UNIVERSAL TOPOLOGY $W = P \pm iV$ AND HORIZON OF DARK FLUXIONS AND THERMODYNAMICS

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PART I: UNIVERSAL TOPOLOGY $W = P \pm iV$ AND FIRST HORIZON OF QUANTUM FIELDS

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Universal Topology $W = P \pm iV$ and Horizon of Dark Fluxions and Thermodynamics

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Abstract: Associated with the virtual or physical manifolds, the universe topology aggregates quantum objects and forms the second horizon as the group effects of the flow conservations both physically and virtually, called Dark Fluxions, a dynamics cosmology of energy flows. Inherent to its internal nature, the universe produces each of opposite dualities as a complex conjugate, the statistical representation of dark fluxions dynamically affiliated to bulk entropy, motion continuities, statistical works, and interactive fields, giving rise to the horizon of thermodynamics. As a result, this becomes a groundwork in quest for nature transformations delivered by the life energy of dark fluxions, or the dynamic flows of dark energy...

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I. INTRODUCTION

Worlds in universe constitutes a topological pair of manifolds, each of which represents unique dimensions, transforms objects within their neighborhood or subsets, and orchestrates events across multiple spaces. As a duality of the universe topology, these manifolds are central to many parts of worlds, allowing sophisticated structures, evolving into natural events, determining systematic solution sets, and carrying out natural laws and principles. Any objects in the universe has a sequence of events corresponding to the historical or future points of worlds appearing as a type of framework in the universe infrastructure. Defined by global parameters of the world or universe, a universe line is curved out in a continuous and smooth coordinate system representing events as a collection of points. Each point has multidimensional surfaces, called World Plane, with analogue associations among the worlds. In our universe, scopes and boundaries among each world are composed of, but not limited to, the homeomorphic duality: virtual and physical worlds.

In the part I of this series [1], the *Universal Topology* $W = P \pm iV$ represent the dual manifolds, event operations, Lagrangian density, and general quantum equations. Approximated to the second orders, the *Physical and Virtual Quantum Dynamics* represent the following expressions:

$$3\kappa_{\tau 2}\frac{\partial^2 \phi_n^-}{\partial {x_0}^2} + \kappa_\tau \frac{\partial \phi_n^-}{\partial x_0} - \kappa_{r2}\nabla^2\phi_n^- + V(\mathbf{r}, x_0)\phi_n^- = 0 \qquad : x_0 = ict \qquad (1.1)$$

$$-\kappa_{\tau 2}\frac{\partial^2 \phi_n^+}{\partial {x_0}^2} - \kappa_{r2}\nabla^2\phi_n^+ + V(\mathbf{r}, x_0)\phi_n^+ = 0 \qquad : \kappa_\tau = \hbar c,\ \kappa_{\tau 2} = \kappa_{r2} = \frac{\hbar^2}{2m^*} \qquad (1.2)$$

Arising from the internal nature of these first horizon of quantum fields, the spacetime manifolds form the second horizon as the group effects of the fluxions, characterized by the duality of virtual and physical dynamics inherent to the Universal Topology. The fluxions, named Dark Fluxions, define the dual dynamic flows of manifold energies, a base for any movements of density and current. For example, it associates to electromagnetism in charge distribution, to gravitation in mass distribution, thermodynamics in statistic distribution, and to dark energy at all time in dynamic equilibrium.

Associated with the physical space or virtual time fields of primary state ϕ_n^- or ϕ_n^+, the internal nature produces each of opposite dualities as complex conjugate φ_n^- or φ_n^+, an integral pair which statistically represents dark fluxions. For an observable value O, the ensemble is in a mixed state such that each pair of the primary states $\phi_n^\mp$ and the auxiliary states $\varphi_n^\mp$ occurs with probability $p_n(T)$ rising from horizon factors $h_n(T)$, where temperature T is in units of ***Kelvin*** [2] introduced in 1848. Together, they form an object defined as the following under an event operator $\hat{O}$.

