

The Physical Origin of Matter, Energy, Time, and Angular Momentum in World–Universe Cosmology

From the Eternal Universe to the Three-Dimensional World

Vladimir S. Netchitailo

netchitailo.vs@gmail.com

Abstract

World–Universe Cosmology (WUC) proposes that the physical World is a finite, boundless three-dimensional Hypersphere forming the surface of an expanding four-dimensional Nucleus embedded in the Eternal Universe. The Nucleus expands in the fourth spatial dimension at the fundamental speed (c). Matter is continuously created by the Eternal Universe through the formation of Universe-Created Particles (UCPs) within the expanding Nucleus.

The present paper proposes a common physical foundation for Matter, Energy, Time, and Angular Momentum. It introduces the fundamental Surface Tension (σ_0) of Cosmic Bubbles and the Angular Momentum flux density (J_h), directed from the four-dimensional Nucleus into the three-dimensional World. WUC proposes the fundamental relationship

$$\sigma_0 = J_h = \frac{h}{a^2 t_0}$$

where (a) is the fundamental length and ($t_0 = a/c$) is the fundamental time scale. The fundamental rest-energy scale and Planck's constant are expressed through

$$E_0 = \sigma_0 a^2 \quad h = \sigma_0 a^2 t_0$$

Within the four-spatial interpretation, Time represents the evolution of the fourth spatial position of the expanding Nucleus. Rest Energy is the three-dimensional representation of the fourth spatial momentum component, transformed by the fundamental expansion speed (c). Angular Momentum is proposed to manifest as a collective property of organized UCP ensembles whose circulation already exists within the four-dimensional Nucleus before their entry into the three-dimensional Hypersphere.

These relationships suggest a common physical foundation for fundamental quantities that appear distinct within our three-dimensional experience. The proposed interpretation is presented as a physical hypothesis requiring further theoretical development and quantitative experimental and observational testing.

1. Introduction

Matter, Energy, Time, and Angular Momentum are among the most fundamental concepts in physics. Their mathematical descriptions are well established, and their manifestations can be investigated through precise experiments and astronomical observations. Nevertheless, questions concerning their underlying physical nature remain important.

What is the physical origin of Matter? What does Energy physically represent? What is Time? Where does Angular Momentum originate?

World–Universe Cosmology proposes that these questions may have a common physical answer.

According to WUC, the Eternal Universe exists independently of the physical World. The World is a finite, boundless three-dimensional Hypersphere forming the surface of an expanding four-dimensional Nucleus. The Nucleus expands in the fourth spatial dimension at the fundamental speed (c).

Within this structure, Matter is not introduced as a primordial substance existing from the Beginning of the World. Instead, Universe-Created Matter (UCM) is continuously generated by the Eternal Universe within the expanding Nucleus through the formation of Universe-Created Particles (UCPs).

This continuous creation of Matter is the starting point of the present paper.

We introduce the fundamental Surface Tension (σ_0) of Cosmic Bubbles as a primary physical parameter. We also introduce the Angular Momentum flux density (J_h), which characterizes the transfer of Angular Momentum from the four-dimensional Nucleus into the three-dimensional World.

The central proposed relationship is

$$\sigma_0 = J_h$$

These quantities describe different physical phenomena. Surface Tension characterizes the energetic properties of Cosmic Bubble boundaries, whereas Angular Momentum flux density characterizes the transfer of collective Angular Momentum across the four-dimensional-to-three-dimensional transition.

Their proposed equality establishes a fundamental connection between these phenomena within WUC.

The fundamental rest-energy scale and Planck's constant are expressed through

$$E_0 = \sigma_0 a^2 \quad h = \sigma_0 a^2 t_0$$

The four-spatial structure of the World provides the next level of physical interpretation.

Time is interpreted through the evolution of the fourth spatial position of the expanding Nucleus. Rest Energy represents the fourth spatial momentum component of an individual particle, transformed by the fundamental expansion speed (c). Angular Momentum is proposed to manifest through organized collective circulation of UCP ensembles already existing within the four-dimensional Nucleus.

The central hypothesis of the present paper is therefore:

The continuous creation of Matter within the expanding four-dimensional Nucleus, together with the fundamental Surface Tension of Cosmic Bubbles and the transfer of Angular Momentum into the three-dimensional World, provides a common physical foundation for Matter, Energy, Time, and Angular Momentum.

