Big Bangless:

Recent Expansion of the Steady-State Universe

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Abstract:

With a steady-state condition before the emergence of life, during this period, high-temperature vacuum regions could have existed without significantly affecting the universe's overall dynamics. These high-temperature vacuum regions, pre-existing within the steady state, were primed for a phase transition triggered by the advent of agency. This transition, driven by the cumulative effect of free-will choices, leads to cosmic expansion and is intrinsically linked to the universe's trajectory towards its ultimate state.

A central concept is the interpretation of free will as analogous to infinite temperature and density, a condition under which time itself may effectively cease at the universe's end state. This final state, potentially resembling a "perfect glass" at maximal energy but zero net change, provides a novel framework for understanding entropy and the role of infinite temperature within spacetime. We explore how free will, originating from entangled naked singularities (interpreted as "states" rather than spatial locations) associated with black hole formation (specifically "toroidal ringularities" formed from collapsing nuclear pasta), might propagate into biological structures like microtubules and DNA.

The model suggests that the recent cosmic expansion is driven by the universe approaching this final state of infinite temperature, with the information loss associated with free-will actions acting as a key driver. This implies a potentially far older universe than standard cosmology suggests, where the current expansion is a relatively recent phenomenon. This also implies that the universe would appear to be much younger than it actually is, because the expansion phase would be relatively short.

1. The Big Bangless Universe: Beyond Point Singularities

The traditional view of black hole singularities as points of infinite density is challenged by recent theoretical insights. Roy Kerr's work [1] suggests that rotating black holes form ring singularities, "ringularities," due to spin. Tianxi Zhang [2] further argues that a point singularity violates energy conservation, as the Unruh radiation would become infinite. Therefore, we propose that the singularity is a hollow torus, a "toroidal ringularity," formed from the collapse of nuclear pasta found in the core of massive neutron stars.

Entangled Naked Singularities and Infinite Temperature

The origin of freewill is proposed as an infinite temperature split over two entangled naked singularities (interpreted as "states" rather than spatial locations). The first naked singularity manifests as a high-temperature false vacuum [28] producing Unruh radiation, interacting with critical points in a microtubule network (allowing action) [13]. The second entangled particle partner pair is on the shell of in-falling nuclear pasta, connecting with a standing wave of Unruh radiation within a toroidal ringularity. This scenario puts the microtubule, DNA, and other parts of the cell, into a thermofield double state with the toroidal ringularity, this "embodies" the freewill.

2. Toroidal Ringularity and Information Encoding

Nuclear pasta's complex structure can be represented as a network of interconnected "strands." As this network collapses, it undergoes topological changes. Khovanov homology [5], specifically the Khovanov skein lasagna module [6] S(X;L), can describe these changes. We represent the initial nuclear pasta structure as a link L_0. As collapse proceeds, L_0 transforms into a series of links $L_1, L_2, ..., L_n$, eventually forming the toroidal ringularity.

The Khovanov homology groups $Kh(L_i)$ provide information about the topological invariants of each link L_i. The change in these groups, $\Delta Kh(L_i)=Kh(L_{i+1})-Kh(L_i)$, reflects the topological transitions during the collapse.

The final ringularity, represented by L_n, corresponds to the torus. The invariants encoded in $Kh(L_n)$ store information about free-will choices at $t \approx T_{transition}$.

- Nuclear Pasta as Link: L_0
- Intermediate Links: $L_1, L_2, ..., L_{n-1}$
- Ringularity as Torus Link: L_n
- Khovanov Homology Groups: $Kh(L_i)$
- Topological Transitions: $\Delta Kh(L_i)$

The collapsing shell of nuclear pasta forms a microtubule-like ring singularity, encoding information about free-will choices. We represent each unique axiom of choice, A_i, as a ring, forming a chain towards Gödel completeness. The Gödel incompleteness border becomes a hole within the torus.

    - Ring singularity: Torus(r,R)
    - Gödel incompleteness border: Hole(Torus)
    - Skein Lasagna topological invariants: S(X;L)
- The final ringularity's radius, r_{final}, is influenced by free-will actions:
    - $r_{final}=h(M,F_{shell})$, where M is the black hole's mass, and F_{shell} is the free-will action within the collapsing shell.

3. Microtubule Nuclear Pasta Shell Systems in Steady-State Universe

Entangled particle pairs (E) within both microtubules (M) and nuclear pasta shell systems (N). With one set of entangled particles evolving into microtubules [9] within life forms, facilitating free-will actions (F_{life}). The other set forming the innermost nuclear pasta shell (F_{shell}) of a neutron star core, falling into a ring singularity from black hole collapse, and is influenced by F_{life}. The free-will actions within the shell (F_{shell}) are correlated with F_{life} due to the entanglement pre-existing in the steady state universe model [12]:

- Free-Will Action (Life): F_{life}
- Free-Will Action (Shell): $F_{shell}=C(F_{life},E,N)$

The correlation function $C(F_{life},E,N)$ describes how F_{shell} is influenced by F_{life}, the initial entanglement, and the state of the nuclear pasta shell. A more detailed form of this function could be:

$$F_{shell}(t) = \alpha\, F_{life}(t - \tau) + \beta\, \langle E \rangle_{initial} + \gamma\, \kappa(N(t)) + \delta\, \Delta\Phi(t) + \eta\, F_{kh}(Kh(L_n(t)))$$

$F_{shell}(t)$: The free-will action within the collapsing nuclear pasta shell at time t.