$$\left\langle \hat{O}, \phi \right\rangle \equiv \sum_n p_n(\varphi_n\hat{O}\phi_n - \phi_n\hat{O}\varphi_n) \quad : \sum_n p_n = 1 \qquad (1.3a)$$

$$\hat{O} \in \left\{\partial_\tau, \nabla, \hat{H}, \hat{V}, \cdots\right\}, \quad \phi_n \in \{\phi_n^-, \phi_n^+\}, \quad \varphi_n \in \{\varphi_n^-, \varphi_n^+\} \qquad (1.3b)$$

where the probability $p_n = f[h_n(T)]$ is a statistical function of the horizon factor of $h_n(T)$. The above equation illustrates the ***Heisenberg*** picture [3], introduced in 1925. The integral pair gives rise to temperature during formations of a bulk system. On the microscopic horizon, an entity of objects is observable if and only if it satisfies spacetime asymmetry represented as:

$$\varphi_n \hat{O} \phi_n \neq \phi_n \hat{O} \varphi_n \tag{1.4}$$

The invariance does not follow the symmetric effects of the internal balance, only the manifold duality does. In action, each part of the duality is its own dominant primacy and parallels that of the other part. The auxiliary reactions between two parts of the duality maintain their common horizon or give rise to the next horizon.

This paper further extends the universal topology of quantum state fields into fluxions of energy, such that the manifold includes a dynamic duality of virtual and physical movements, organized into the following sections:

In Section 2, the flux continuum of physical states is theorized as rising from the *Physical Quantum Dynamics* of the equation (1.1).

In Section 3, the flux continuum of virtual states is formulated as rising from the *Virtual Quantum Dynamics* of the equation (1.2).

Together, they form conservation law of dark fluxions, which are summarized in Section 4 using the covariant tensors.

In Section 5, the characteristics of the state densities are extended statistically to derive the horizon factor of the energy distribution associated with the virtual temperature and fluxions of a bulk system.

The entropy states are shown in Section 6, as the traditional thermodynamics, from which the entropy equilibria are derived for either increasing to maximal physical disorder or decreasing to minimal virtual disorder.

Finally, the argument of this paper extends the motion equations of the thermal density in Section 7, resulting in the bulk-density equilibrium of thermal dynamics.

II. CONTINUITY OF PHYSICAL FLUXIONS

The density probability of a physical flux, ρ_n^-, and its current, $\mathbf{J}_n^-$, can be shown to rise from virtual movements by the following expressions:

$$\rho^- = \sum_n \rho_n^- = i \left\langle \partial_\tau, \phi^- \right\rangle \quad : \partial_\tau \phi_n^- \equiv \frac{\partial \phi_n^-}{\partial x_0},\ x_0 = ict \tag{2.1a}$$

$$\mathbf{J}^- = \sum_n \mathbf{J}_n^- = \frac{c}{3} \left\langle \nabla, \phi^- \right\rangle \quad : \nabla = \mathbf{e}_\nu \partial / \partial x_\nu,\ \nu \in (1,2,3) \tag{2.1b}$$

where defines a relationship between the physical source in one movement and its current in three-physical-dimension. Since the complex conjugate of state φ_n^- has similar equations as its opponent state ϕ_n^-, the *Physical Quantum Equation* (1.1) represents the following relationships for both states:

$$\sum_n p_n \left(3\kappa_{\tau 2} \varphi_n^- \frac{\partial^2 \phi_n^-}{\partial {x_0}^2} - \kappa_\tau \varphi_n^- \frac{\partial \phi_n^-}{\partial x_0} - \kappa_{r2} \varphi_n^- \nabla^2 \phi_n^- + \varphi_n^- \hat{V} \phi_n^- \right) = 0 \tag{2.2a}$$

$$\sum_n p_n \left(3\kappa_{\tau 2} \phi_n^- \frac{\partial^2 \varphi_n^-}{\partial {x_0}^2} - \kappa_\tau \phi_n^- \frac{\partial \varphi_n^-}{\partial x_0} - \kappa_{r2} \phi_n^- \nabla^2 \varphi_n^- + \phi_n^- \hat{V} \varphi_n^- \right) = 0 \tag{2.2b}$$