The purpose of this paper is to develop this hypothesis in a concise and physically transparent form, emphasizing physical principles rather than a completed mathematical description of the underlying dynamics.

2. The Eternal Universe, Four-Dimensional Nucleus, and Continuous Creation of Matter

2.1. The Eternal Universe and the Physical World

World-Universe Cosmology distinguishes between the Eternal Universe and the physical World.

The Eternal Universe exists independently of the World and has no Beginning or End. The physical World, by contrast, has a finite age and evolves within the Eternal Universe.

According to WUC, the World is a finite, boundless three-dimensional Hypersphere forming the surface of an expanding four-dimensional Nucleus. The Nucleus expands in the fourth spatial dimension at the fundamental speed (c).

The radius of the Nucleus is

$$R = aQ = c\tau$$

where (a) is the fundamental length, (Q) is the evolving dimensionless World Parameter, and (τ) is Absolute Cosmological Time.

The World Parameter

$$Q = R/a$$

characterizes the size of the World and its curvature in the fourth spatial dimension.

As the Nucleus expands, (Q) increases continuously. Within WUC, this evolution determines the changing values of the primary cosmological parameters.

2.2. Continuous Creation of Matter

A fundamental proposition of WUC is that Matter is continuously created by the Eternal Universe within the expanding four-dimensional Nucleus.

This creation occurs through the formation of Universe-Created Particles, which constitute Universe-Created Matter.

UCPs possess four spatial momentum components within the four-dimensional Nucleus, while their fourth spatial momentum components are represented as rest energies in the three-dimensional World. They participate in the formation and evolution of the physical World. Through their interactions and pair annihilation, they are proposed to generate Ordinary Matter and contribute to the development of physical structures.

Matter creation is therefore not restricted to the Beginning of the World. It is a continuing physical process associated with the expansion of the Nucleus.

Individual UCPs possess rest energy, while organized ensembles of UCPs are proposed to carry collective Angular Momentum.

2.3. The Four-Spatial Nature of Universe-Created Particles

Within the four-dimensional Nucleus, a Universe-Created Particle is described by four spatial coordinates:

$$(x, y, z, w)$$

where (w) represents the fourth spatial coordinate.

The corresponding four-spatial-momentum is

$$\mathbf{P}_4 = (p_x, p_y, p_z, p_4)$$

The first three momentum components correspond to the directly observable spatial dimensions of the World. The fourth component (p_4) is associated with the fourth spatial dimension.

WUC proposes that the rest energy of an individual particle is the three-dimensional representation of its fourth spatial momentum component:

$$E = cp_4$$

Here, (c) is fundamentally the speed of expansion of the Nucleus in the fourth spatial dimension.

Angular Momentum, by contrast, is considered a collective property of organized UCP ensembles.

Within WUC, these ensembles possess organized circulation already inside the four-dimensional Nucleus. When they enter the three-dimensional Hypersphere, their pre-existing organization is proposed to manifest as three-dimensional collective Angular Momentum.

Thus, rest energy characterizes individual particles, while collective Angular Momentum characterizes organized ensembles.

2.4. Cosmic Bubbles. Surface Tension and Angular Momentum Transfer

Within WUC, Cosmic Bubbles are characterized by a fundamental Surface Tension (σ_0), representing Energy per unit area [1].

The continuous creation of Matter within the four-dimensional Nucleus is accompanied, according to the proposed hypothesis, by a transfer of collective Angular Momentum into the three-dimensional World.

This transfer is characterized by the Angular Momentum flux density (J_h).

WUC proposes that these quantities are fundamentally connected:

$$\sigma_0 = J_h$$

Their common dimensions allow a quantitative relationship, while their physical interpretations remain distinct.

The following section develops this connection and introduces the fundamental scales (E_0) and (h) .

3. Fundamental Surface Tension of Cosmic Bubbles and Angular Momentum Flux from Four Dimensions to Three

3.1. Fundamental Surface Tension

World–Universe Cosmology introduces the fundamental Surface Tension (σ_0) of Cosmic Bubbles as a primary physical parameter.

Surface Tension characterizes the Energy associated with a unit area of a Cosmic Bubble boundary.

