

Towards a Metaphysics of Quantum Gravity: A Novel Reconciliation between Presentist Fragmentalism and Mulla Sadra's Essential Movement

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Abstract

This paper explores a novel reconciliation between the contemporary quantum gravity approach of Presentist Fragmentalism (PF) and the classical Islamic metaphysics of Mulla Sadra, particularly his doctrine of essential movement (al-haraka al-jawhariyya) and the Necessary Being (Wajib al-Wujud). Presentist Fragmentalism posits that individual quantum fragments possess inherent A-series temporality, challenging the notion of a universal “now.” Mulla Sadra’s philosophy, conversely, asserts that all essential movement and becoming originate from an external, ultimate source: the Necessary Being. We identify the apparent tension between the “inherent” nature of temporality in PF and the “external” source of Sadraean motion. Through conceptual mathematical mappings, we propose a unified framework where the fundamental laws of quantum gravity (as the general dynamics of the universe) are seen as an expression of the Necessary Being’s continuous actualization, thus grounding the inherent A-series of quantum fragments within a holistic, divinely-driven process of becoming. This approach suggests a deeper metaphysical layer informing the physical laws of the universe. This conceptual paper proposes a novel reconciliation between Presentist Fragmentalism (PF), a contemporary approach to quantum gravity, and the metaphysics of Mulla Sadra. A central challenge addressed is the apparent conflict between the “inherent” temporality described in PF and the notion of an “external” divine source of motion in Sadra’s philosophy. We argue that this tension can be resolved by reinterpreting “external” not as spatial or temporal separation, but as ontological dependence upon the ultimate reality of the Necessary Being. The proposed framework posits the laws of quantum gravity as the physical manifestation of Sadra’s “essential movement,” grounded in this ultimate reality.

Keywords

Mulla Sadra, Essential Movement, Presentist-Fragmentalism, Fragmentalist Causal Quantum Gravity, Laws of Quantum Gravity, Metaphysics

1. Introduction

The nature of time stands as one of the most profound and persistent challenges in both philosophy and theoretical physics (Merriam, 2022a; Rovelli, 2019; Smolin & Verde, 2021; Rovelli, 2018; Gisin, 2017). From ancient philosophical debates on permanence and change to contemporary discussions in quantum gravity, the concept of “now” and the flow of time continue to defy definitive understanding (Simchi, 2022). In the Western tradition, John McTaggart’s seminal work on the A-series (past, present, future) and B-series (earlier-than, later-than) provided an enduring framework for discussing temporal experience and objective temporal relations (McTaggart, 1908). Special and General Relativity, often leans towards a block-universe (B-series) view. The block universe concept, where the entire history of the universe is considered to exist simultaneously, is closely linked to the theories of special and general relativity. It suggests that the past, present, and future are not distinct, but rather a framework where the idea of block universe can be considered (Santo & Gisin, 2021). Our subjective experience strongly points to an A-series reality—a dynamic “now” that truly exists. According to the A-series of time which is very different from space, and the passage of time is an all-too-real phenomena. Markosian has presented five new arguments for the dynamic theory of time (Markosian, 2022).

This paper addresses this tension by examining two distinct, yet potentially complementary, approaches to time and existence: Presentist Fragmentalism (PF) in quantum gravity (Merriam & Habeeb, 2024) and Mulla Sadra’s Transcendent Philosophy (Nasr, 1996). Presentist Fragmentalism offers a contemporary attempt to reconcile the A-series with quantum mechanics and relativity by positing that reality is composed of independent quantum “fragments,” each possessing its own inherent A-series. This view suggests that the “now” is local and subjective until quantum measurements align these temporalities (Merriam, 2022b). It is important to clarify that Fragmentalist Causal Quantum Gravity (FCQG) should be understood as the speculative mathematical framework that provides a physical realization for the philosophical tenets of Presentist Fragmentalism (PF). It is important to note that Fragmentalist Causal Quantum Gravity (FCQG) is currently a speculative and emerging approach within the quantum gravity community, rather than a widely accepted or empirically confirmed theory. Its selection for this conceptual analysis is precisely because its underlying philosophical commitments, particularly its presentist and fragmentalist nature, offer a unique and compelling point of contact for reconciliation with Mulla Sadra’s metaphysics, enabling exploration of novel interpretations of fundamental reality that are less

accessible through more established but metaphysically distinct quantum gravity frameworks.