Combined with equations (2.1), the space fields of quantum dynamics forms a continuous density equation that rises to the macroscopic horizon, formulated as the following integrity of flux density equations in physical movements:

$$3\kappa_{\tau 2} \frac{\partial \rho^-}{\partial x_0} + \frac{3\kappa_{r2}}{ic} \nabla \cdot \mathbf{J}^- = \kappa_\tau \rho^- - i \left\langle \hat{V}, \phi^- \right\rangle \qquad : \kappa_\tau = \hbar c,\ \kappa_{\tau 2} = \kappa_{r2} = \frac{\hbar^2}{2m^*} \tag{2.3}$$

Therefore, the space fields of quantum dynamics forms a flux continuity of density that raises spacetime duality to a new horizon:

$$ic \frac{\partial \rho^-}{\partial x_0} + \nabla \cdot \mathbf{J}^- = K_s^-(\rho^-, \hat{V}) \tag{2.4a}$$

$$K_s^-(\rho^-, \hat{V}) = \frac{2m^* c}{3\hbar^2} \left(< \hat{V}, \phi^- > + i\hbar \rho^- \right) \tag{2.4b}$$

where the scalar K_s^- is a resource oscillation with its own flux of density ρ^- as the physical source if $K_s^- > 0$ or the sink if $K_s^- < 0$. The above equations are time-dependent physical density flux, rising into a part of the horizon for bulk dynamics.

III. CONTINUITY OF VIRTUAL FLUXIONS

Likewise, there is a virtual flux of density ρ_n^+ with its density current of $\mathbf{J}_n^+$. The following integrity shows the virtual flux rising from space movements with their time field interactions:

$$\rho^+ = \sum_n \rho_n^+ = i\left\langle \partial_\tau, \phi^+ \right\rangle \qquad : \partial_\tau \phi_n^+ \equiv -\frac{\partial \phi_n^+}{\partial x_0}, x_0 = ict \tag{3.1a}$$

$$\mathbf{J}^+ = \sum_n \mathbf{J}_n^+ = -c\left\langle \nabla, \phi^+ \right\rangle \qquad : \nabla = \mathbf{e}_\nu \partial / \partial x_\nu, \nu \in (1,2,3) \tag{3.1b}$$

where defines a relationship between a virtual density and its single virtual current over the three-dimensional space. Since the complex conjugate of state φ_n^+ has equations similar to its opponent state, the *Virtual Quantum Equation* (1.2) represents the following relationships for both of states:

$$\sum_n p_n \left(\varphi_n^+ \frac{\partial^2 \phi_n^+}{\partial x_0^2} - \varphi_n^+ \nabla^2 \phi_n^+ + \frac{m}{\hbar^2} \varphi_n^+ \hat{V} \phi_n^+ \right) = 0 \tag{3.2a}$$

$$\sum_n p_n \left(\phi_n^+ \frac{\partial^2 \varphi_n^+}{\partial x_0^2} - \phi_n^+ \nabla^2 \varphi_n^+ + \frac{m}{\hbar^2} \phi_n^+ \hat{V} \varphi_n^+ \right) = 0 \tag{3.2b}$$

Combined with equations (3.1), the time fields of quantum dynamics forms a continuous flux of the density equations that raises the thermodynamic horizon, shown as the following integrity of flux equations of density and current in the virtual movements:

$$ic\frac{\partial \rho^+}{\partial x_0} - \nabla \cdot \mathbf{J}^+ = K_s^+(\hat{V}) \qquad K_s^+(\hat{V}) = \frac{mc}{\hbar^2}\left\langle \hat{V}, \phi^+ \right\rangle \Rightarrow 0^+ \tag{3.3}$$

where the scalar K_s^+ is the virtual source of manifold energy producing continuity of dark flax, a virtual object of time energy and momentum in the manifold. Because its symmetric entity is cyclic surrounding a point object: $\hat{V}\phi_n^+ = mc^2\phi_n^+$=$\hat{V}\varphi_n^+ = mc^2\varphi_n^+$, the time field may appear as if its virtual source were not existent, or physically empty: 0^+. The symbol 0^+ means that, although the fluxion may be physically undetectable, its time field rises whenever there is a physical object as its opponent in tangible interactions. This space-dependent flux is the virtual dark movement of energy, giving rise to another twin part of the horizon for bulk dynamics.