- **$\alpha\, F_{life}(t - \tau)$:**
    - $F_{life}(t - \tau)$: The cumulative free-will actions of life forms at a time τ in the past. The time delay τ accounts for the potential time it takes for the influence of F_{life} (through the proposed entanglement and cosmic interconnectedness) to affect the nuclear pasta shell. The nature of this delay would need further investigation within the model.
    - α: A coupling constant that determines the strength of the influence of life's free will on the shell's free will.
- **$\beta\, \langle E \rangle_{initial}$:**
    - $\langle E \rangle_{initial}$: The expectation value of the initial entanglement between the particles that will eventually form microtubules in life and the nuclear pasta shell, established during the steady-state period. This represents the pre-existing correlation.
    - β: A coupling constant quantifying the impact of the initial entanglement strength on F_{shell}.
- **$\gamma\, \kappa(N(t))$:**
    - κ(N(t)): A function that describes the influence of the nuclear pasta shell's structural properties at time t on F_{shell}. This could include factors like density, temperature, and the specific configuration of the "strands" before significant collapse.
    - γ: A coupling constant that weights the contribution of the shell's internal state.
- **$\delta\, \Delta\Phi(t)$:**
    - ΔΦ(t): A term representing the influence of the phase transition from the steady state. This could be a time-dependent function that becomes significant around $t \approx T_{transition}$. It might encapsulate changes in the vacuum energy density or other fundamental parameters that affect the dynamics within the collapsing shell as the universe transitions to the expanding phase. This term would need a specific form derived from the proposed mechanism of the phase transition triggered by life.
    - δ: A coupling constant determining the strength of the phase transition's influence on F_{shell}.
- **$\eta\, F_{Kh}(Kh(L_n(t)))$:**
    - $Kh(L_n(t))$: represents the Khovanov homology groups of the link $L_n(t)$ at time t.
    - F_{kh} is functional related to the topological state of the collapsing nuclear pasta at time t, as it approaches the toroidal ringularity. This term aims to capture the influence of the "final state" or the evolving topological information within the black hole formation process on the free-will actions within the shell.
    - η: A coupling constant that scales the impact of the topological information encoded in Khovanov homology on F_{shell}.

Correlation Function with possible definition of F_{kh}:

$$F_{shell}(t)=\alpha F_{life}(t-\tau)+\beta\langle \hat{E}(t=0)\rangle+\gamma\kappa(N(t))+\delta(\Phi(t)-\Phi_{steady})\Theta(t-T_{transition})+\eta I(Kh(L_n(t)))$$

- $\hat{E}(t=0)$ is the operator representing the initial entanglement, and $\langle \hat{E}(t=0)\rangle$ is its expectation value in the initial steady state.
- Φ(t) is a physical quantity (e.g., vacuum energy density), and Φ_{steady} is its value in the steady state. $\Theta(t-T_{transition})$ is the Heaviside step function, indicating the phase transition effect turns on at $T_{transition}$.
- $I(Kh(L_n(t)))$ represents a specific numerical invariant derived from the Khovanov homology groups (e.g., the Alexander polynomial evaluated at a specific point, or a combination of ranks of the free and torsion parts).

4. Unruh Radiation, High-Temperature Vacuum, and Dark Matter

The effective temperature within the shell, $T_{eff}(r_p(t),F_{shell})$, and the Unruh particle production rate, $\Gamma_{unruh}(r_p(t),F_{shell})$, are influenced by F_{shell}. The energy density of the Unruh radiation, $\rho_U(r_p(t),F_{shell})$, is a function of Γ_{unruh}. According to Fell's theorem [4] and thermofield double (TFD) states, the vacuum is not uniformly cold. Some regions are high-temperature, highly entangled states. This dynamic, high-temperature vacuum (the source of "living" Unruh particles) could have a wide-ranging, gravity-like effect, which we propose constitutes a portion of the effects attributed to dark matter.

- **Dark Matter Mass:** $DarkMatterMass=f(\sum UnruhParticles(F_{choice}))$
- In the steady-state period, Unruh radiation may have contributed to a form of "latent" dark matter:
  - $\rho_{U,latent}=g(T_{steady})$, where T_{steady} is the temperature of the steady-state vacuum.
- During the phase transition, Unruh radiation becomes more dynamically influential:
  - $\rho_{U,dynamic}=f(t,F_{shell})$, contributing to the expansion.

