$	$b_1 = -2z^m$ (14-7b)
Positron $e^{+1}_{m,n,N}$	Real $(+)$	$E^{+}_{m,n,N}$	$b_1 = 2z^m / (4z^m - 1)$ (14-7c)
	Imag. $(+)$	$\breve{E}^{+}_{m,n,N}$	$b_1 = 2z^m / (4z^m + 1)$ (14-7d)
A-tron $a^{0}_{m,n,N}$	Real $(-)$	$A^{-}_{m,n,N}$	$b_1 = 2z^m / (2z^m - 1)$ (14-7e)
	Real $(+)$	$A^{+}_{m,n,N}$	$b_1 = 2z^m / (2z^m + 1)$ (14-7f)
Z-tron $z^{0}_{m,n,N}$	Imag. $(-)$	$\breve{Z}^{-}_{m,n,N}$	$b_1 = 1 / (1 - 2z^m)$ (14-7g)
	Imag. $(+)$	$\breve{Z}^{+}_{m,n,N}$	$b_1 = 1 / (1 + 2z^m)$ (14-7h)

Table 14.3 shows the quantization equations defining the quantum energy states of the toryces forming the four principal elementary particles: electron, positron, a-tron, and z-tron. The elementary particles are identified by the lower-case Latin letters, while the individual toryces are designated by the respective capital Latin letters. The symbols for the particles and the toryces have three subscripts and one superscript. The subscripts indicate the excitation quantum energy states *m* and *n*, and also the *oscillation quantum energy state N* in a consecutive order. The superscript shows either a sign or/and a relative value of electric charge.

There is a "smile" cap in the symbols of imaginary toryces to distinct them from the real toryces.

In Chapter 13, we showed that the relative radii of the matched toryces b_1' and b_1'' are related to one another by Equation (13-9):

$$b_1'' = \frac{b_1'}{(q_t + 2)b_1' - 1}$$

3D-SST uses this equation to provide a logical procedure for the derivation of the quantization equations shown in Table 14.3.

- Equation (14-7a) for the real negative toryx of an electron is assumed to be the *basic quantization equation* from which it is possible to derive the remaining seven equations. The basic quantization equation predicts accurately the known orbital radii of atomic electrons in the hydrogen atom of *ordinary matter* with $m = 2$.
- Equation (14-7b) for the imaginary negative toryx of an electron is derived from Equations (14-7a) and (13-9) in which $\varepsilon_t = -2$.
- Equation (14-7c) for the real positive toryx of a positron is derived from Equation (14-7a) and (13-9) in which $\varepsilon_t = 0$.
- Equation (14-7d) for the imaginary positive toryx of a positron is derived from Equations (14-7b) and (13-9) in which $\varepsilon_t = 0$.
- Equation (14-7e) for the real negative toryx of an a-tron is derived from Equations (14-7a) and (13-9) in which $\varepsilon_t = -1$.
- Equation (14-7f) for the real positive toryx of an a-tron is derived from Equations (14-7e) and (13-9) in which $\varepsilon_t = 0$.
- Equation (14-7g) for the imaginary negative toryx of a z-tron is derived from Equations (14-7e) for the imaginary negative toryx of an a-tron by assuming that b_1(z-tron) = b_2(a-tron).
- Equation (14-7h) for the imaginary positive toryx of a z-tron is derived from Equations (14-7g) and (13-9) in which $\varepsilon_t = 0$.

To evaluate the validity of the proposed quantization equations for the toryces, we calculated the three principal physical parameters of the elementary particles made up of the toryces: the relative electric charge e/e_0, the gravitational mass m_g, and also four relative magnetic moments, μ/μ_N, μ/μ_B, μ/μ_μ and μ/μ_τ, where μ_N is the *nucleon magneton*, μ_B is the *Bohr magneton*, μ_μ is the *muon magneton*, and μ_τ is the *tau magneton*. Then we compared the calculated values with respective experimentally measured values.

OSCILLATED TORYCES

Toryces can be in various *oscillation quantum energy states N*. When a toryx oscillates, its inversion radius r_{iN} changes inversely proportional to the *toryx oscillation factor Q*, while both the frequency f_{iN} and the elementary mass m_{0N} change proportionally to this factor, as given by the equations:

$$Q = 1 \quad \text{when } N = 0$$

$$Q = 3\left(\frac{U}{2(N-1)}\right)^{N-1} = \frac{r_i}{r_{iN}} = \frac{m_{0N}}{m_0} = \frac{f_{iN}}{f_i} \qquad N = 1, 2, \ldots \quad (14\text{-}8)$$

In this equation: r_{iN}, m_{0N}, and f_{iN} are respectively the inversion radius of the real inversion string, the elementary mass and the frequency of the real inversion string in the oscillation quantum energy states N. A plot of Equation (14-8) appears as a bell-type curve (Fig. 14.3).

Table 14.4. Oscillation quantum energy states of oscillated toryces.

N	Q	r_{iN}, m	m_{0N}, MeV/c^2	f_{iN}, Hz
0	1	1.409×10^{-15}	0.51099892	$3.386 \times 10^{+22}$
1	3.00	4.697×10^{-16}	1.53299675	$1.016 \times 10^{+23}$
2	205.554	6.855×10^{-18}	105.037871	$6.961 \times 10^{+24}$
3	3521.037	4.002×10^{-19}	1799.24620	$1.192 \times 10^{+26}$
4	35741.396	3.942×10^{-20}	18263.8148	$1.210 \times 10^{+27}$
…	…………	…………	…………	…………
26	2.6530×10^{11}	5.311×10^{-27}	1.356×10^{11}	$8.984 \times 10^{+33}$

As shown in Table 14.4, when $N = 1$, the toryx oscillation factor $Q = 3$. As N increases, Q increases too. At $N = N_m$, Q reaches its maximum value Q_m:

$$N_m = 1 + \frac{U}{2e} = 26.20636$$

$$Q_m = 3e^{U/2e} = 2.6553 \times 10^{11}$$

where e is the base of natural logarithms.

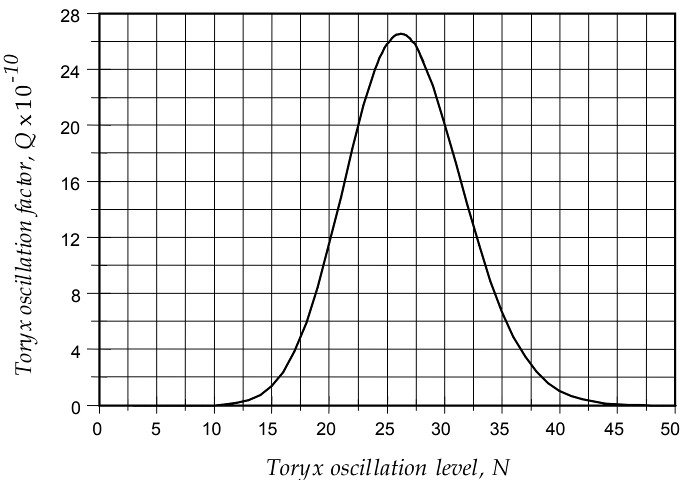

Figure 14.3. Toryx oscillation factor *Q*.