IV. CONSERVATION LAW OF DARK FLUXIONS

In summary, the dynamic effects of dark flexions can be statistically derived by the virtual and physical interactions as the continuity equations of fluxions acting as the spacetime energy continuity:

$$ic\frac{\partial \rho^\pm}{\partial x_0} \mp \nabla \cdot \mathbf{J}^\pm = K_s^\pm(\hat{V}) \qquad : x_0 = ict \tag{4.1}$$

where $K_s^\pm(\hat{V})$ are the conservation resources defined by

a. The physical dynamics streamed by its energy state distribution as the sources of ρ^- and $< \hat{V}, \phi^- >$, and

b. The virtual dynamics emerging from its twin as the dark sources of 0^+ if $K_s^+ \to 0$ or 0^- if $K_s^- \to 0$.

The dark fluxions of the physical and virtual resources are essential in sourcing and generating thermodynamics. Particularly, appeared as the dark energy, it is a critical source of the duality arising their next horizons of electromagnetic fields and gravitational fields.

Therefore, the space and time states establish twin fields of manifold dynamics, which appear as the conserved fluxions of density and current rising from the continuous symmetry and antisymmetry of spacetime interactions. The dynamic effects of fluxions can be statistically derived as equilibrium of flux continuity by a duality of the current vectors in the form of covariant tensors:

$$\partial_\mu J_\mu^\pm = -K_s^\pm \qquad : J_\mu^\pm = \left(ic\rho^\pm, \mp\mathbf{J}^\pm\right), \ \partial_\mu \in (\partial/\partial x_0, \nabla) \tag{4.3}$$

For a stabilized environment of density $\rho^-(x_0)$ and potential $< \hat{V}, \phi^- >$ of the system, the physical flux evolutions remain constant and invariant throughout their motions. These equations illustrates the principle that every differentiable symmetry of the action of a physical system has a corresponding conservation law, similar to the ***Noether*** first theorem [4], introduced in 1918.

V. HORIZON FACTOR

During the formation of the second horizon, flux movements of group objects undergo interactions with and are propagated by the time fields, while events of motion objects are characterized by space dynamics. Under the statescope of the first horizon, the flux dynamics of the continuum system aggregates timestate objects to represent thermodynamics with dark energies, statistical works, and interactive forces towards the second horizon of macroscopic variables for processes and operations characterized as a bulk system, associated with the rising temperature.

For a bulk system of N particles, each particle is in one of three possible states: space-like |-⟩, time-like |+⟩, and neutral |o⟩ with the energy of these states given as $E_n^{\pm}$ and E_n^{o}. If the bulk system has $N_n^{\pm}$ particles at non-zero charges and $N^o = N - N_n^{\pm}$ particles at neutral charge, the interruptible internal energy of the system is $E_n = N_n^{\pm} E_n^{\pm}$. The number of states $\Omega(E_n)$ of the total system of energy E_n is the number of ways to pick $N_n^{\pm}$ particles from a total of N,

$$\Omega(E) = \prod \Omega(E_n) = \prod \frac{N!}{N_n^{\pm}!(N - N_n^{\pm})!}, \quad N_n^{\pm} = \frac{E_n}{E_n^{\pm}} \tag{5.1}$$

and the entropy is given by

$$S(E) = -k_B \log \Omega(E) = -k_B \sum_n \log \frac{N!}{(N_n^{\pm})!(N - N_n^{\pm})!} \tag{5.2}$$

where k_B is the ***Boltzmann*** constant [5], introduced in 1877. For large N, there is an accurate approximation to the factorials, $\log(N!) = N \log(N) - N + \frac{1}{2}\log(2\pi N) + \Re(1/N)$, known as Stirling's formula [6]. Hence, the entropy simplifies to:

$$S(N_n^{\pm}) = -k_B N \left[\left(1 - \frac{N_n^{\pm}}{N}\right) \log\left(1 - \frac{N_n^{\pm}}{N}\right) + \frac{N_n^{\pm}}{N} \log\left(\frac{N_n^{\pm}}{N}\right) \right]$$