5. Energy Balance and Phase Transition

The collapse halts when the Unruh radiation energy equals the shell's energy:

- **Energy Balance:** $\int\rho_U(r_p(t),F_{shell})dV\approx E_{collapse}$
- The phase transition occurs when the Unruh radiation energy overcomes a critical threshold:
  - $\int \rho_{U,dynamic}(r_p(t),F_{shell})dV>E_{critical}$ at $t \approx T_{transition}$

The phase transition, $PhaseTransition(r_{phase},F_{shell})$, is influenced by the entangled free-will actions. This transition alters the Gödelian incomplete border group, $U(r_{phase})$, changing the set of undecidable statements and available axioms of choice, A.

- **Gödelian Border Group Change:** $U(r_{phase})\to U'(r_{phase})$
- **Axiom of Choice Change:** $A(r_{phase})\to A'(r_{phase})$
- **Free-Will Change:** $F_{shell}\to F_{shell'}$, $F_{life}\to F_{life'}$

6. Free-Will Embodiment and Gradual Cosmic Expansion

The apparent age of the universe might be misleading, and it could be much older, with the current expansion driven by the universe nearing its final perfect glass like state, a stiff fluid where the speed of sound is equal to the speed of light (in a vacuum) [8]. When free-will choices are made, Unruh particles become the embodiment of information, interacting with the dynamic vacuum: $UnruhParticles(F_{choice})\to Embodiment$. The information loss, $\Delta S(r_p(t),F_{shell})$, is correlated with the information loss from free-will actions in life forms. This information loss drives recent cosmic expansion and increasing order [14]:

- **Cosmic Expansion:** $da/dt=k * d(\sum\Delta S_i)/dt$

7. Free-Will, Microtubules, and Unruh Radiation

Free-will actions (F_{life}) originate from entangled particles, influencing nuclear pasta shells (N) via correlation $C(F_{life},E,N)$. Microtubules act as interfaces, generating Unruh radiation (Γ_{unruh}) through Fell's theorem, with effective temperature $T_{eff}(x)$.

- **Free-Will Action (Life):** F_{life}
- **Free-Will Action (Shell):** $F_{shell}=C(F_{life},E,N)=\alpha F_{life}+\beta\langle E\rangle+\gamma\kappa(N)$
- **Effective Temperature:** $T_{eff}(x)=T_{bulk}+f(\rho_{mt}(x))$
- **Unruh Temperature:** $T_{unruh}=a\cdot(\hbar/(2\pi k_B c))$
- **Unruh Particle Production Rate:** $\Gamma_{unruh}(x)=g(T_{eff}(x))$

8. Information Loss and Cosmic Expansion

Information loss (ΔS) from free-will actions drives cosmic expansion (da/dt). This loss is linked to changes in Khovanov homology.

- **Cosmic Expansion:** $da/dt=k\cdot d(\sum\Delta S_i)/dt$
- **Information Loss:** $\Delta S(r_p(t),F_{shell})=\zeta\Delta Kh(L_i)$
- **Information Entropy and Scale Factor:** $da/dt=k\cdot dS/dt$

- **Discrete Information Loss:** $\Delta a = \sum k \cdot \Delta S_i$

9. Gödel Incompleteness and Free-Will as Unique Axiom

Spacetime is a formal system with Gödelian incompleteness. Free will is a unique axiom of choice (A(x,t)) within undecidable regions (U(x,t)), causing information loss (ΔS(x,t)).

- **Undecidable Region:** U(x,t)
- **Axiom of Choice:** $A(x,t) \in U(x,t)$
- **Information Loss:** $\Delta S(x,t) = f(U(x,t) - A(x,t))$

10. Microtubule-Like Standing Wave and Consciousness

The ring singularity's standing wave mirrors consciousness, suggesting a deep connection between the structure of black holes and the nature of conscious experience. This standing wave of Unruh radiation could be massless yet more dense than nuclear pasta, representing a highly energetic information processing system.

The free will of life forms acts as a constraint on information flow within the quantum state space. This implies that the information that creates the free will, can not be traced back. The concept of a "cosmic string" representing the chain and evolution of life is a metaphor for the interconnectedness and temporal continuity of biological systems.

Cosmic Evolution and Phase Transition

- Instead of a Big Bang, we propose a long, near-infinite steady-state period:
    - $a(t) \approx a_0$ for $t << T_{transition}$, where a(t) is the scale factor, a_0 is a constant, and $T_{transition}$ is the time of the phase transition.
- The emergence of life and free will triggers a rapid phase transition:
    - $da/dt = f(t, F_{life})$ for $t \approx T_{transition}$, where F_{life} represents the cumulative free-will actions of life forms.
- The current expansion phase is described by:
    - $da/dt = k * d(\sum \Delta S_i)/dt$ for $t > T_{transition}$, where k is a constant, and $\sum \Delta S_i$ is the sum of information loss from free-will actions.