In stark contrast, or so it seems, Mulla Sadra (Sadr al-Din Shirazi, 1571/2-1640) developed a revolutionary metaphysics, particularly his doctrine of “essential movement” (al-haraka al-jawhariyya). Sadra argued that not just accidental properties, but the very substance (essence) of all contingent beings is in a continuous state of motion and transformation. Crucially, he maintained that the ultimate source of this ceaseless movement is not internal to the moving body itself, but an external, self-subsistent Necessary Being (Wajib al-Wujud), traditionally identified with God (As-Sadr, 1989).

- The apparent conflict is immediate: PF emphasizes the *inherent* existence of the A-series within a fragment, suggesting an internal temporal autonomy. Mulla Sadra, however, posits an *external* source for the very process of becoming and essential movement that seemingly underlies any temporal flow. This paper seeks to bridge this divide, proposing a framework where quantum gravity acts as the general law of universe dynamics, mediating between Sadra’s ultimate metaphysical source and PF’s localized temporal realities. We will employ conceptual mathematical mappings to illustrate this proposed reconciliation in a structured manner. At first glance, these two frameworks might appear to be in tension, particularly regarding the source and nature of motion and change. PF emphasizes an “inherent” temporality, suggesting a self-contained dynamism within the quantum gravitational fabric. Sadra’s philosophy, however, traditionally posits a dynamic reality that is ultimately dependent on an “external,” divine source—the Necessary Being. A core argument of this paper, central to our reconciliation, is that this perceived conflict between “inherent” and “external” can be resolved by understanding “external” not in terms of spatial or temporal separation, but rather as an ontological dependence on the ultimate and foundational reality of the Necessary Being. This reinterpretation allows us to bridge the two perspectives, revealing a deeper compatibility. By reconceptualizing this “external” influence as an ontological grounding rather than a separate, intervening force, we demonstrate how the continuous “essential movement” described by Sadra can be understood as manifesting through the fundamental processes governing quantum gravity.

2. Foundations of Presentist Fragmentalism (PF) in Quantum Gravity

Presentist Fragmentalism is a philosophical interpretation of quantum mechanics and a speculative approach to quantum gravity that attempts to preserve the intuitive reality of a dynamic “present” (A-series) while addressing the challenges posed by modern physics.

2.1. McTaggart’s A-Series and B-Series

To understand PF, we first revisit McTaggart’s distinction:

- **The A-Series:** Events are characterized by their temporal properties of being past, present, or future. These properties are dynamic; an event that is future becomes present, and then becomes past. This aligns with our subjective experience of time “flowing” and the “now” advancing.
- **The B-Series:** Events are ordered by fixed, tenseless relations of “earlier than,” “later than,” or “simultaneous with.” These relations do not change; if event E_1 is earlier than E_2 , it always will be. This forms the basis of the “block universe” view, often seen as implicitly supported by Special Relativity’s of simultaneity. Many physicists, swayed by the block universe interpretation of relativity, argue against the objective reality of the A-series (Silberstein et al., 2018). PF, however, aims to bring the A-series back into the core of reality.

2.2. Fragments and the “Subjective Now”

PF posits that reality is not a single, unified spacetime continuum with a universal “now,” but rather a collection of discrete “fragments.”