In general, one of the characteristics for a bulk system can be presented and measured completely by the thermal statistics of energy $k_B T$. In a bulk system with intractable energy of E_n, its temperature rises from its entropy S_n by the following:

$$\frac{1}{T} = \sum_n \frac{\partial S_n}{\partial E_n} = \sum_n \frac{k_B}{E_n^{\pm}} \log\left(\frac{N E_n^{\pm}}{E_n} - 1\right) \tag{5.3}$$

where the index of n is the charged or interruptible particles. Therefore, with the multiple particles of a bulk system of n particles, both of the energy of $E_n(T)$ and state probability p_n are temperature-dependent by the following.

$$E_n = h_n N E_n^{\pm} = \frac{N E_n^{\pm}}{e^{E_n^{\pm}/k_B T} + 1} = k_B T N_n^{\pm} \log\left(\frac{N}{N_n^{\pm}} - 1\right) \tag{5.4}$$

where h_n is the horizon factor that gives rise to and emerges as the temperature T of a bulk system.

During processes that give rise to the bulk horizon, the temperature emerges in the form of energy between zero and $k_B T \simeq E_n^{\pm}$, reproducing the particle n balanced at its population $N_n^{\pm}$. Therefore, the horizon factor is simplified to:

$$h_n = \frac{N_n^{\pm}}{N} = \frac{1}{e^{E_n^{\pm}/k_B T} + 1} \simeq e^{i\beta E_n^{\pm}} \quad : k_B T \in (0, E_n^{\pm}) \tag{5.5}$$

where $\beta = i/(k_B T)$ presents the temperature T as virtual character similar to that at time ict. Fundamental to statistical mechanics, we recall that all accessible energy states are equally likely. This means the probability that the system sits in state |n⟩ is just the ratio of this number of states to the total number of states, emerged and reflected in equation (5.5) as a horizon factor to form the probability of an observable object in equation (1.3):

$$p_n = \frac{h_n}{\sum h_m} = \frac{e^{i\beta E_n}}{Z} \quad : Z \equiv \sum_m e^{i\beta E_m} \tag{5.6}$$

known as the ***Boltzmann*** distribution [7], or the canonical ensemble, introduced in 1877. As $T \rightarrow 0$, the distribution forces the system into its ground state at the lowest energy before transforming to the virtual world. All higher energy states have vanishing probability at zero, the mirroring effects of infinite temperature.

VI. EQUILIBRIUM OF THERMODYNAMICS

For a bulk system with the internal energy shown as above and the intractable energy of E_n, the chemical potential $\mu = -\sum \mu_n$, rises from the following numbers of particles:

$$\mu_n = -\left(\frac{\partial E_n}{\partial N_n^{\pm}}\right)_{S,V} = -\left[E_n^{\pm} - k_B T\left(1 + e^{-E_n^{\pm}/k_B T}\right)\right] \tag{6.1}$$

Its heat capacity can be given by the following definition:

$$C_V \equiv \sum_n \left(\frac{\partial E_n}{\partial T}\right)_{V,N_n^{\pm}} = k_B \sum_n \frac{N\left(E_n^{\pm}\right)^2 e^{E_n^{\pm}/k_B T}}{\left[k_B T\left(e^{E_n^{\pm}/k_B T} + 1\right)\right]^2} \tag{6.2}$$

The maximum heat capacity is around $T \rightarrow E^{\pm}k_B$. As $T \rightarrow 0$, the specific heat exponentially drops to zero. As $T \rightarrow \infty$, the specific heat drops off at a much slower pace defined by the power-law.