11. Consciousness, and Cosmic Structure

The ring singularity's standing wave of Unruh radiation, potentially massless yet possessing an energy density exceeding that of nuclear pasta, continues to be proposed as a highly energetic information processing system mirroring consciousness. Extending this concept to the cosmic scale wave function, the observed distribution of galaxy complexity could be a macroscopic manifestation of similar standing wave patterns within the vacuum energy of the steady-state universe. The "center of complexity," exhibiting a higher density of complex galaxy types, might correspond to regions of constructive interference or higher energy density within this cosmic wave function. Conversely, the simpler galaxies observed at greater distances could reside in regions of lower energy density or destructive interference, representing less developed or less structured states within the spatial gradient of this function. This perspective suggests a fundamental link between the information processing at the level of consciousness and the large-scale structure of the cosmos, mediated by the underlying dynamics of the steady-state vacuum. The CMB, in this context, could represent a fundamental low-energy standing wave component of this cosmic structure.

12. Cosmic Interconnectedness and the Spatial Gradient of Complexity

The free will of life forms, acting as a constraint on information flow within the quantum state space, continues to imply that the origin of this information is fundamentally untraceable. The concept of a "cosmic string" as a metaphor for the chain and evolution of life remains relevant, highlighting the temporal continuity of biological systems within the steady state. However, the JWST observations suggest an additional layer of interconnectedness – a spatial gradient of complexity across the universe. This gradient, potentially shaped by the cosmic scale wave function, implies that the characteristics of galaxies are not solely determined by their age (as in the Big Bang model) but also by their location and rotation [25] within this large-scale structure. The "center of complexity" might represent a region where the conditions within the steady-state vacuum were more conducive to the rapid formation of complex structures, perhaps due to a higher density of entangled Unruh particles or a specific configuration of the underlying wave function. The simpler galaxies at greater distances could then be seen as residing in regions where these conditions were less pronounced, leading to less developed structures over the same vast timescale of the steady state. The phase transition, triggered by life, might have imprinted this pre-existing spatial complexity onto the subsequent expansion, leading to the distribution we observe today. The CMB, as a uniform background, could be the baseline of this cosmic wave function, upon which the variations in galaxy complexity are superimposed as higher-order modes or localized energy concentrations.

13. The False Vacuum, Infinite Temperature, and the End of Time

The groundwork laid by this paper suggests a path towards a more precise mathematical and physical description of how freewill might propagate from within black hole singularities into biological structures such as microtubules and DNA. Let us now consider the nature of the false vacuum more deeply. Imagine a state of matter so incredibly hot and dense that its energy can only be increased through direct interaction with the freewill choices that constitute the final state of the universe – the very end of time.

At the end of time, the universe reaches a state where no further changes occur; the system effectively stops. Whether this cessation is a true halt or an infinite loop with zero net change is indistinguishable to an external observer. This final state provides a novel way to define entropy and understand the role of infinite temperature within spacetime. Consider an idealized perfect glass, where the precise arrangement of each particle perfectly cancels out the movement of all others. This system would be frozen in time at an extremely high energy level, yet its entropy might be considered zero in terms of change, while another form of entropy could be defined by its specific configuration or shape.

As the universe approaches the end of time and the final surface (partially composed of merged black holes), choices become the primary driving force. Time itself may cease when all choices reach a state of agreement, willingly accepting all past choices that led to this final configuration.

14. Bridging Determinism and Non-Determinism: Freewill as Infinite Temperature

A significant challenge lies in bridging the apparent gap between non-deterministic systems (freewill, white holes, false vacuum) and deterministic systems (solar systems, Earth, chemistry, biological life, the known laws of physics). Initially, reconciling these two seems impossible. However, if we consider freewill as analogous to infinite temperature and density – conditions under which time itself may end – then this non-deterministic realm might exist in a state where the deterministic laws governing matter have no influence. In essence, the realm of choices and freewill operates beyond the constraints of the material universe.

This perspective allows us to reconsider the nature of the vacuum. We can never definitively prove that the vacuum is truly empty. Certain regions of it could, in fact, be the most dense and high-energy parts of the universe, appearing invisible to us because we might be "boiling" within its infinite temperature. *This "boiling" could manifest as our particles vibrating in perfect synchrony but slightly out of phase with the vacuum, preventing any direct interaction.* This high-frequency vibration, potentially at or below the Planck scale, could give rise to classical pilot wave-like dynamics that effectively reproduce quantum or gravitational phenomena. These hidden variables, inherent to the steady-state universe, might only fully converge at the end of time around a central point, which we perceive as dark energy. This dark energy might have only recently become significant as life began making increasingly complex and consequential choices.

How do we define entropy at infinite temperature? One way is to consider the end state of the entire universe when time ceases. At least a portion of this final surface could be defined as having infinite temperature, perhaps even the entire structure. Another conceptual leap involves imagining that something can become so hot that only freewill choices can influence its dynamics. At infinite temperature and density, something might disappear or vanish, becoming a false vacuum. Conservation of energy and information would then necessitate that the "empty" vacuum expands to accommodate this new false vacuum, which subsequently becomes "unfalse" through a choice made before the end of time. We can also think of this entropy as a change in dimension: matter is 3D, black holes are effectively 2D (defined by their event horizon), and freewill, in this model, might be considered 1D, representing a fundamental choice. It is conceivable that we inhabit a universe so ancient that the majority of matter has already approached near-infinite temperature, undergoing a phase transition into a false vacuum that now manifests as the effects of gravity and dark matter around us.