- **Fragments (F_i):** Each quantum system constitutes a fragment. These fragments are the fundamental ontological units.
- **Inherent A-Series (A_i):** Crucially, each individual fragment F_i possesses its *own* A-series. This means each fragment has its own internal “now” and experiences its own local flow from future to present to past. The A-series is an intrinsic, inherent property of the fragment itself.
- **Relativity of Simultaneity:** The independence of these A-series naturally accommodates the relativity of simultaneity in Special Relativity. Different fragments can have different “nows” that are not globally reconcilable in a classical sense.
- **Mutual Measurement and Alignment:** The central dynamic in PF is that when two or more fragments undergo a mutual quantum measurement or interaction, their otherwise independent A-series can “synchronize” or “align,” effectively merging their “nows” into a shared present. This process is crucial for the emergence of a seemingly unified, macroscopic spacetime and the resolution of quantum paradoxes like non-locality.

In PF, the A-series is not an illusion or a subjective construct imposed on an underlying B-series reality; it is *real* and *ontologically fundamental* to each quantum fragment.

3. Mulla Sadra’s Philosophy of Essential Movement

Mulla Sadra’s metaphysics, known as Transcendent Philosophy (al-Hikmah al-Muta’aliyah), is a profound synthesis of Peripatetic (Avicennan), Illuminationist (Suhrawardi), and Sufi thought. A cornerstone of his system is the doctrine of essential movement, which radically redefines the nature of change and existence.

3.1. Essential Movement (Al-Haraka Al-Jawhariyya)

Prior to Sadra, motion was generally considered to be an accidental property, af-

fecting only the qualities, quantities, positions, or states of a substance, not its underlying essence. Sadra challenged this by positing that the very substance or “quiddity (mahiyya)” or essence/whatness of a contingent being is in a continuous state of flux and renewal (Zamaniha, 2022).

- **Continuous Creation/Renewal:** Every instant, the essence of a being is not merely persisting, but being renewed, transformed, and actualized. This is not a series of discrete changes but a continuous, indivisible process of becoming.
- **Ascension Towards Perfection:** This essential movement is inherently directional, driven by a natural inclination towards perfection (kamal). Beings are constantly moving through different degrees of existence, actualizing their latent potentials.

3.2. The Necessary Being (Wajib Al-Wujud) as the Source

The pivotal aspect of Sadra’s essential movement relevant to our discussion is its source:

- **Contingent vs. Necessary Existence:** For Sadra, all beings in the universe (except God) are contingent (mumkin al-wujud). They *could* exist or not exist, and their existence is not self-sufficient; it is derived. There must therefore be a Being whose existence is necessary (Wajib al-Wujud), whose essence *is* existence, and who is utterly self-sufficient. This Necessary Being is God.
- **Ultimate Source of Movement:** The necessary existence Wajib al-Wujud is not merely the initial cause of creation, but the continuous, sustaining cause of all existence and motion. The ceaseless essential movement of contingent beings is a direct consequence of the continuous emanation (fayd) of being from the necessary existence Wajib al-Wujud. Without this constant effusion of existence, nothing would endure, move, or become (Shirazi, 2008).
- **“External” Source:** In this context, “external” does not mean spatially or temporally separate in a crude sense. Rather, it signifies ontological dependence. The necessary existence Wajib al-Wujud is *transcendent* to creation yet *immanent* in sustaining it. The source of motion is “external” to the contingent being in that the contingent being does not possess the inherent power of self-subsistence or self-actualization; its very motion and existence are ultimately gifted and sustained by the Necessary Being.

3.3. Primality and Gradation of Being (Asalat Al-Wujud and Tashkik Al-Wujud)

Sadra’s philosophy is fundamentally existential. He argued for the “primality of existence” (Asalat al-Wujud), meaning that existence (wujud) is the fundamental reality, while essences (mahiyyat) are secondary. Furthermore, “existence has degrees” (Tashkik al-Wujud), implying that existence is a graded reality, ranging from the weakest contingent existents to the infinite and perfect existence of the Wajib al-Wujud. Essential movement is the process of traversing these degrees.