THE HEISENBERG'S UNCERTAINTY PRINCIPLE

In accordance with the Heisenberg's uncertainty principle, a particle with the energy E may pop up out of Nothingness and will exist for the period of time T when the product of the particle energy E by the period of time T does not exceed the ratio of the Planck constant h over 2π, as given by the equation:

$$E \cdot T \leq \frac{h}{2\pi} \tag{14-9}$$

In 3D-SST we adopted a similar concept to explain the creation of the harmonic toryces by the polarization of Nothingness. To do that, we made three assumptions.

Firstly, we assumed that the Plank constant h is dependent on the toryx exponential quantum energy state m, and is equal to:

$$h = \frac{e_0^2 U^{m-1}}{2\varepsilon_0 c} \qquad m = 1, 2, 3... \tag{14-10}$$

As we will show later, for the toryces making up electrons and positrons of ordinary matter $m = 2$. Consequently, Equation (14-10) reduces to a well-known equation for the Plank constant h.

Secondly, we assumed that the energy E in Equation (14-9) is equal to the toryx string energy E_s expressed by the equation shown Table 14.1. Finally, we assumed that the time T in Equation (14-9) is equal to the time period of the trailing string T_2 expressed by the equation shown in Table 13.2. By using the above three assumptions, it is possible to derive the ranges of the relative radii of the toryx leading string b_1 within which the toryces can continuously be created from Nothingness – see Table 14.5.

Table 14.5. Ranges of relative radii of the toryx leading strings within which the toryces can be continuously created from Nothingness.

Toryx type	$b_{1\min}$	$b_{1\max}$
Real	$\dfrac{\pi Z + 2U^{m-1}}{\pi Z + 4U^{m-1}}$	$\dfrac{\pi Z + 2U^{m-1}}{\pi Z}$
Imaginary	$-\dfrac{\pi Z + 2U^{m-1}}{\pi Z}$	$\dfrac{\pi Z + 2U^{m-1}}{3\pi Z + 4U^{m-1}}$

SUSTAINING THE LIVES OF TORYCES

The toryces can be compared with the live creatures who must breathe to survive. Think for a moment: what is the essence of breathing? As we all know, it is a cyclic process that involves absorbing some air from atmosphere and returning it back to the atmosphere. If you want to use a scientific analogy, you may say that during each breathing cycle we borrow a small amount of energy from a huge pool of energy contained in the atmosphere and, after using a tiny part of it inside of our body, return the remaining energy back to the atmosphere.

The breathing of air is provided by a fluctuation of air pressure below and above the atmospheric pressure. During inhaling we create a volume of lower pressure inside our lungs, forcing the atmospheric air to flow in. As soon as the pressure inside our lungs builds up and exceeds the atmospheric pressure, the air is pushed out, making exhaling. To assure their survival, the toryces must also be involved in a similar process of borrowing energy and returning it back to the energy pool. But what is the mechanism for providing their "breathing" cycle?

In a toryx, the "breathing" mechanism is associated with a cyclic fluctuation of the rotational velocity of its trailing string V_{2r}. As we discussed in Chapter 13, the magnitude of this velocity is not limited. It can be either subluminal or superluminal. And all the values of the rotational velocities are allowed as long as the spiral velocity of the trailing string V_2 remains equal to the velocity of light c. The toryx absorbs energy when the rotational velocity V_{2r} exceeds the velocity of light, and releases energy when it is less than the velocity of light.

Notably, during the absorption of energy, the translational velocity V_{2t} is imaginary, while during the release of energy it is real.

The exchange energy E_x determines the amount of either absorbed or released energy by the toryces. The released energy E_x is positive, while the absorbed energy is E_x is negative. There are two methods of making the "breathing" mechanism to work. Depending on the method, the toryces are divided into two groups, the *self-sustained toryces* and the *mutually-sustained toryces*.

Self-sustained toryces – In the real self-sustained toryces, during each winding cycle of the trailing strings, the magnitude of the rotational velocity V_{2r} oscillates above and below a certain *critical velocity* V_c that is equal to the velocity of light c. This occurs when the relative radii of the toryx leading strings are within the range:

$$0.5437 < b_1 < 6.2223 \tag{14-11}$$

In the imaginary toryces, the translational velocity V_{2t} oscillates above and below the critical velocity V_c that is equal to:

$$V_c = 4z^{2m}c \tag{14-12}$$

The oscillation of either rotational or translational velocity above and below the critical velocity V_c provides both the release and the absorption of energy during each cycle without any assistance from other toryces.

Mutually-sustained toryces – The mutually-sustained toryces are formed by one real and one imaginary toryces. In the real toryx, the rotational velocity V_{2r} never exceeds the velocity of light during each cycle of trailing string, providing only the release of energy. But, in the imaginary toryces, the rotational velocity V_{2r} always exceeds the velocity of light, providing only the absorption of energy. A complete "breathing" cycle is provided when the appropriately matched real and imaginary toryces work together. The matched toryces form the elementary particles.

MICRO-GENESIS & NATURAL SELECTION

3D-SST defines the micro-genesis as a part of the overall creation process that starts from the polarization of Nothingness leading to the creation of polarized toryces and finishes with the formation of hydrogen atoms. The micro-genesis is accompanied by the *process of natural selection* leaving alive only those elementary particles whose toryces can sustain their existence by absorbing and releasing of energy. The micro-genesis proceeds in seven stages.

1. Creation of quantum vacuum
2. Formation of harmons
3. Formation of excited elementary particles
4. Formation of oscillated elementary particles
5. Formation of ether
6. Formation of nucleons
7. Formation of hydrogen atoms.

Quantum Vacuum

Quantum vacuum is created by the polarization of Nothingness. This process produces four types of toryces: the toryces $Z^{-}_{m,0,N}$ and $Z^{+}_{m,0,N}$ forming the z-tron $z^{0}_{m,0,N}$, and the toryces $A^{-}_{m,0,N}$ and $A^{+}_{m,0,N}$ forming the a-tron $a^{0}_{m,0,N}$. Importantly, the constituent toryces of both the a-trons and the z-trons are in the lowest excitation quantum energy state $n = 0$. Consequently, according to Equations 14.6 and (14-7e) through (14-7h), the toryces of the a-tron form the imaginary inversion string with the relative radii $b_1 = 0$ and $b_2 = 1$, while the toryces of the z-tron form the real inversion string with the relative radii $b_1 = 1$ and $b_2 = 0$.