The fundamental length (a) defines a characteristic area (a^2) . Within WUC, the fundamental rest-energy scale is expressed as

$$E_0 = \sigma_0 a^2$$

Thus, the fundamental rest-energy scale is directly connected with the Surface Tension of Cosmic Bubbles.

The fundamental time scale is

$$t_0 = a/c$$

The quantities (a) and (t_0) characterize fundamental spatial and temporal scales of WUC. They are extrapolated scales and do not, by themselves, identify the physical Beginning of the Cosmic Medium.

3.2. The Origin of Planck's Constant

Within the proposed framework, Planck's constant is introduced through the fundamental Surface Tension and the characteristic spatial and temporal scales:

$$h = \sigma_0 a^2 t_0$$

Combining this expression with the definition of (E_0) , we obtain

$$h = E_0 t_0$$

Since $(t_0 = a/c)$,

$$E_0 = hc/a$$

This is the fundamental rest-energy relationship used in WUC, now expressed through the primary parameter (σ_0) .

For the fundamental length adopted in WUC,

$$a = 1.7705641 \times 10^{-14} \text{ m}$$

the corresponding fundamental rest-energy scale is approximately

$$E_0 \sim 70.025 \text{ MeV}$$

The proposed interpretation does not change this quantitative relationship. It establishes a hierarchy in which the Surface Tension of Cosmic Bubbles is introduced first, while (E_0) and (h) are connected through the fundamental area and time scales.

3.3. Angular Momentum Flux from Four Dimensions to Three

The continuous creation of Matter within the four-dimensional Nucleus is proposed to be accompanied by the transfer of collective Angular Momentum into the three-dimensional World.

We introduce the fundamental Angular Momentum flux density

$$J_h = \frac{h}{a^2 t_0}$$

This quantity represents Angular Momentum transferred per unit area per unit time.

Substituting the proposed relationship for (h) , we obtain

$$J_h = \frac{\sigma_0 a^2 t_0}{a^2 t_0}$$

and consequently

$$J_h = \sigma_0$$

Surface Tension and Angular Momentum flux density have identical dimensions.

Their equality is proposed as a physical relationship of WUC, not as a consequence of dimensional consistency alone.

The Surface Tension (σ_0) characterizes Cosmic Bubble boundaries, while (J_h) characterizes the directional transfer of collective Angular Momentum from the four-dimensional Nucleus into the three-dimensional World.

3.4. Physical Significance

The proposed fundamental relationships are

$$\sigma_0 = J_h \quad E_0 = \sigma_0 a^2 \quad h = \sigma_0 a^2 t_0$$

They connect the fundamental Surface Tension of Cosmic Bubbles, the fundamental rest-energy scale, and the transfer of Angular Momentum across the four-dimensional-to-three-dimensional transition.

Rather than treating Energy and Angular Momentum as unrelated fundamental quantities, WUC proposes that their characteristic scales are connected through the physical structure of Cosmic Bubbles and the continuous creation of Matter.

The detailed dynamics producing these relationships remain to be established.

4. The Physical Nature of Time

4.1. Time and the Fourth Spatial Dimension

Time is conventionally used to describe the duration and sequence of physical processes. Within WUC, Absolute Cosmological Time has a more specific geometrical interpretation.

The four-dimensional Nucleus expands at the fundamental speed (c). Its radius is

$$R = c\tau$$

Therefore,

$$\tau = R/c$$

Within WUC, Time is our three-dimensional description of the evolution of the fourth spatial position of the expanding Nucleus.

The fourth spatial coordinate is a real spatial coordinate in the proposed model. The passage of Absolute Cosmological Time corresponds to the increasing radius of the Nucleus.

Time is thus connected with a physical geometrical process rather than introduced solely as an independent parameter.

4.2. The World Parameter and Absolute Cosmological Time

Using the fundamental length (a), the radius is expressed as

$$R = aQ$$

Consequently,

$$\tau = t_0 Q$$

where ($t_0 = a/c$).

The evolving World Parameter (Q) therefore provides a dimensionless measure of Absolute Cosmological Time.

Within this interpretation, the evolution of the World and the increase of its radius are two descriptions of the same fundamental process.