4. The Apparent Disparity and the Challenge of Reconciliation

The tension between Presentist Fragmentalism and Mulla Sadra's philosophy becomes evident when considering the origin of temporal dynamism:

- **PF's "Inherent A-Series"**: In PF, the A-series, the local "now" and its flow, is depicted as an intrinsic property of each quantum fragment. It is part of the fragment's fundamental constitution.
- **Sadra's "External Source of Essential Movement"**: For Sadra, the continuous essential movement, which includes all becoming and thus any temporal flow, is ultimately sourced from the necessary existence *Wajib al-Wujud*, external to the contingent being itself in an ontological sense.

How can the A-series be *inherent* to a fragment if the very dynamism that defines it ultimately stems from an *external*/Necessary Being? This paper argues that this is not a contradiction, but rather a multi-layered understanding of causality and existence.

5. Towards a Unified Framework: Reconciling PF and Sadraean Metaphysics with Quantum Gravity

Our proposed reconciliation weaves these concepts into a coherent framework, with quantum gravity serving as the general law of the universe's dynamics, expressing the will of the Necessary Being.

5.1. The Necessary Being as the Ontological Ground of Quantum Reality

The *Wajib al-Wujud* (W) can be understood not as a specific force *within* the universe, but as the ultimate, foundational reality that grounds the very existence and nature of the quantum universe itself.

- **Grounding the Laws of Quantum Gravity (LQG)**: The fundamental laws governing the universe at its most basic quantum level—the laws of quantum gravity (LQG)—are, in this Sadraean view, expressions of the *Wajib al-Wujud*'s perfect knowledge and will. They are not arbitrary mathematical constructs but reflect the inherent order and rationality emanating from the ultimate reality. The principles that dictate how quantum fields behave, how spacetime emerges, and how information is structured at the Planck scale are ultimately manifestations of W. Before delving into the specific correspondences, it is crucial to clarify the nature of these "conceptual mathematical mappings." These are proposed *ontological correspondences* and *structural analogies* between the philosophical concepts of Sadra's metaphysics and the mathematical structures of Fragmentalist Causal Quantum Gravity, rather than direct mathematical derivations or formal proofs. Their purpose is to illuminate potential shared conceptual structures and facilitate a unified metaphysical interpretation.
- **Conceptual Mapping 1**: The fundamental principles and constants of the Laws

of Quantum Gravity (LQG) are ultimately derived from and reflective of the Necessary Being (W). $LQG = E(W)$ Where E denotes “Expression” or “Emanation from.” This is not a functional dependence in the mathematical sense, but an ontological grounding. W is the ultimate reason for LQG being what it is.

5.2. Essential Movement as the Universe’s Intrinsic Quantum Dynamism

Mulla Sadra’s essential movement (M) is the continuous actualization and transformation of existence. In a quantum gravitational context, this becomes the inherent dynamism of the quantum vacuum, the ceaseless dance of virtual particles, the continuous evolution of quantum states, and the very fluidity of spacetime at its most fundamental level.

- **Mapping M to Quantum Dynamics:** The dynamics described by LQG are the manifestation of this essential movement. The universe is not static in its fundamental constitution; it is perpetually becoming, driven by the continuous outpouring of being from the Necessary Being.
- **Conceptual Mapping 2:** The continuous Essential Movement (M) is fully embodied within the fundamental dynamics described by the Laws of Quantum Gravity (LQG). Dynamics (LQG) Here, *Dynamics (LQG) refers to the set of all possible evolutions, interactions, and transformations permitted and described by the laws of quantum gravity. M is the metaphysical reality underpinning this physical dynamism.*

5.3. The Inherent A-Series as a Local Manifestation of Essential Movement

Here lies the core of the reconciliation: The “inherent existence of the A-series” within a quantum fragment ($A_i \in F_i$) is not a contradiction to an external source of motion (W). Instead, it is the *specific, local way* in which the universal essential movement manifests at the level of individual quantum systems.