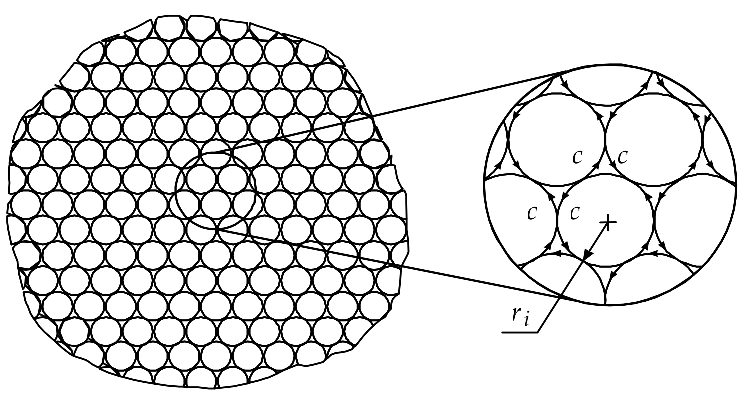

Figure 14.4. Quantum vacuum.

The properties of the z-trons and a-trons are shown in Table 14.6. Both the a-trons and the z-trons are chargeless, but their masses are quite different: the z-trons are massles, while the a-tron's mass is infinitely large. One can envision the quantum vacuum as a spacetime configure-tion in which one a-trons $a^{0}_{m,0,N}$, the *singularity*, is surrounded by the infinite number of the z-trons $z^{0}_{m,0,N}$ as shown in Figure 14.4.

Table 14.6. Components and calculated physical properties of a-tron and z-trons forming the quantum vacuum.

Particle	Matched toryces			Inversion strings		
	Symbol	b_1	b_2	Name	e/e_0	m_g, MeV/c^2
A-tron $a^0_{m,0,N}$	$A^-_{m,0,N}$	0.0	1.0	Imaginary	0.0	∞
	$A^+_{m,0,N}$	0.0	1.0			
Z-tron $z^0_{m,0,N}$	$\breve{Z}^-_{m,0,N}$	1.0	0.0	Real	0.0	0.0
	$\breve{Z}^+_{m,0,N}$	1.0	0.0			

Another extraordinary feature of the quantum vacuum is its infinitely high rigidity. This is due to the infinitely high rigidity of the inversion strings making up the a-trons of the quantum vacuum. According to Equation shown in Table 14.2, the modulus of elasticity Y of the strings with the relative radius $b_1 = 1$ is infinitely large.

3D-SST identifies two principal purposes of the quantum vacuum. Firstly, since the velocities of the inversion strings making up the z-trons of the quantum vacuum are equal to the velocity of light, the quantum vacuum provides the velocity reference to all the moving entities in the universe. But the velocity effect is hidden. As shown in Figure 14.4, at the points of contacts of the adjacent z-trons, the toryx string velocities are equal in magnitude and have the opposite directions. Therefore, for an external observer, the motion effect disappears. Secondly, as we will show later, the charge-polarization of the z-trons and a-tron of the quantum vacuum produces the harmonic toryces forming the first elementary particles, the harmons. Thus, 3D-SST considers the quantum vacuum as a cradle of the universe. Its role is somewhat similar to that of the Higgs field.

HARMONS

According to 3D-SST, the harmonic excitation of the a-trons and the z-tron of the quantum vacuum gives birth to many polarized pairs of harmonic toryces. The frequencies of trailing strings of the harmonic toryces are related to one another by the simple harmonic ratios: 3 : 2 : $\frac{3}{2}$: 1 , etc., explaining their name. But, the majority of the created toryx pairs are short-lived, and only four of these pairs are involved in the formation of the harmonic elementary particles called the *harmons.*

- Real harmonic toryces $E^{-1/4}_{0,1,N}$ and $E^{+1/4}_{0,1,N}$
- Imaginary harmonic toryces $\breve{E}^{-3/4}_{0,1,N}$ and $\breve{E}^{+3/4}_{0,1,N}$.
- Real harmonic toryces $A^{-1/4}_{0,1,N}$ and $A^{+1/4}_{0,1,N}$

- Imaginary harmonic toryces $\breve{Z}^{-1}_{0,1,N}$ and $\breve{Z}^{+1}_{0,1,N}$.

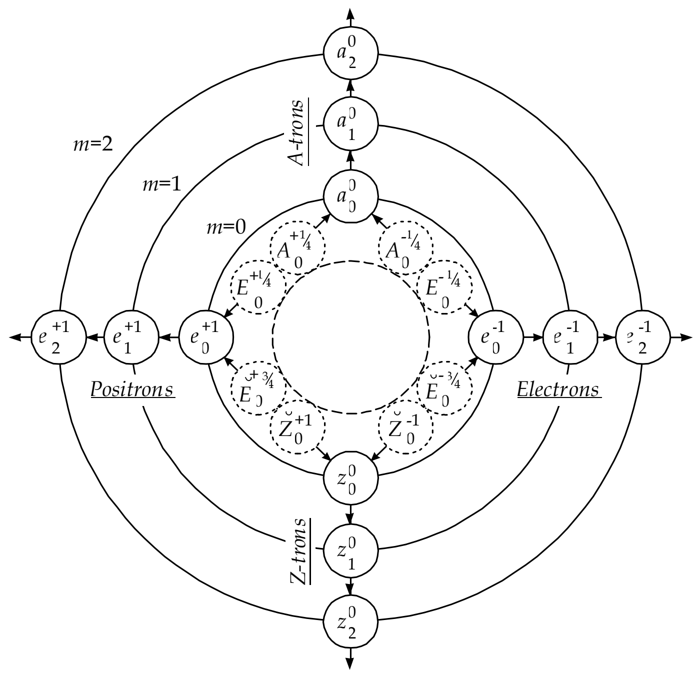

Figure 14.5. A sequence of the creation of elementary particles

Figure 14.5 presents schematically the process of formation of the elementary particles, including the harmons. For the sake of clarity, the last two subscripts are omitted in the symbols of the toryces and the elementary particles. One shall notice an interesting conversion that occurs during the formation of the harmons from the quantum vacuum. While the a-trons of the quantum vacuum are made of imaginary toryces, the harmonic a-trons are made of real toryces. The opposite is true for the z-trons of the quantum vacuum and the harmonic z-trons.

Table 14.7 shows the calculated properties of the excited harmonic toryces and the excited harmons that they form. The values of the relative radii b_1 of the harmonic toryces are defined by Equations (14-6) and (14-7a) through (14-7h) for the quantum energy states (m = 0, n = 1, N = 0). Notably, the harmonic toryces are relatively small. The maximum radius of their leading strings (b_1 = 2) is only two times greater than the radius of the real inversion string. The reality-polarized negative harmonic toryces $E^{-1/4}_{0,1,0}$ and $\breve{E}^{-3/4}_{0,1,0}$ form the harmonic electron $e^{-1}_{0,1,0}$ illustrated in Figure 14.6, while the reality-polarized positive harmonic toryces $E^{+1/4}_{0,1,0}$ and $\breve{E}^{+3/4}_{0,1,0}$ form the harmonic positron $e^{+1}_{0,1,0}$. The charge-polarized real harmonic toryces $A_{0,1,0}^{-1/4}$ and $A_{0,1,0}^{+1/4}$ form the harmonic a-tron $a_{0,1,0}^{0}$ depicted in Figure 14.7, while the charge-polarized imaginary harmonic toryces $\breve{Z}_{0,1,0}^{-1}$ and $\breve{Z}_{0,1,0}^{+1}$ form the harmonic z-tron $z_{0,1,0}^{0}$.