Consider a bulk system with entropy $S(E, V, N_n^{\pm})$ that undergoes a small change in energy, volume, and particle number $N_n^{\pm}$. The change in entropy is

$$dS = \frac{\partial S}{\partial E}dE + \frac{\partial S}{\partial E}\frac{\partial E}{\partial V}dV + \frac{\partial S}{\partial E}\sum_n\left(\frac{\partial E}{\partial N_n^{\pm}}dN_n^{\pm}\right) \tag{6.3a}$$

$$dS = \frac{1}{T}\left(dE + PdV - \sum_n \mu_n dN_n^{\pm}\right) \quad : P \equiv \left(\frac{\partial E}{\partial V}\right)_T \tag{6.3b}$$

known as the fundamental thermodynamic laws of thermodynamics of common conjugate variable pairs, developed by ***Rudolf Clausius***, ***William Thomson***, and ***Josiah Willard Gibbs*** [8], introduced during the period from 1850 to 1879.

Furthermore, convert all of the parameters to their respective densities of internal energy $\rho_E = E/V$, thermal entropy $\rho_s = S/V$, mole number $\rho_{n_i} = N_i/V$, state volume $\rho_v = k_v/V$. The equation (6.3) becomes the entropy relationship in terms of their following density:

$$S_v = -k_v \int \rho_v d\Gamma = -k_v \int \frac{d\rho_E - Td\rho_s - \sum_i \mu_i d\rho_{n_i}}{T\rho_s + \sum_i \mu_i \rho_{n_i} - (P + \rho_E)} d\Gamma \tag{6.4}$$

Satisfying a duality of the thermal entropy equilibrium at extrema results in the general density equations of the thermodynamics:

$$d\rho_E^- = Td\rho_s^- + \sum_i \mu_i d\rho_{n_i}^- \tag{6.5}$$

$$P + \rho_E^+ = T\rho_s^+ + \sum_i \mu_i \rho_{n_i}^+ \tag{6.6}$$

The first equation of (6.5) indicates that *Physical Entropy* increases towards maximal physical disorder, so that the dynamics of the internal energy are the interactive fields of thermal entropy and chemical reactions as they influence substance molarity. The second equation (6.6) indicates that *Virtual Entropy* decreases towards minimal physical order, so that both external forces and internal energy hold balanced macroscopic fields in a bulk system.

VII. EQUILIBRIUM OF THERMAL BULK DENSITY

At the second horizon, the operator ∂_ν can be defined with reference to the 4-tuple coordinates given by the thermo-space under the single virtual $y_0 \equiv \beta = i/(k_B T)$ and three real $\mathbf{r} = (y_1, y_2, y_3)$ dimensions, For the density equation under the second horizon, we acquire the following equation of state entropy:

$$S_\rho = \int \rho(\varrho^{\pm}, \partial_\mu \varrho^{\pm}) d\Gamma \quad : \partial_\nu = \left\{\partial/\partial y_0, \nabla\right\} \tag{7.1}$$

where ϱ^- or ϱ^+ are the space or time field of the thermal density at a macroscopic state. Their operators have the following equivalences, respectively:

$$\partial_\beta \varrho^\pm = \mp \frac{\partial}{\partial y_0}\varrho^\pm, \quad \partial_r \varrho^\pm = \nabla \varrho^\pm \qquad : y_0 \equiv \frac{i}{k_B T}, \partial_r \equiv \nabla \tag{7.2}$$

Based on the principle of entropy extrema $\delta S_\psi=0$, we similarly derive a motion equation for virtual thermo-space dimensions:

$$\partial_\mu\left(\frac{\partial \rho}{\partial(\partial_\mu \varrho^\mp)}\right) - \frac{\partial \rho}{\partial \varrho^\mp} = 0 \quad : \partial_\mu = \frac{\partial}{\partial y_\mu}, y_\mu = \left\{y_0, y_1, y_2, y_3\right\} \tag{7.3}$$