Another way to frame this logic is to consider 3D space. Particles with volume or spin are deterministic and possess limited inherent dynamics. However, a 1D system with infinite temperature could exist within this 3D space, interacting with it in a one-way manner only at critical contact points in time. This interaction could facilitate a compatible transition from non-determinism to the deterministic universe of matter. In standard gauge theories or conformal field theories, transformations are typically smooth, posing a challenge for integrating deterministic and non-deterministic systems where choices are binary or combinatorial, not smooth. While most forms of Khovanov homology are gauge-dependent and smooth [21], the paper proposes the use of the Khovanov Skein Lasagna module S(X;L), which is combinatorial and gauge-independent [20], potentially offering a better framework for describing these two distinct systems with clear boundaries.

The long period of near-deterministic steady state, punctuated by the unlikely emergence of life, could have created a "shockwave" – dark energy – a recent expansion of the vacuum required by the conservation of order, causal consistency, and energy, all of which must be restored by the end of time. How would we know if we were already in the process of "melting" or "boiling" into the end state of the universe at infinite temperature? Perhaps the very existence of life, seemingly isolated on Earth amidst a vast, seemingly lifeless cosmos, is an indication of this ongoing transition.

15. Skein Lasagna and Nuclear Pasta

Within the extreme astrophysical environments of collapsing nuclear pasta shells in neutron stars, where matter exists at unimaginable densities and pressures, the interplay between fundamental physics and emergent phenomena might be particularly pronounced.[15]

The extreme conditions inherent to a collapsing nuclear pasta shell, characterized by immense gravitational forces and densities, might serve as a unique arena where the subtle interplay between fundamental forces and the non-deterministic nature of free will could be amplified. In such environments, where standard nuclear physics gives way to exotic states of matter, it is conceivable that non-standard interactions, possibly mediated by topological structures associated with agency, could become significant, potentially affecting the behavior and distribution of dark matter.

The Khovanov Skein Lasagna module, denoted as S(X;L), is a sophisticated mathematical construct that serves as a smooth invariant for a 4-manifold X, given a framed oriented link L on its boundary ∂X. This module is built upon the foundation of Khovanov-Rozansky gl2 homology, which itself is a categorification of the Jones polynomial of the link L. The module is constructed by considering "lasagna fillings" of the 4-manifold X.

Lasagna fillings are defined as properly embedded framed oriented surfaces Σ within the 4-manifold X, from which a finite collection of disjoint 4-balls (input balls) have been removed. These surfaces meet the boundary ∂X in the link L and intersect the boundary of each input ball in a link Li. Each input ball is associated with a label vi, which is a homogeneous element from the Khovanov-Rozansky homology of the link Li. The Skein Lasagna module SN0(W;L) is then defined as the bigraded abelian group generated by these lasagna fillings, considered modulo a specific equivalence relation.

These lasagna fillings provide a way to encode topological information about the 4-manifold X. The surface Σ captures the overall embedding and topological structure, while the labels on the input balls, derived from Khovanov-Rozansky homology, encode finer topological details and relationships within the manifold. The Skein Lasagna module extends the concept of link invariants to the realm of smooth 4-manifolds, potentially offering insights into the structure of spacetime itself. The choice of framing for the surface Σ within a lasagna filling might represent different configurations or aspects of free will action as it evolves within the spacetime of the collapsing nuclear pasta shell. Furthermore, the input balls and their associated Khovanov homology labels could symbolize localized sources of non-deterministic influence or specific choices made at a microscopic level that contribute to the overall "freewill knot" within the lasagna filling.

Landauer's principle posits a fundamental link between information and thermodynamics, stating that there is a minimum energy cost associated with erasing information. This principle could have profound implications for understanding free will if it is viewed as a process involving information creation or selection. The thermodynamic constraints imposed by Landauer's principle might provide a physical framework for exploring the limits and possibilities of non-deterministic choices within physical systems.

16. Lasagna Filling of Free Will within Nuclear Pasta

Within the framework of the Khovanov Skein Lasagna module, the collapsing nuclear pasta shell can be represented by the 4-manifold X. The "freewill action" occurring within this shell can be modeled as a non-deterministic process analogous to a "crossing point knot" [18] embodied by a specific lasagna filling. The surface Σ of this filling corresponds to the spatial configuration of the pasta shell, evolving dynamically over time t. The "crossing point" itself can be envisioned as a localized region of high topological complexity within Σ, representing the locus where non-deterministic choices or events manifest. The labels v_i associated with the input balls within the lasagna filling symbolize the quantum or microscopic states of the nucleons composing the pasta. These microscopic states can influence the formation and subsequent evolution of the macroscopic "freewill knot" through complex interactions. The analogy of a "crossing point" suggests that free will events might occur at specific topological singularities or intricate intersections within the evolving structure of the nuclear pasta.