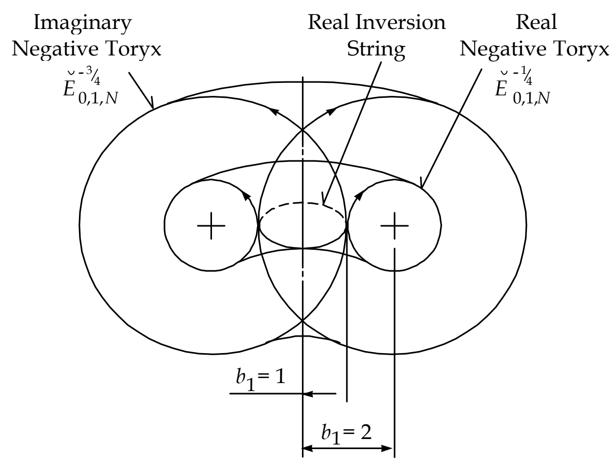

Figure 14.6. Cross-section of a harmonic electron $e_{0,1,N}^{-1}$.

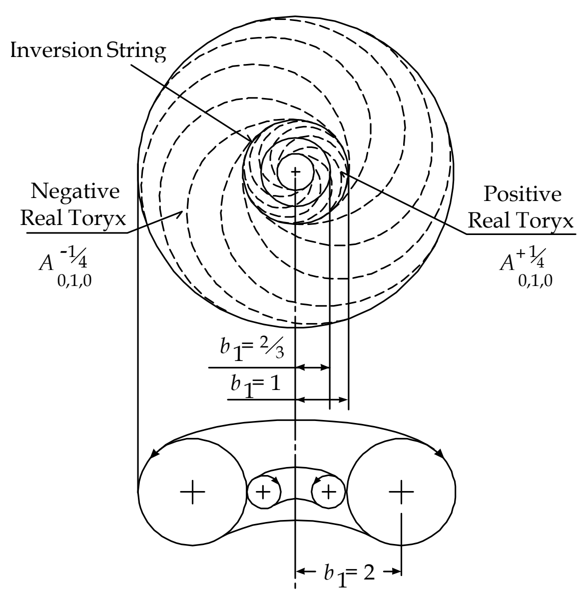

Figure 14.7. Harmonic a-tron $a_{0,1,0}^{0}$ and its constituent toryces.

Table 14.7. Components and calculated physical properties of excited harmons and their constituent harmonic toryces.

Harmonic toryces			**Excited harmons**		
Name	Symbol	b_1	Name	μ/μ_N	m_g, MeV/c^2
Real Negative	$E^{-1/4}_{0,1,0}$	2.0	Harmonic electron $e^{-1}_{0,1,0}$	-14.136428	0.51099892
Imaginary Negative	$\breve{E}^{-3/4}_{0,1,0}$	-2.0			
Real Positive	$E^{+1/4}_{0,1,0}$	⅔	Harmonic positron $e^{+1}_{0,1,0}$	3.214083	0.51099892
Imaginary Positive	$\breve{E}^{+3/4}_{0,1,0}$	⅖			
Real Negative	$A^{-1/4}_{0,1,0}$	2.0	Harmonic a-tron $a^{0}_{0,1,0}$	-1.933987	0.255499
Real Positive	$A^{+1/4}_{0,1,0}$	⅔			
Imaginary Negative	$\breve{Z}^{-1}_{0,1,0}$	-1.0	Harmonic z-tron $z^{0}_{0,1,0}$	-7.735947	1.021998
Imaginary Positive	$\breve{Z}^{+1}_{0,1,0}$	⅓			

Electrons & Positrons

The excited electrons $e^{-1}_{m,n,N}$ and positrons $e^{+1}_{m,n,N}$ are respectively made up of the negative and positive reality-polarized matched toryces. These toryces exist at the excitation quantum energy states $m \geq 1$ and $n \geq 1$. The quantum values of the relative radii of their leading strings b_1 are defined by Equations (14-6) and (14-7a) through (14-7d).

Table 14.8 shows the components and the calculated properties of the excited electrons in various exponential excitation quantum energy states m, with the linear excitation quantum energy state $n = 1$ and the oscillation quantum energy state $N = 0$. Notably, the relative radii b_1 of the toryces making up the excited electrons are significantly greater than the respective radii of the harmonic toryces making up the harmonic electrons. For instance, for the excited electrons of the ordinary matter ($m = 2$), the radius b_1 increases about 19000 times.

Table 14.9 provides the same information for the excited positrons. Notably, in the excited electrons, as m increases, the relative radius b_1 of the leading strings of their constituent toryces increases exponentially, while, in the constituent toryces of the excited positrons, b_1 approaches exponentially to 0.5 (Fig. 14.8).

Table 14.8. Components and calculated physical properties of excited electrons (e/e_0 = -1, m_g = 0.510998918 MeV/c^2) and their constituent matched toryces in excitation quantum states m and n (N = 0).

m	n	Electron toryces		Excited electron	
		Symbol	b_1	Symbol	μ/μ_B
1	1	$E^-_{1,1,0}$	274.072	$e^{-1}_{1,1,0}$	-0.08542479
		$\breve{E}^-_{1,1,0}$	-274.072		
2	1	$E^-_{2,1,0}$	37557.73	$e^{-1}_{2,1,0}$	-0.9999999895
		$\breve{E}^-_{2,1,0}$	-37557.73		
3	1	$E^-_{3,1,0}$	5.14676×10^6	$e^{-1}_{3,1,0}$	-11.70623749
		$\breve{E}^-_{3,1,0}$	-5.14676×10^6		
4	1	$E^-_{4,1,0}$	7.05292×10^8	$e^{-1}_{4,1,0}$	-137.035998
		$\breve{E}^-_{4,1,0}$	-7.05292×10^8		

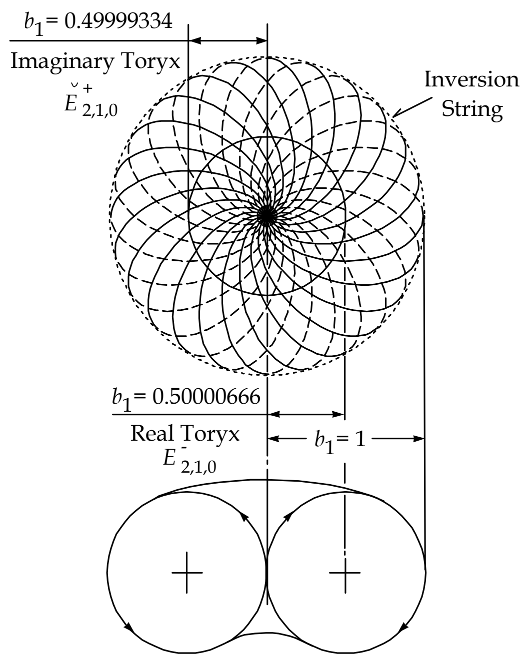

Figure 14.8. Excited positron $e^{+1}_{2,1,N}$ and its constituent toryces.