4.3. Physical Interpretation

Imagine creatures confined to the two-dimensional surface of an expanding sphere. They can move within the surface but cannot directly explore the third spatial direction in which the sphere expands.

WUC proposes an analogous situation with one additional spatial dimension.

We inhabit a three-dimensional Hypersphere, while its expansion occurs in a fourth spatial direction that is not directly accessible within our ordinary three-dimensional experience.

The proposed physical interpretation is:

Time is our three-dimensional description of the evolution of the fourth spatial position, determined by the expansion of the Nucleus at speed (c).

This statement concerns Absolute Cosmological Time.

5. The Physical Nature of Energy [2]

5.1. Energy as a Physical Parameter

Energy occupies a central position in physics. It can be measured, transferred, transformed, and conserved with extraordinary precision.

These properties describe how Energy behaves, but they do not necessarily identify what Energy physically represents.

WUC approaches this question through the four-spatial-dimensional structure of the World.

Within this framework, momentum possesses four spatial components. Three are associated with the directly observable spatial dimensions, while the fourth is directed along the fourth spatial dimension.

5.2. Energy as Fourth Spatial Momentum

For an individual particle, the four-spatial-momentum is

$$\mathbf{P}_4 = (p_x, p_y, p_z, p_4)$$

WUC proposes the fundamental relationship

$$E = cp_4$$

where (E) denotes the rest energy of the particle.

For a particle at rest in the three-dimensional World,

$$p_x = p_y = p_z = 0$$

while its fourth spatial momentum component remains nonzero.

Its rest energy is therefore associated with a real momentum component directed along the fourth spatial dimension.

The central proposition is:

Energy is our three-dimensional description of the fourth spatial momentum component, transformed by the fundamental expansion speed (c).

In this interpretation, four-spatial-momentum is fundamental, while rest energy is an individual-particle property representing its fourth spatial component.

5.3. The Fundamental Energy Scale

The fundamental rest-energy scale introduced in Section 3 is

$$E_0 = \sigma_0 a^2 = hc/a$$

The corresponding fourth spatial momentum scale is

$$p_{4,0} = E_0/c = h/a$$

Thus, the fundamental Surface Tension of Cosmic Bubbles is connected with the fundamental fourth spatial momentum scale through

$$p_{4,0} = \sigma_0 a^2/c$$

This relationship provides a proposed connection between the surface properties of Cosmic Bubbles and the fourth spatial momentum of individual UCPs.

Different UCP species possess different rest energies and consequently different fourth spatial momentum components.

5.4. Where Does Energy Come From?

The four-spatial interpretation changes the physical question concerning the origin of Energy.

If Energy represents the fourth spatial momentum component, the deeper question becomes:

What is the physical origin of four-spatial momentum?

Within WUC, this question leads directly to the continuous creation of UCPs by the Eternal Universe within the expanding four-dimensional Nucleus.

The fundamental Surface Tension (σ_0) establishes the characteristic rest-energy scale, while individual UCPs possess definite fourth spatial momentum components.

In this way, the surface properties of Cosmic Bubbles, Matter creation, and the physical nature of Energy are connected within a single framework.

6. The Physical Origin of Angular Momentum [3]

6.1. Angular Momentum as a Collective Property

Angular Momentum is a fundamental physical quantity characterizing rotational motion and organized circulation.

Astronomical systems exhibit Angular Momentum across an enormous range of scales, from planetary systems to galaxies and larger cosmic structures.

Within WUC, the origin of Angular Momentum is connected with the organization of Universe-Created Matter.

An individual UCP possesses rest energy associated with its fourth spatial momentum component. Organized ensembles of UCPs are proposed to carry collective Angular Momentum.

The distinction between individual-particle Energy and collective Angular Momentum is essential.

6.2. Organized Circulation within the Four-Dimensional Nucleus

WUC proposes that UCP ensembles can possess organized collective circulation already within the four-dimensional Nucleus.

This organization may be visualized intuitively as microscopic vortical structures, resembling air vortices, although their proposed physical nature is four-spatial-dimensional.

The circulation is not created from nothing when particles enter the three-dimensional Hypersphere.

Instead, the proposed hypothesis is that organized rotational correlations already exist within the Nucleus. Upon entry into the Hypersphere, this pre-existing organization manifests as three-dimensional collective Angular Momentum.