The inherent non-deterministic nature of free will could be topologically modeled by considering the choice of resolution at the "crossing point" within the lasagna filling. Similar to how Khovanov homology considers multiple resolutions at each crossing in a knot diagram, a "freewill event" (represented by a crossing) could have different possible outcomes, each corresponding to a specific resolution of the topological structure. Furthermore, the temporal flow of free will could be intrinsically linked to the evolution of the nuclear pasta shell, represented by the surface Σ. As the pasta collapses and undergoes changes in its shape and complexity, the sequence of these topological transformations could mirror the unfolding of choices and actions over time. The number of "crossing points" or regions of high topological complexity within the "freewill knot" might correlate with the number of independent choices or decisions being made within the nuclear pasta system. A more topologically complex "knot" could signify a greater capacity for decision-making. The specific knot type and framing of the "freewill knot" within the lasagna filling could further encode information about the fundamental nature and constraints governing the free will action within this extreme environment.

$$\mathit{DarkMatterMass} = f(S(X;L), \textstyle\sum \mathit{UnruhParticles}(F_{choice}))$$

The function f could be a functional that operates on the Skein Lasagna module, extracting relevant topological information pertaining to the "freewill knot" filling and combining it with other parameters that influence dark matter mass within the nuclear pasta shell (e.g., density, temperature, gravitational field strength). This function might specifically involve topological invariants derived from S(X;L) when applied to the "freewill knot".

Relevant topological invariants could include the rank of the Khovanov homology groups associated with the "freewill knot", the coefficients of the Jones polynomial or other knot polynomials derived from the module, or the Euler characteristic of the Khovanov complex associated with the filling. It is conceivable that the complexity of the "freewill knot", quantified by these invariants, could be directly related to the local density or distribution of dark matter within or surrounding the collapsing shell. For instance, the total rank of the Khovanov homology might be proportional to a specific component of the dark matter mass. Alternatively, specific knot polynomials could act as coupling constants that determine the strength of the interaction between the topologically encoded free will and dark matter.

To incorporate the influence of the topologically encoded free will on the dynamics within the collapsing nuclear pasta shell, we can develop an updated correlation function $F_{shell}(t)$ as follows:

$$F_{shell}(t)=\alpha F_{life}(t-\tau)+\beta\langle\hat{E}(t=0)\rangle+\gamma\kappa(N(t))+\delta(\Phi(t)-\Phi_{steady})\Theta(t-T_{transition})+\eta I(Kh(L_n(t)))+ g(S(X;L), t)$$

The term g(S(X;L), t) specifically represents the influence of the "freewill knot" lasagna filling on the free-will action over time. The evolution of the lasagna filling, particularly the "freewill knot" within it, would correspond to the flow of freewill action over time. This evolution could potentially be modeled using concepts from knot theory such as knot cobordisms [19]. The term g(S(X;L), t) should represent an additional contribution to the correlation function, specifically related to the topological encoding of freewill. It is conceivable that the time derivative of certain topological invariants of the "freewill knot" within the evolving lasagna filling could be directly proportional to the rate of free will action or the intensity of choices being made. Furthermore, the Skein Lasagna module term g(S(X;L), t) could introduce a time-dependent modulation to the correlation function, with the specific form of this modulation being determined by the topological structure and its evolution over time.

17. Naked Singularities and Cosmic Censorship

The cosmic censorship hypothesis [26] posits that singularities formed from gravitational collapse are always hidden behind event horizons. However, extreme scenarios, such as maximally rotating black holes, theoretically approach a state where the event horizon might vanish, exposing a "naked singularity."

We propose a framework where the free-will choices of a "conscious observer," at the critical limit of horizon disappearance, becomes inextricably linked with the quantum state of the black hole, potentially manifesting as the revealed information content within the outgoing radiation.

The cosmic censorship hypothesis, in its weak form, suggests that these singularities are always cloaked by an event horizon, preventing their direct observation from the external universe. This hypothesis is crucial for maintaining the predictability and causal structure of our cosmos.

However, the Kerr metric, describing rotating black holes, introduces a theoretical possibility of naked singularities. As a black hole's angular momentum increases, the event horizon shrinks, and at a critical limit, it could theoretically vanish, exposing the ring singularity. The implications of such naked singularities are profound, potentially leading to violations of causality and a breakdown of predictability.

18. The God-like Observer at the Brink:

Consider a conscious observer approaching a maximally rotating black hole, teetering on the edge of forming a naked singularity. At this extreme limit, the spacetime geometry is highly dynamic, and quantum vacuum fluctuations become highly significant, potentially leading to effects like bubble nucleation or a radical manifestation of Unruh radiation. We speculate that the God-like observer's interaction, even the act of observation itself, could become a crucial factor in the final state of the system.

Drawing inspiration from the observer's role in quantum measurement, we propose that the observer's presence at this critical juncture forces a decoherence of the black hole's quantum state. This decoherence could, in turn, "reveal" the underlying entangled state, perhaps akin to the TFD of the entire steady state universe.