Table 14.9. Components and calculated physical properties of excited positrons ($e/e_0 = +1$) and their constituent matched toryces in excitation quantum energy states *m*.

m	Positron toryces		Excited positrons		
	Symbol	b_1	Symbol	μ/μ_N	m_g, MeV/c^2
1	$E^{+}_{1,1,0}$	0.5009138362	$e^{+1}_{1,1,0}$	0.2861514	0.510998918
	$\breve{E}^{+}_{1,1,0}$	0.4990894920			
2	$E^{+}_{2,1,0}$	0.5000066565	$e^{+1}_{2,1,0}$	0.0244444	0.510998918
	$\breve{E}^{+}_{2,1,0}$	0.4999933437			
3	$E^{+}_{3,1,0}$	0.5000000486	$e^{+1}_{3,1,0}$	0.0020882	0.510998918
	$\breve{E}^{+}_{3,1,0}$	0.4999999514			
4	$E^{+}_{4,1,0}$	0.5000000004	$e^{+1}_{4,1,0}$	0.0001784	0.510998918
	$\breve{E}^{+}_{4,1,0}$	0.4999999996			

A-TRONS & Z-TRONS

The excited a-trons $a^0_{m,n,N}$ and z-trons $z^0_{m,n,N}$ are respectively made up of the real and imaginary charge-polarized toryces, These toryces exist at the excitation quantum energy states: $m \geq 0$ and $n \geq 1$. The quantum values of the relative radii of their leading strings b_1 are defined by Equations (14-6), (14-7e) through (14-7h). Remarkably, the constituent toryces of both a-trons and z-trons are self-sustained.

Table 14.10 shows the components and the calculated physical properties of the a-trons $a^0_{m,1,0}$ and their constituent matched toryces in the quantum energy states $m \geq 1$, $n = 1$, and $N = 0$. As *m* increases, the relative radii b_1 of the a-tron toryces approaches exponentially to 1.0, while their relative radii b_2 approach exponentially to zero. The electric charge of the excited a-trons is equal to zero, and their gravitational masses are extremely small.

Table 14.11 shows the components and the calculated physical properties of the z-trons $z^0_{m,1,0}$ and their constituent matched toryces in various exponential excitation quantum energy states $m \geq 1$. As *m* increases, the relative radii b_1 of the z-tron toryces approaches exponentially to zero, while their relative radii b_2 approaches exponentially to -1. Similarly to the a-trons, the electric charge of the z-trons is equal to zero, but, unlike the a-trons, their gravitational masses are extremely large.

Table 14.10. Components and calculated physical properties of excited a-trons and their constituent matched toryces in various excitation quantum energy states *m*.

m	**A-tron toryces**		**Excited A-trons**		
	Symbol	b_1	Symbol	μ/μ_N	m_g, MeV/c^2
1	$A^{-}_{1,1,0}$	1.003662038	$a^{0}_{1,1,0}$	-8.92×10^{-5}	1.8645×10^{-3}
	$A^{+}_{1,1,0}$	0.996364588			
2	$A^{-}_{2,1,0}$	1.000026626	$a^{0}_{2,1,0}$	-4.75×10^{-9}	1.3606×10^{-5}
	$A^{+}_{2,1,0}$	0.999973375			
3	$A^{-}_{3,1,0}$	1.000000194	$a^{0}_{3,1,0}$	-2.53×10^{-13}	9.9286×10^{-8}
	$A^{+}_{3,1,0}$	0.999999806			
4	$A^{-}_{4,1,0}$	1.000000001	$a^{0}_{4,1,0}$	0.00000000	7.2452×10^{-10}
	$A^{+}_{4,1,0}$	0.999999999			

Table 14.11. Components and calculated physical properties of excited z-trons and their constituent matched toryces in various excitation quantum energy states *m*.

m	**Z-tron toryces**		**Excited Z-trons**		
	Symbol	b_1	Symbol	μ/μ_N	m_g, MeV/c^2
1	$\breve{Z}^{-}_{1,1,0}$	-3.6620×10^{-3}	$z^{0}_{1,1,0}$	-6.699571226	140.050495
	$\breve{Z}^{+}_{1,1,0}$	3.6354×10^{-3}			
2	$\breve{Z}^{-}_{2,1,0}$	-2.6626×10^{-5}	$z^{0}_{2,1,0}$	-6.699526633	1.9192×10^{4}
	$\breve{Z}^{+}_{2,1,0}$	2.6625×10^{-5}			
3	$\breve{Z}^{-}_{3,1,0}$	-1.9430×10^{-7}	$z^{0}_{3,1,0}$	-6.699526634	2.6300×10^{6}
	$\breve{Z}^{+}_{3,1,0}$	1.9430×10^{-7}			
4	$\breve{Z}^{-}_{4,1,0}$	-1.4179×10^{-9}	$z^{0}_{4,1,0}$	-6.699526310	3.6040×10^{8}
	$\breve{Z}^{+}_{4,1,0}$	1.4179×10^{-9}			

THE "EXTREMOFILES"

One can find from Equations (14-6) and (14-7a) through (14-7h) the extreme quantum energy states of the matched toryces composing the elementary particles (electrons, positrons, a-trons and z-trons). In these states, the matched toryces of the particles merge and form four inversion strings: negative, positive, real and imaginary shown in Figure 13.8 of Chapter 13. Notably, the exchange energy E_x of the inversion strings is equal to zero. Table 14.12 shows some properties of the extreme elementary particles and their constituent toryces in the extreme quantum energy states.

The matched toryces of the extreme electron $e^{-}_{\infty,\infty,0}$ form the negative inversion string. Because the relative radii b_1 of these toryces approach infinity, the negative inversion string appears as a straight line. The matched matched toryces of the extreme positron $e^{+}_{\infty,\infty,0}$ form the positive inversion string that appears as a circle with the relative radius $b_1 = 0.5$.

The matched toryces of the extreme a-tron $a^{0}_{\infty,\infty,0}$ tend to approach to the real inversion string with the relative radii $b_1 = 1$ and $b_2 = 0$, while the matched toryces of the extreme z-tron $z^{0}_{\infty,\infty,0}$ tend to approach the imaginary inversion string with the relative radii $b_1 = 0$ and $b_2 = 1$.