During the spacetime transformation, considering $\rho = U_l + U_y - T$, the timestate density $\varrho^- \varrho^+$ incepts temperature evolution in giving rise to the thermal energy density of:

$$T = \left(\frac{\kappa_T}{2}\varrho - h_\beta \frac{\partial \varrho}{\partial y_0}\right) \quad : \varrho = \left(\frac{\partial \varrho^-}{\partial y_0}\varrho^+ - \varrho^- \frac{\partial \varrho^+}{\partial y_0}\right) \tag{7.4}$$

form the internal bulk energy of $V_l = \hat{V}(\beta, \mathbf{r})\varrho^- \varrho^+$ and give rise to the internal potential of energy density of:

$$V_y = (\kappa_y \nabla + \kappa_{y2}\nabla^2 \cdots)\varrho^- \varrho^+ \tag{7.5}$$

where κ_T, κ_y, h_β and κ_2 are the first and second orders of the coefficients. The motion equation of (7.3) derives the following:

$$3h_\beta \frac{\partial^2 \varrho^-}{\partial {y_0}^2} + \kappa_T \frac{\partial \varrho^-}{\partial y_0} + \hat{H}\varrho^- = 0 \quad : \hat{H} \equiv -\kappa_{y2}\nabla^2 + \hat{V}(\mathbf{r}, y_0) \tag{7.6}$$

$$-h_\beta \frac{\partial^2 \varrho^+}{\partial {y_0}^2} - \kappa_{y2}\nabla^2 \varrho^+ + \hat{V}\varrho^+ = 0 \quad \Rightarrow \quad h_\beta \frac{\partial^2}{\partial \beta^2}\varrho^+ = \hat{H}\varrho^+ \tag{7.7}$$

If the second order is ignored, it simplifies the equation (7.6) to:

$$i\frac{\partial}{\partial \beta}\varrho^- = -\hat{H}\varrho^- \quad : \kappa_T = i, \beta = i/(k_B T) \tag{7.8}$$

known as ***Bloch*** density equation [9], introduced in 1932. The formula of equation (7.7) illustrates that the virtual harmonic oscillations produce thermal reactions to maintain the physical thermodynamics of equation (7.8). The thermal operator of $\partial^2/\partial\beta^2$ appears as part of the internal energy that gives rise to the bulk dynamics along with kinetic energy and its horizon constant h_β. As a thermal horizon of dynamic equations for the dual densities, the operator communicates a parametrized relationship of h_β between a quantum state constant of ħ, and a thermal variable of $\beta=i/k_B T$. Therefore, during the thermal and space evolutions, the bulk density of physical dynamics rises from each other's opponent of spacetime fields into macroscopic regime, a result of a continuity duality of dark current fluxions.

VIII. CONCLUSION

The continuum of dark fluxions is philosophically and theoretically presented as the second horizon rising from the first horizon of physical and virtual quantum dynamics. The principles convey the nature *Conservation Law* of *Dark Fluxions*, an essential dynamic formation and duality of the energy flows:

$$ic\frac{\partial \rho^\pm}{\partial x_0} \mp \nabla \cdot \mathbf{J}^\pm = K_s^\pm(\hat{V}) \tag{8.1a}$$

$$K_s^-(\rho^-, \hat{V}) = \frac{2m^*c}{3\hbar^2}\left(< \hat{V}, \phi^- > + i\hbar\rho^-\right) \qquad K_s^+(\hat{V}) = \frac{mc}{\hbar^2}\left\langle \hat{V}, \phi^+ \right\rangle \Rightarrow 0^+ \tag{8.1b}$$

Embedded in the processes that give rise to the bulk horizon, the temperature emerges with the horizon factor, $h_n \simeq e^{i\beta E_n^\pm}$, to form the probability of an object in *Boltzmann* distribution. The entropy of thermodynamic equilibrium derives the duality and balances at its extrema alternately towards maximum in physical formation or decreases towards minimum in virtual annihilation:

$$d\rho_E^- = Td\rho_s^- + \sum_i \mu_i d\rho_{n_i}^- \tag{8.2}$$

$$P + \rho_E^+ = T\rho_s^+ + \sum_i \mu_i \rho_{n_i}^+ \tag{8.3}$$

Finally, the spacetime duality represents the following equations:

$$i\frac{\partial}{\partial\beta}\rho^- = -\hat{H}\rho^-, \qquad h_\beta\frac{\partial^2}{\partial\beta^2}\rho^+ = \hat{H}\rho^+ \tag{8.4}$$

resulting in the bulk-density equilibrium of thermal dynamics.

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