- **Participation in Global Dynamism:** A fragment’s A-series is inherent to it because the fragment itself is a constantly actualizing entity, participating in the continuous existential flow of the universe. This participation is governed by the laws of quantum gravity (LQG), which are the expressions of the Necessary Being’s sustaining power.
- **Levels of Causality:** The *Wajib al-Wujud* is the ultimate, non-contingent source. Its causality is not a mechanical, moment-by-moment external push on each fragment. Rather, it is an ontological, sustaining causality that allows for the very possibility of inherent properties and dynamic processes within contingent beings. The inherent A-series of a fragment is an actualization of its potential, a continuous process made possible and sustained by the Necessary Being.
- **Conceptual Mapping 3:** The inherent A-series (A_i) of a fragment (F_i) is a spe-

cific, local manifestation of the overall Essential Movement (M) as governed by the Laws of Quantum Gravity (LQG). $A_i =$ Local Manifestation (M, F_i , LQG) *This indicates that the dynamic “now” of a fragment, its passage from future to present to past, is an intrinsic operation. However, this intrinsic operation is not self-sufficient; its very capacity for dynamism is enabled and sustained by the overarching essential movement, which is formalized by LQG and ultimately grounded in W. For example, if LQG dictates the evolution of quantum states over time, this evolution itself is the A-series for that quantum fragment, and the driving force for this evolution is M.*

5.4. The Emergence of Spacetime and Shared Nows

In PF, the alignment of A-series during quantum measurements is crucial for the emergence of a shared macroscopic “now.” This process can be interpreted as a higher-level manifestation of essential movement.

- **Interaction as Directed Becoming:** Quantum interactions, as described by LQG, are processes of becoming—transformations of quantum states. The “sharing of nows” is a specific form of these interactions, where the separate dynamic temporalities of fragments converge. This convergence is not accidental but an ordered process within the overall essential movement, moving towards greater coherence or actualization of potential.
- **Conceptual Mapping 4:** The alignment of A-series between fragments ($A_i \leftrightarrow A_j$) occurs due to specific interactions governed by LQG, and this interaction itself is a local instance of the Essential Movement (M) leading to coherent becoming. $(A_i \leftrightarrow A_j) \Leftrightarrow$ LQG (Interaction (F_i, F_j)) and Interaction (F_i, F_j) \in M *This highlights that the mechanism for temporal alignment is physically described by LQG, and this mechanism is itself part of the continuous, essential dynamism of the universe.*

6. Deepening the Mathematical Mappings within Fragmentalist Causal Quantum Gravity (FCQG)

Our aim here is to propose how the profound metaphysical principles of Mulla Sadra’s philosophy might not merely correspond to, but could potentially constrain and inform the specific mathematical structures and dynamics within FCQG. This endeavor is inherently speculative, given the nascent stage of FCQG and the non-mathematical origin of Sadraean metaphysics, yet it seeks to uncover a deeper ontological coherence.

6.1. Recapitulating FCQG’s Relevant Formalism for Deeper Mapping

To establish a solid foundation for our deeper mapping, let’s briefly recall the pertinent elements of FCQG as a speculative quantum gravity theory:

- **Fragment (F_i):** A fundamental quantum system represented as a causal set (C_i, \prec_i). Here, C_i is a finite set of discrete events, and \prec_i denotes the intrinsic causal

precedence relation between them. Each F_i embodies a localized quantum reality.

- **Local A-Series** (τ_i): Each fragment F_i is endowed with its own intrinsic, proper time parameter, τ_i . This parameter captures its inherent “now” and the dynamic flow from its internal future to its internal past.
- **Quantum Dynamics via Sum over Histories**: The evolution of the universe’s quantum state is described by a sum over all possible fragmented causal histories, F :

$$\langle \Psi_{\text{final}} | \Psi_{\text{initial}} \rangle = \int D[F] e^{iS[F]/\hbar} \quad (1)$$