Table 14.12. Components and calculated physical properties of extreme electrons, positrons, a-trons, and z-trons and their constituent matched toryces ($N = 0$).

Extreme particle	Matched toryces		Inversion strings		
	Symbol	b_1	Name	e/e_0	m_g, MeV/c^2
Electron $e^{-}_{\infty,\infty,0}$	$E^{-}_{\infty,\infty,0}$	$+\infty$	Negative	-1	0.51099892
	$\breve{E}^{-}_{\infty,\infty,0}$	$-\infty$			
Positron $e^{+}_{\infty,\infty,0}$	$E^{+}_{\infty,\infty,0}$	0.5	Positive	+1	0.51099892
	$\breve{E}^{+}_{\infty,\infty,0}$	0.5			
A-tron $a^{0}_{\infty,\infty,0}$	$A^{-}_{\infty,\infty,0}$	1.0	Real	0.0	0.0
	$A^{+}_{\infty,\infty,0}$	1.0			
Z-tron $z^{0}_{\infty,\infty,0}$	$\breve{Z}^{-}_{\infty,\infty,0}$	0.0	Imaginary	0.0	∞
	$\breve{Z}^{+}_{\infty,\infty,0}$	0.0			
	$\breve{Z}^{+}_{1,0,0}$	1.0			

LEPTONS

The oscillated elementary particles, known as leptons, are formed by the constituent oscillated toryces. Table 14.13 shows the calculated properties of negative excited leptons and their constituent reality-polarized matched toryces in the linear excitation quantum energy state $n = 1$. It is easy to see from the data shown in Tables 14.8 that the excited electron $e^{-1}_{2,1,0}$ is a lepton in the lowest oscillation quantum energy state $N = 0$. It is also the lightest of all the leptons.

Table 14.13. Components and physical properties of leptons of ordinary Matter (m = 2) in linear excitation quantum energy state n = 1 (μ/μ_L = -0.9999999895).

N	Q	Lepton toryces		Leptons	
		Symbol	b_1	Name	m_g, MeV/c^2
0	1.00	$E^{-}_{2,1,0}$	+37557.73	Electron $e^{-1}_{2,1,0}$	0.51099892
		$\breve{E}^{-}_{2,1,0}$	-37557.73		
1	3.00	$E^{-}_{2,1,1}$	+37557.73	3electron $e^{-1}_{2,1,1}$	1.53299675
		$\breve{E}^{-}_{2,1,1}$	-37557.73		
2	205.554	$E^{-}_{2,1,2}$	+37557.73	Muon $e^{-1}_{2,1,2}$	105.037872
		$\breve{E}^{-}_{2,1,2}$	-37557.73		
3	3521.037	$E^{-}_{2,1,3}$	+37557.73	Tau $e^{-1}_{2,1,3}$	1799.246
		$\breve{E}^{-}_{2,1,3}$	-37557.73		
4	35741.40	$E^{-}_{2,1,4}$	+37557.73	X-lepton $e^{-1}_{2,1,4}$	18263.82
		$\breve{E}^{-}_{2,1,4}$	-37557.73		

Equation (14-8) describes how an increase of the toryx oscillation quantum energy state N affects the parameters of the toryces. The toryx radii r_i and r_1 become smaller by the toryx oscillation factor Q in respect to the same radii of the toryces composing the excited electron $e^{-1}_{2,1,0}$ in which N = 0. At the same time, the gravitational masses of the leptons m_g become greater by the same factor. When the relative magnetic moment of each lepton μ/μ_L is defined in respect to its own magneton μ_L, all the leptons have the same value of μ/μ_L.

ETHER

Similarly to the quantum vacuum, the ether is made of chargeless a-trons and z-trons. There is however, a principal difference between these two spacetime arrangements. In the quantum vacuum, the singularity is made up of the imaginary a-tron $a^{0}_{m,0,N}$ having infinitely large mass. It is surrounded by the infinite number of massless real z-trons $z^{0}_{m,0,N}$. Notably, both particles are in the lowest excitation quantum energy state $n = 0$.

Unlike the quantum vacuum having a single imaginary a-tron surrounded by one set of real z-trons, the ether is composed of many zones, and in each of them the imaginary z-tron $z^{0}_{m,n,N}$ is surrounded by numerous real a-trons $a^0_{m,n,N}$. Tables 14.10 and 14.11 show physical properties and the compositions of the a-trons and z-trons that form the ether. The ether is stable when the total exchange energy of the toryces making up both the a-trons and the z-trons is equal to zero. This would occur in the ether in which the *ether ratio* ψ, or the ratio of a-trons to z-trons, is equal to:

$$\psi = 4z^{2m} \tag{14-13}$$

For instance, as shown in Table 14.14, for each z-tron in the excitation quantum state $m = 2$ (ordinary matter), ether contains about 1.41×10^9 a-trons surrounding one z-tron.

Table 14.14. Modulus of elasticity of a-trons and z-trons, and -z-tron ratio for various excitation quantum states m ($n = 1$, $N = 0$).

M	**A-tron**		**Z-tron**		**Ether ratio**
	Symbol	Y, N/m^2	Symbol	Y, N/m^2	Ψ
1	$a^0_{1,1,0}$	2.032×10^{32}	$z^0_{1,1,0}$	4.184×10^{39}	7.51×10^4
2	$a^0_{2,1,0}$	2.785×10^{34}	$z^0_{2,1,0}$	1.476×10^{48}	1.41×10^9
3	$a^0_{3,1,0}$	3.816×10^{36}	$z^0_{3,1,0}$	5.203×10^{56}	2.65×10^{13}

As in the quantum vacuum shown in Figure 14.4, at the points of contacts of adjacent z-tron toryces of ether, the toryx string velocities are equal in magnitude and have the opposite directions. Therefore, for an external observer, the motion effect disappears. Another extraordinary feature of both a-trons and z-trons is their very high rigidity, with the modulus of elasticity Y exceeding the modulus of elasticity of steel by many orders (Table 14.14). Thus, practically massless and completely chargeless ether has high rigidity, an important property that the proponents of vortex theory could not explain, as we described before in Chapters 6 and 12. The other purpose is to provide communication between elementary particles at the superluminal velocity, as we will describe in Chapter 15.

NUCLEONS

Nucleons make up the nuclei of atoms. They are stable composite particles made of the principal elementary particles. The quantum energy states of the elementary particles making up nucleons depend on the matter level $M = 1, 2, 3,. . ..$ The structure of a nucleon can be divided into two distinct components, a *nucleon core* and a *nucleon shell.* The nucleon core contains a bulk of the nucleon mass; its constituent elementary particles are held together by superstrong (color) forces, as we will describe in Chapter 16. The nucleon shell is light, and its constituent elementary particles are held together by strong forces. The nucleus of a hydrogen atom contains only one nucleon that is a proton. The nuclei of all other atoms contain two kinds of nucleons, protons and neutrons. In the latter case, the adjacent nucleons are held together mainly by strong forces between their nucleon shells.