This interpretation suggests a physical connection between the continuous creation of UCPs, their collective organization, and the rotational properties of structures within the World.

6.3. From Four-Spatial Organization to Three-Dimensional Angular Momentum

In three-dimensional space, the Angular Momentum of a system is expressed through its spatial position and momentum distributions.

Within WUC, the proposed origin of these distributions lies in organized four-spatial correlations of UCP ensembles.

The transition from the four-dimensional Nucleus to the three-dimensional Hypersphere must therefore preserve or transform relevant aspects of this organization.

The resulting three-dimensional Angular Momentum is not assumed to arise from a newly created circulation at the boundary.

Rather, it is proposed to be the three-dimensional manifestation of pre-existing collective organization.

The precise mapping between four-spatial rotational correlations and three-dimensional Angular Momentum remains an unresolved dynamical question.

6.4. Connection with the Fundamental Angular Momentum Flux

Section 3 introduced

$$J_h = \frac{h}{a^2 t_0} = \sigma_0$$

Within WUC, this fundamental flux density characterizes the transfer of Angular Momentum from the four-dimensional Nucleus into the three-dimensional World.

The equality with the fundamental Surface Tension suggests a connection between the surface properties of Cosmic Bubbles and the transfer of collective Angular Momentum.

However, the equality alone does not determine the magnitude or direction of Angular Momentum in a particular physical system.

Such a determination requires a dynamical description of particle organization, momentum correlations, and their evolution.

7. Cosmic Bubbles, Surface Tension, and the Observable World

7.1. Surface Energy of the Observable World

Within WUC, the Observable World can be considered in terms of a Hubble Bubble with characteristic radius

$$R = aQ$$

The bounding two-dimensional sphere of this Hubble Bubble has area

$$A_{HB} = 4\pi R^2$$

Using the fundamental Surface Tension, WUC introduces the corresponding surface Energy quantity

$$E_{OW} = 4\pi R^2 \sigma_0$$

This relationship associates the Energy of the Observable World with the fundamental Surface Tension and its characteristic geometrical area.

The factor $(4\pi R^2)$ refers here to the bounding sphere of the Hubble Bubble, not to the three-dimensional hypersurface measure of the entire four-dimensional Nucleus.

7.2. Integrated Angular Momentum Flux

Analogously, the integrated Angular Momentum flux associated with the same bounding area is

$$I_h = 4\pi R^2 J_h$$

Since WUC proposes

$$\sigma_0 = J_h$$

we obtain

$$E_{OW} = I_h$$

The two quantities have the same dimensions but different physical meanings.

(E_{OW}) represents the proposed surface Energy associated with the Hubble Bubble, whereas (I_h) represents the integrated rate of Angular Momentum transfer from the four-dimensional Nucleus into the three-dimensional World.

Within WUC, their equality expresses the proposed connection between Cosmic Bubble Surface Tension and the Angular Momentum flux.

7.3. Dependence on the World Parameter

Substituting $(R = aQ)$ gives

$$E_{OW} = 4\pi a^2 Q^2 \sigma_0$$

Using $(E_0 = \sigma_0 a^2)$,

$$E_{OW} = 4\pi E_0 Q^2$$

The corresponding integrated Angular Momentum flux is

$$I_h = 4\pi E_0 Q^2$$

Thus, within the proposed framework, both quantities depend on the evolving World Parameter (Q).

This dependence connects the surface properties of Cosmic Bubbles with the expanding geometry of the Observable World and the proposed transfer of Angular Momentum.

8. Interconnectivity of Fundamental Cosmological Parameters [4]

8.1. The World Parameter

One of the central features of WUC is the proposed interconnectivity of cosmological parameters through the evolving World Parameter (Q).

The fundamental geometrical relationships are

$$R = aQ \quad \tau = \frac{a}{c}Q$$

The corresponding Hubble parameter is

$$H = \frac{c}{a}Q^{-1}$$

Within WUC, the Hubble parameter is therefore determined by the radius and expansion speed of the Nucleus.