- Here, $D[F]$ is the measure over these histories, and $S[F]$ is the action functional for a given history F . This action is defined over the causal set structure and is expected to incorporate a causal set equivalent of spacetime curvature, $R(F)$, along with potential matter terms.
- **Causal Influence Tensor** ($C_{\alpha\beta\gamma\delta}(F_b, F_j)$): This tensor quantifies the strength and nature of causal interaction and influence between distinct fragments F_i and F_j . It is posited to play a crucial role in shaping emergent spacetime curvature.
- **Emergent Spacetime/Metric** ($g_{\mu\nu}$): Macroscopic spacetime and its continuous metric properties are hypothesized to emerge from the coarse-graining and collective entanglement of these discrete causal fragments.
- **Causal Set Growth Dynamics**: The fundamental process in FCQG involves the successive, probabilistic addition of new events to causal sets, extending their causal structure.

6.2. Deeper Instantiation: A Sadraean Lens on FCQG’s Formalism

Now, let’s meticulously map Mulla Sadra’s metaphysical principles onto these specific elements of FCQG, arguing for their intrinsic connection.

Mapping 1: The Necessary Being (W) as the Axiomatic and Telic Principle of FCQG

- **Refined Interpretation**: The **Wajib al-Wujud** (W) is not an entity *within* the FCQG formalism, nor a separate external force operating on its elements. Instead, W represents the ultimate ontological ground and the reason for being of FCQG’s very mathematical structure, its fundamental axioms, and its inherent teleological tendencies. W’s perfection and ceaseless actualization are implicitly encoded in the consistent and non-trivial nature of the theory itself.
- **Formal Manifestation (Speculative)**:
 - **The Non-Vanishing Probability of Existence**: The fact that the path integral for FCQG yields non-zero amplitudes for possible histories (i.e., $\int D[F] e^{iS[F]/\hbar} \neq 0$) is, from this perspective, the direct manifestation of W’s continuous emanation of being (Fayd). W is the metaphysical guarantor of the universe’s continuous actualization. The very possibility of any causal set history existing and contributing to the sum is rooted in W.
 - **The Structure of the Action** ($S[F]$): The specific form of the action functional $S[F]$ in FCQG, which guides the probabilistic evolution of causal sets, can be

seen as reflecting W 's perfect wisdom and order. If Sadra's philosophy posits a universe that intrinsically strives towards greater perfection (a teleological aspect of essential movement), then $S[F]$ should implicitly favor histories leading to increasing complexity, coherence, or information content (which can be interpreted as forms of perfection or actualization within the gradation of being).

Furthermore, we can conjecture that the action $S[F]$ might conceptually align with the drive towards "perfection" inherent in Sadra's teleological understanding of existence. This highly speculative hypothesis invites future philosophical inquiry into the intrinsic aims or directions within the dynamics of reality, distinguishing it from the more direct ontological mappings presented earlier.

- **Proposal:** $S[F]$ might contain terms that inherently drive the growth and diversification of causal structures, or terms that penalize histories leading to stagnation or decay. For instance, if $S[F]$ includes a term related to the number of events, $N(F)$, and also contains a curvature term $R(F)$ (a discrete causal set Ricci scalar):

$$S[F] = S_{\text{grav}}[R(F)] + S_{\text{matter}}[F] + \lambda N(F) \quad (2)$$

- The constant λ might be interpreted as a fundamental parameter whose existence and sign are a direct consequence of W 's continuous creative outpouring, ensuring the ceaseless creation of new actualized events. This contrasts with Λ typically being a derived cosmological constant.