For the ordinary matter, the matter level $M = 2$. Since we know the physical properties of the nucleons of the ordinary matter, we can use this information for the construction of these nucleons based on the equations of 3D-SST:

- The calculated gravitational mass of a neutron must slightly be greater than their measured gravitational mass to account for binding energy.
- The calculated electric charge of a neutron must be equal to zero.
- The calculated relative electric charge of a proton $e/e_0 = +1$.
- The calculated magnetic moments of the nucleons must be comparable with known measured values of these parameters.
- The assembled neutron n^0 shall be capable of decaying into a proton p^{+1}, an electron e^{-1}, and an antineutrino $\overline{\nu}_e$, according to the known nucleon reaction:

$$n^0 \to p^{+1} + e^{-1} + \overline{\nu}_e$$

Nucleon core – Nucleon cores of protons and neutrons that belong to the same matter level M are identical. Each nucleon core contains seven z-trons $z^0_{m,1,0}$. One of the z-trons located in the center is surrounded by the other six z-trons. The z-trons have significant magnetic moments. Therefore, to minimize the total magnetic energy, they must be arranged in respect to one another in a special way shown in Figure 14.9. In that figure, four z-trons with spins "up" are indicated by the symbols ($\bullet$), and three z-trons with spins "down" are indicated by the symbols ($\times$).

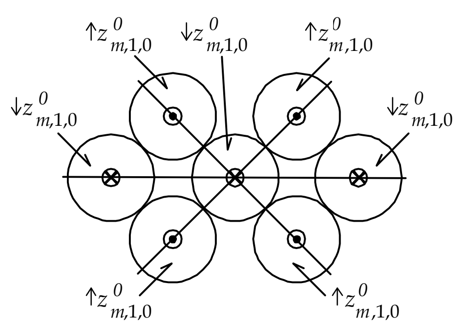

Figure 14.9. Initial engagement of z-trons forming a nucleon.

This arrangement assures minimum magnetic energy for seven z-trons. But, the assembly of the z-trons is still not completely tight. A final very tight engagement of z-trons is controlled by superstrong (color) forces that bring the centers of all seven z-trons almost to a single point, as we will describe in Chapter 16. Table 14.15 shows the components and the calculated physical properties of z-trons forming nucleon cores of various matter levels. Importantly, for a given matter level *M*, the z-trons making up the nucleon cores are in the exponential quantum energy state $m = M - 1$.

Table 14.15 Components and calculated physical properties of nucleon cores of various matter levels *M* ($m = M - 1$, $n = 1$, $N = 0$).

M	Nuclear core			
	Contents	μ/μ_N	m_g, MeV/c^2	e/e_0
1	$4 \times \uparrow z^0_{0,1,0} + 3 \times \downarrow z^0_{0,1,0}$	7.735947007	7.153985	0
2	$4 \times \uparrow z^0_{1,1,0} + 3 \times \downarrow z^0_{1,1,0}$	6.699571226	980.353462	0
3	$4 \times \uparrow z^0_{2,1,0} + 3 \times \downarrow z^0_{2,1,0}$	6.699526633	134343.716	0
4	$4 \times \uparrow z^0_{3,1,0} + 3 \times \downarrow z^0_{3,1,0}$	6.699526634	18409925.4	0

Nucleon shell – Nucleon shells of protons and neutrons are only partially identical. As shown in Table 14.16, the nucleon shell of the neutron contains one harmonic electron $e^{-1}_{0,1,1}$ shown in Figure 14.5, two harmonic a-trons $a^0_{0,1,0}$ shown in Figure 14.6, and one excited positron $e^{+1}_{m,1,0}$ shown in Figure 14.7. The harmonic electron $e^{-1}_{0,1,1}$ is in the oscillation quantum energy state $N = 1$. During the neutron decay the oscillation quantum energy state reduces to $N = 0$. The released energy is used for transforming the harmonic electron into a free excited electron ($e^{-1}_{m,1,0}$), and also for the formation of the antineutrino $\bar{\nu}_e$.

Table 14.17 shows the physical properties of the nucleons of various matter levels *M*. It follows from Table 14.17 that the nucleons of the matter level $M = 1$ are much lighter than the nucleons of ordinary matter ($M = 2$). Conversely, the nucleons of the matter levels $M > 2$ are progressively heavier than the nucleons of the ordinary matter.

Table 14.16. Components and calculated physical properties of nucleon shells of various matter levels M (n = 1).

M	Contents	μ/μ_N	m_g, MeV/c^2
Neutron shell ($e/e_0 = 0$)			
1	$2\times\downarrow a^0_{0,1,0}+\downarrow e^{+1}_{1,1,0}+\downarrow e^{-1}_{0,1,1}$	-8.866268	2.554995
2	$2\times\downarrow a^0_{0,1,0}+\downarrow e^{+1}_{2,1,0}+\downarrow e^{-1}_{0,1,1}$	-8.604561	2.554995
3	$2\times\downarrow a^0_{0,1,0}+\downarrow e^{+1}_{3,1,0}+\downarrow e^{-1}_{0,1,1}$	-8.582204	2.554995
4	$2\times\downarrow a^0_{0,1,0}+\downarrow e^{+1}_{4,1,0}+\downarrow e^{-1}_{0,1,1}$	-8.580295	2.554995
Proton shell ($e/e_0 = +1$)			
1	$2\times\downarrow a^0_{0,1,0}+\downarrow e^{+1}_{1,1,0}+(\downarrow e^{-1}_{1,1,0})$	-4.154125	1.021998
2	$2\times\downarrow a^0_{0,1,0}+\downarrow e^{+1}_{2,1,0}+(\downarrow e^{-1}_{2,1,0})$	-3.892418	1.021998
3	$2\times\downarrow a^0_{0,1,0}+\downarrow e^{+1}_{3,1,0}+(\downarrow e^{-1}_{3,1,0})$	-3.870062	1.021988
4	$2\times\downarrow a^0_{0,1,0}+\downarrow e^{+1}_{4,1,0}+(\downarrow e^{-1}_{4,1,0})$	-3.868152	1.021998

The brackets indicate that the free excited electron is not a part of a proton.

Table 14.17 Calculated physical properties of nucleons of various matter levels M (n = 1, N = 0).

Nucleon		M	μ/μ_N	m_g, MeV/c^2	e/e_0	**Matter kind**
Proton	p_1^{+1}	1	3.58182210	8.175983	+1	Light dark
	p_2^{+1}	2	2.80715318	981.37546	+1	Ordinary
	p_3^{+1}	3	2.82946498	134344.74	+1	Heavy dark
	p_4^{+1}	4	2.83137475	18409926.4	+1	Heavy dark
Neutron	n_1^0	1	-1.13032052	9.708979	0	Light dark
	n_2^0	2	-1.90498930	982.90846	0	Ordinary
	n_3^0	3	-1.88267764	134346.27	0	Heavy dark
	n_4^0	4	-1.88076787	18409927.9	0	Heavy dark

COMPARISON WITH EXPERIMENTAL DATA

In the previous sections of this chapter, we showed that four elementary particles, including electrons, positrons, a-trons and z-trons, are composed of four kinds of reality- and charge-polarized matched toryces. We demonstrated that it is possible to construct very sophisticated composite particles, such as nucleons, by combining appropriate elementary particles. To form composite particles, elementary particles must be in certain excitation and oscillation quantum energy states. The quantum energy states are defined by the quantization equations applicable to various matter levels, including our ordinary matter M = 2.