8.2. Gravitation and Energy Density

WUC proposes the following relationship for the gravitational parameter:

$$G = \frac{a^2 c^4}{8\pi h c} \times Q^{-1}$$

Using ($h = \sigma_0 a^2 t_0$) and ($t_0 = a/c$), this can also be written as

$$G = \frac{c^4}{8\pi \sigma_0 a} \times Q^{-1}$$

The critical Energy density is expressed as

$$\rho_{cr} = \frac{3hc}{a^4} \times Q^{-1}$$

or, in terms of the fundamental Surface Tension,

$$\rho_{cr} = \frac{3\sigma_0}{a} \times Q^{-1}$$

These expressions illustrate how the proposed primary parameter (σ_0) enters the quantitative cosmological relationships of WUC.

8.3. Background Radiation Temperatures

Within WUC, the temperature of Microwave Background Radiation is related to the evolving World Parameter through

$$T_{MBR} = \frac{E_0}{k_B} \left(\frac{15K_U}{2\pi^3} \frac{m_e}{m_p} \right)^{1/4} \times Q^{-1/4}$$

where (k_B) is Boltzmann's constant, (K_U) is the fixed dimensionless Universe Constant [4]:

$$K_U^{-1} \approx 4\pi^3 + \pi^2 + \pi \approx 137.036303776$$

The proton-to-electron ratio is a dimensionless quantity [4]:

$$m_p/m_e = 6\pi^5 \approx 1836.118109$$

The temperature associated with the Far-Infrared Background Radiation peak is expressed as

$$T_{FIRB} = \frac{E_0}{k_B} \left(\frac{15}{4\pi^5} \right)^{1/4} \times Q^{-1/4}$$

In these expressions, the fundamental rest-energy scale can be replaced by

$$E_0 = \sigma_0 a^2$$

Consequently, the proposed fundamental Surface Tension enters the relationships connecting cosmological evolution and background radiation.

An important result of the developed Model is that WUC presented quantitative predictions in 2013 that were subsequently found to be consistent with experimental measurements and astronomical observations. These include the Newtonian gravitational parameter (G), the Hubble parameter (H), the density of ionized baryons in the intergalactic medium, and a predicted minimum photon energy. Relevant measurements, observational estimates, and constraints reported between 2016 and 2021 provide opportunities for quantitative comparison with these predictions.

In addition, WUC provides direct calculations of the Microwave Background Radiation temperature and the peak temperature of Far-Infrared Background Radiation. These quantities can be compared with independently measured radiation spectra and temperatures [5].

8.4. Physical Interpretation

The proposed relationships suggest that several apparently independent cosmological parameters may be connected through a small set of fundamental quantities and the evolving World Parameter (Q).

Within WUC, their evolution is interpreted as a manifestation of the changing curvature of the World in the fourth spatial dimension.

The introduction of (σ_0) adds a proposed physical connection between this cosmological evolution and the surface properties of Cosmic Bubbles.

9. Conclusion

World–Universe Cosmology proposes that Matter, Energy, Time, and Angular Momentum can be understood through the existence of the Eternal Universe, the expanding four-dimensional Nucleus, and the continuous creation of Universe-Created Matter.

The principal new proposition of the present paper is the fundamental relationship between the Surface Tension of Cosmic Bubbles and the Angular Momentum flux density directed from four spatial dimensions into three:

$$\sigma_0 = J_h$$

The fundamental rest-energy scale and Planck's constant are expressed through

$$E_0 = \sigma_0 a^2$$

$$h = \sigma_0 a^2 t_0$$

These relationships suggest a common physical foundation connecting Cosmic Bubble Surface Tension, the fundamental Energy scale, and the transfer of Angular Momentum into the three-dimensional World.

Within the same four-spatial framework, Time represents the evolution of the fourth spatial position, Energy represents the fourth spatial momentum component transformed by (c), and Angular Momentum is proposed to manifest through pre-existing collective organization of UCP ensembles.

The central conclusion is:

The continuous creation of Matter, the Surface Tension of Cosmic Bubbles, and the transfer of Angular Momentum from four spatial dimensions into three may provide a common physical foundation for Matter, Energy, Time, and Angular Momentum in the World.

The hypothesis offers a unified physical interpretation but does not yet provide a complete description of the underlying dynamics.

Its further development requires a quantitative theory of UCP creation, a mechanism for collective Angular Momentum transfer, and independent experimental and observational tests.

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