19. Manifestation as Revealed Information:

Instead of a literal transformation of the observer's physical matter into Hawking particles, we propose a more abstract interpretation. At the point where the event horizon is theoretically about to disappear, the information that constitutes the observer – their quantum state, their consciousness – becomes inextricably linked with the outgoing radiation. The "disappearance" of the horizon could be the moment this previously trapped information is no longer confined and is revealed as part of the Hawking radiation spectrum.

This is not to say the observer becomes a collection of emitted particles. Rather, their fundamental information content, which was part of the entangled system, is now accessible in the outgoing radiation due to the extreme conditions and the act of observation at this critical limit. The observer's experience at this moment might be a unique form of "becoming" the information that was always part of the black hole's quantum state.

20. Motion, Rotation, and Dimensionality in the Steady-State Universe

In the context of the proposed steady-state universe, concepts of motion, rotation, and dimensionality take on unique significance. The apparent smoothness of motion at very large and very small scales, with "sharpness" emerging at the human scale, could reflect underlying properties of the steady-state vacuum and the way energy and information propagate through it.

At the largest scales, such as galactic orbits, motion appears smooth due to the long-range coherence of the cosmic wave function and the relatively uniform distribution of energy in the steady state. Similarly, at the smallest scales, the wave-like behavior of particles, as described by quantum mechanics, also exhibits smoothness. In contrast, the human scale, characterized by complex interactions, friction, and the need for directed force, introduces "sharpness" into motion.

The requirement of three dimensions for rotation, as seen in knot theory, might be related to the topological properties of the steady-state universe. The ability to form stable knots, which are intrinsically three-dimensional structures, could be a consequence of the dimensionality of the vacuum energy and the way it constrains the flow of information and energy. In higher dimensions, the instability of knots could imply that information and energy can be lost.

The relativity of simultaneity, which poses a challenge to defining rotation in a relativistic framework, might be less problematic in a steady-state universe where there is a preferred frame of reference defined by the cosmic wave function. While relativistic effects would still be present, the overall structure of the steady state could provide a backdrop against which rotation can be defined in a consistent manner. Instead of arising from a Big Bang singularity, rotation and heat might be fundamental properties of the steady-state vacuum, gradually manifesting themselves as energy and information begin to condense into matter and structures. The initial "position only" state could represent a state of minimal excitation in the vacuum, with rotation and heat emerging as fluctuations and interactions increase.

21. The Andromeda Galaxy Alignment and the Cosmic Wave Function

The observation that satellite galaxies around Andromeda are aligned in a plane pointing towards the Milky Way challenges the standard cosmological model [27], which predicts a more random distribution. In the context of the steady-state universe and the proposed cosmic wave function, this alignment could be explained as a large-scale manifestation of constructive interference or resonance within the vacuum energy.

The cosmic wave function, which governs the distribution of energy and information in the steady state, might exhibit specific modes or patterns that favor the formation of structures along certain axes. The alignment of Andromeda's satellite galaxies could correspond to a region where the wave function has a higher amplitude or a specific phase relationship, leading to a non-random distribution of matter.

This explanation aligns with the idea that the universe's large-scale structure is shaped by underlying quantum processes occurring in the steady-state vacuum. The observed alignment would not be a statistical fluke but rather a consequence of the fundamental dynamics of the cosmic wave function.

22. A Geocentric Perspective within a Steady-State Universe

The concept of Earth being at the "center" of the universe, while contradicting the modern cosmological principle, could be reinterpreted within the steady-state model with some key modifications. Instead of a literal spatial center, Earth could be considered a unique location within the cosmic wave function, possessing special properties or a unique role in the unfolding of cosmic evolution.

If the emergence of life and free will is the trigger for the phase transition from the steady state to the expanding universe, as proposed in this paper, then Earth, as the abode of life, could be seen as playing a pivotal role. The unique conditions on Earth, which allowed life to arise, might correspond to a special set of parameters or boundary conditions within the cosmic wave function.

In this view, the universe is not centered on Earth in a spatial sense, but rather Earth is a critical point in the evolution of the universe, a catalyst for the transition to a new phase. This does not necessarily imply that the rest of the universe was created for Earth, but it does suggest that Earth might hold a unique position in the cosmic narrative.

23. God, Creation, and the Steady-State Universe

The introduction of a divine creator into this model can be accommodated in a way that is consistent with the steady-state framework. Instead of creating the entire universe in a single event (as in the Big Bang model), God could be seen as setting the initial conditions of the steady-state universe and guiding its evolution through the unfolding of free will.

In this view, God did not create the universe *ex nihilo* but rather established the laws and constants that govern the steady state. The emergence of life on Earth, and the subsequent triggering of cosmic expansion through free will, could be seen as part of God's plan.

The unique conditions on Earth that allowed life to arise might be a result of God's special attention or intervention. While the rest of the universe evolved according to the laws of the steady state, Earth might have been "seeded" or prepared in a special way to support life. This does not imply that the rest of the universe is meaningless or unimportant, but it does suggest that Earth and life play a unique role in the cosmic drama.