Table 14.18. Comparison of calculated and measured physical properties of various particles of ordinary matter (M = 2, n = 1).

Particle		Physical properties		
Name	Symbol	μ/μ_B	m_g, MeV/c^2	e/e_0
Atomic electron	$e_{2,1,0}^{-1}$	-0.9999999895	0.51099892	-1.00
Measured values:		-1.0011596522	0.51099892	-1.00
Calc./meas. ratio:		0.9988	1.0000	1.00
Negative muon	$e_{2,1,2}^{-1}$	-1.0059073607	105.037872	-1.00
Measured values:		-1.0011659202	105.658389	-1.00
Calc./meas. ratio:		1.0047	0.9941	1.00
Negative tau	$e_{2,1,3}^{-1}$	-0.9876294863	1799.246	-1.00
Measured values:		-	1770.000	-1.00
Calc./meas. ratio:		-	1.0165	1.00
Neutron	n_2^0	-1.90498930	982.90846	0.0
Measured values:		-1.91304273	939.56563	0.0
Calc./meas. ratio:		0.9958	1.0461	1.00
Proton	p_2^{+1}	2.807153318	981.375460	+1.00
Measured values:		2.792847351	938.272029	+1.00
Calc./meas. ratio:		1.0051	1.0459	1.00

As shown in Table 14.18, in the application to the ordinary matter the calculated values of the magnetic moment μ/μ_N and the gravitational mass m_g of atomic electron, muon, tau, neutron, and proton are in a very close agreement with respective measured values. For the magnetic moments, the differences between the calculated values and the measured values vary from -0.42 to +0.51%. For the gravitational masses of proton and neutron, the differences between the calculated values and the measured values are about the same, +4.6 %, that may be attributed to the binding energy that holds elementary particles together within the nucleons. Future experiments may show if the predicted parameters of the nucleons of other matter levels are correct.

CASCADE METHOD OF CREATION OF MATTER

Various matter levels are closely related with one another. The close relations are assured thanks to the so-called *cascade method* of the creation of ether and nucleons related to various matter levels. According to this method, the z-trons making up ether of a lower matter level M form the neutron cores of the next matter level $M + 1$.

As shown in Figure 14.10, the nucleon cores of the matter level $M = 1$, are made of the z-trons z_0^0 in the lowest excitation quantum energy state $m = M - 1 = 1 - 1 = 0$, while in ether of the same matter level the z-trons are in the next excitation quantum energy state $m = M = 1$. Similarly, the nucleon cores of the matter level $M = 2$ are made of the z-trons z_1^0 in the excitation quantum energy state $m = M - 1 = 2 - 1 = 1$, while in ether of the same matter level the z-trons are in the next excitation quantum energy state $m = M = 2$, and so on.

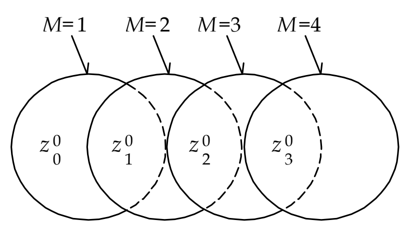

Figure 14.10. Cascade method of the creation of nucleon cores and ether of various matter levels *M*.

HOW MANY MATTER LEVELS ARE OUT THERE?

After we outlined the structures and physical properties of elementary particles and nucleons of various matter levels, a logical question arises: how many various matter levels M are in the universe? To answer this question we assumed that the number of possible matter levels is limited by the minimum possible sizes of toryces composing the elementary particles. Among the matched toryces making up four elementary particles, the z-tron toryces have the minimum radius of their leading strings r_m that is equal to:

$$r_m \approx \frac{r_{i0}}{2z^m} \tag{14-14}$$

In Equation (14-14), r_{i0} is the radius of the real inversion string when the atomic number $Z = 1$. The exponential quantum energy state $m = M - 1$. When m increases with the matter level M, it makes the radius of the toryx leading string r_1 smaller. At a certain value of m this radius becomes comparable with the so-called *Planck length* l_p, or the *quantum of length*. The Planck length is the smallest measurement of length at which classical ideas about gravity and spacetime cease to be valid. It is given by the equation:

$$l_p = \sqrt{\frac{hG}{2\pi c^3}} \tag{14-15}$$

According to 3D-SST, for the matter to exhibit gravitational and spacetime properties, the toryx string radius must be greater than $r_m = l_p/2$. Based on this assumption, we can determine from Equations (14-14) and (14-15) the relative minimum radius of the toryx leading strings b_m and the maximum matter level M_{max}:

$$b_m = \frac{r_m}{r_{i0}} = u\sqrt{U} \tag{14-16}$$

$$M_{\max} = 1 - \frac{\ln(2u\sqrt{U})}{\ln(nU)} \tag{14-17}$$

where u is the *universal polarization factor* given by the equation:

$$u = \frac{2m_0}{e_0}\sqrt{\pi G \varepsilon_0} \tag{14-18}$$

For instance, when the z-trons are in the lowest linear excitation quantum energy state $n = 1$, the maximum matter level $M_{max} = 10$. Thus, the matter with $M \leq 10$ would exhibit gravitational and spacetime properties. Conversely, the matter with $M > 10$ will completely be hidden from us, and may be classified as the *dark energy*. According to 3D-SST, the ordinary matter, dark matter, and dark energy are related to the matter levels M as shown below.

Quantum vacuum: $M = 0$

Light dark matter:	$M = 1$	Heavy dark matter:	$2 < M \leq 10$
Ordinary matter:	$M = 2$	Dark energy:	$M > 10$

The exponential quantum energy states m of the electrons $e^{-}_{m,n,N}$ the positrons $e^{+}_{m,n,N}$, the a-trons $a^{0}_{m,n,N}$, and z-trons $z^{-}_{m,n,N}$ making up the ether and the nucleons are related to the matter level M as shown in Table 14.19.

Table 14.19. Exponential quantum energy states m of elementary particles making up ether and nucleons as a function of the matter level M.

Elementary particle quantum state	**Matter level**					
	Ether		Nucleons			
	$a^{0}_{m,n,N}$	$z^{-}_{m,n,N}$	$e^{-}_{m,n,N}$	$e^{+}_{m,n,N}$	$a^{0}_{m,n,N}$	$z^{-}_{m,n,N}$
m	M	M	0	M	0	$M-1$