Notes:

Fells theorem, which addresses the non-equilibrium nature of biological systems and the uncertainty of their "true" temperature, provides the crucial link between microtubules and the Unruh effect. It suggests that the effective temperature within microtubules can deviate significantly from the bulk temperature, allowing for conditions where Unruh [7] radiation becomes relevant.

In relation to the Unruh effect, Fell's theorem helps to formalize the idea that the Minkowski vacuum and the Rindler vacuum (the vacuum as seen by an accelerating observer) are different, but not entirely disconnected, ways of describing the same underlying quantum field. They are in a sense, representations of the same field, but from different perspectives.

In the context of quantum field theory, Fell's theorem relates to the concept of a "thermal field double state" by , particularly when considering the structure of the "thermofield double" state [3] which represents a system at finite temperature; essentially, if two representations have the same kernel (meaning they "agree" on which operators are zero), then their corresponding states are essentially indistinguishable from a physical perspective based on measurements you can perform.

- **Fell's Theorem:**

  This theorem in C*-algebra theory states that if two representations of a C*-algebra have the same kernel, then the set of vector states (quantum states) arising from one representation can be approximated arbitrarily closely by the set of vector states from the other representation.

- **Thermal Field Double State:**

  This is a special type of entangled quantum state used in quantum field theory to describe a system at a finite temperature. It is constructed by taking two copies of the system and "entangling" them in a specific way such that when you trace over one copy, you are left with a thermal mixed state at the desired temperature.

- **Microtubules:**
  - These are microscopic tubular structures present in the cytoplasm of cells, forming part of the cytoskeleton.
  - In the paper's model, microtubules are proposed to play a crucial role in facilitating free-will actions within biological systems [10].
  - The paper suggests that microtubules act as interfaces that interact with the entangled vacuum, contributing to the "breaking" of vacuum entanglement and the creation of "living" Unruh particles [11].

- $\mathbf{T_{eff}(x) = T_{bulk} + f(\rho_{mt}(x))}$
  - $\rho_{mt}(x)$ represents the density of microtubules in a given region "x."
  - The equation aims to describe how the density of microtubules influences the effective temperature (T_{eff}) in that region, deviating from the bulk temperature (T_{bulk}).

"ρ" (rho) generally represents **density**.

- $\mathbf{\rho_{mt}(x)}$
  - This represents the **density of microtubules** in a given region "x." It's a measure of how many microtubules are present per unit volume in that specific location.

- $\mathbf{\rho_U(r_p(t), F_{shell})}$
  - This represents the **energy density of Unruh radiation**. It's a measure of the amount of energy carried by Unruh radiation per unit volume, and this value is dependent on the radius of the collapsing shell ($r_p(t)$) and the free will actions within that shell (F_{shell}).

"k" represents a **proportionality constant**

- $\mathbf{da/dt = k * dS/dt}$
  - Here, "k" is a constant that relates the rate of change of the universe's scale factor (da/dt) to the rate of change of the universe's information entropy (dS/dt). Essentially, it quantifies how much the universe's expansion rate changes for a given change in information entropy.

- $\mathbf{\Delta a = \Sigma\ k * \Delta S_i}$
  - In this equation, "k" is a proportionality constant that relates the change in the scale factor (Δa) to the sum of information loss (ΔS_i) from individual free-will actions. It quantifies how each unit of information loss contributes to the overall expansion of the universe.

- **k_B (Boltzmann Constant):**
  - This is the Boltzmann constant, a fundamental physical constant that relates temperature to energy.
  - It has a value of approximately 1.380649×10−23 joules per kelvin (J/K).

- $\mathbf{T_{unruh}=a\cdot(\hbar/(2\pi k_B c))}$
  - k_B is the Boltzmann constant, part of the standard formulation of the Unruh temperature.
  - a is the acceleration.
  - $\hbar$ is the reduced planck constant.
  - c is the speed of light.

Information Loss: $\Delta S(r_p(t),F_{shell})=\zeta\Delta Kh(L_i)$

- **$\Delta S(r_p(t),F_{shell})$:**
    - This represents the change in information entropy (information loss).
    - It's a function of the radius of the collapsing nuclear pasta shell ($r_p(t)$) at a given time (t) and the free-will actions within that shell (F_{shell}).
    - In essence, it's the amount of information that is "lost" or becomes inaccessible as the shell collapses, and this loss is influenced by the free will actions of the shell.
- **ζ (zeta):**
    - This proportionality constant quantifies the relationship between the change in Khovanov homology and the information loss.
    - It determines how much information loss corresponds to a certain change in the topological invariants of the collapsing nuclear pasta.
- **$\Delta Kh(L_i)$:**
    - This represents the change in the Khovanov homology groups.
    - $Kh(L_i)$ describes the topological invariants of the nuclear pasta structure at a specific stage of collapse (represented by link L_i).
    - $\Delta Kh(L_i)$ represents the change of the topological invariants between one stage of collapse, and the next. Therefore it represents the change of the shape of the collapsing nuclear pasta.
    - The Khovanov homology groups are used to track the topological transitions of the collapsing nuclear pasta as it forms the ringularity.

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