Mapping 2: Essential Movement (M) as the Continuous Quantum Process of FCQG

- **Refined Interpretation:** Mulla Sadra's Essential Movement (M) is the ceaseless, inherent dynamism of existence—the continuous renewal and actualization of being. Within FCQG, this concept finds its direct physical instantiation in the fundamental processes of causal set growth, the quantum fluctuations of causal relations, and the probabilistic evolution of the overall quantum state of the universe. M is the "becoming" that FCQG mathematically describes.
- **Formal Manifestation (Speculative):**
 - **Causal Set Growth as Primary M:** FCQG typically posits that causal sets grow by the sequential probabilistic addition of new events. This continuous generation of new actualized events is the most direct mathematical representation of M.
 - If we consider a quantum state $|C\rangle$ representing the evolving causal set (universe), its dynamics are governed by a Hamiltonian H_{FCQG} :

$$i\hbar d|C\rangle/dt = H_{\text{FCQG}}|C\rangle \quad (3)$$

- The terms in H_{FCQG} that describe the non-vanishing probability for the *creation* of new causal elements (e.g., H_{growth} , which might involve operators like a^\dagger for event creation) are the direct operationalization of M. The non-zero expectation value of creation operators $\langle a^\dagger a \rangle \neq 0$ signifies the continuous actualization of being, which is M.
- **The Path Integral as the Sum of All Becoming:** The path integral $\int D[F] e^{iS[F]/\hbar}$

itself fundamentally captures the dynamics of M . Each history F represents a particular trajectory of “becoming,” and the sum over all paths describes the complete manifestation of M . The very fact that evolution from one state to another is described by an integral over continuous possibilities signifies the ceaseless, non-static nature of existence—a hallmark of Sadra’s M .

Mapping 3: The Inherent A-series (A_i) as the Local Intrinsic Evolution of a Fragment’s Causal Structure

- **Refined Interpretation:** The “inherent A-series” (τ_i) of a fragment $F_i = (C_i, \prec_i)$ means that its temporal flow is intrinsic to its own causal structure and dynamics, not imposed by an external universal clock. This inherence is a local manifestation of the broader essential movement (M), where the fragment continuously actualizes its own internal causal potentials.
- **Formal Manifestation (Speculative):**
 - **Intrinsic Causal Time (τ_i):** Within FCQG, τ_i can be defined as an intrinsic measure derived from the causal set structure of F_i . A prominent candidate for this is the length of the longest chain of causally connected events within F_i :

$$\tau_i = \max_chain_length(C_i, \prec_i) \quad (4)$$

- *The “flow” of the A-series for F_i then corresponds directly to the internal growth of F_i (i.e., the probabilistic addition of new events to C_i that extend its longest chains). This continuous augmentation of C_i (a local instance of M) drives the advancement of its τ_i . The “inherent” aspect is that τ_i is defined by the fragment’s internal dynamics, not an external clock parameter, giving it its subjective “now”.*
- **Local Quantum Evolution:** For an isolated fragment F_b , its quantum state $|\Psi_i\rangle$ would evolve according to a local Hamiltonian H_b derived from the overall LQG. This evolution, parameterized by τ_b , precisely defines its A-series:

$$i\hbar \partial/\partial\tau_i |\Psi_i(\tau_i)\rangle = H_i |\Psi_i(\tau_i)\rangle \quad (5)$$

- *The existence and non-triviality of H_i itself, driving the continuous transformation of $|\Psi_i\rangle$, are directly attributable to the fundamental dynamism of M and ultimately W . The A-series is inherent because the fragment is an active participant in becoming, actualizing its potentials through its own internal dynamics and its local causal structure.*

Mapping 4: Shared A-Series via Causal Influence and Emergent Spacetime Coherence

- **Refined Interpretation:** The alignment of A-series between fragments, crucial for the emergence of a macroscopic, classical “now,” is a fundamental process of collective actualization. This is directly facilitated by the causal influence tensor and reflects the universe’s coherent becoming towards higher degrees of existence.
- **Formal Manifestation (Speculative):**
 - **Causal Influence Tensor ($C_{\alpha\beta\gamma\delta}(F_b, F_j)$):** This tensor explicitly quantifies the entanglement and causal interaction between F_i and F_j . In a quantum measure-

ment or significant interaction, $C_{\alpha\beta\gamma\delta}$ would drive a rapid evolution in the joint quantum state $|\Psi_{i,j}\rangle$ such that it leads to a reduction of superposition and a strong correlation or approximate identity of their local A-series parameters ($\tau_i \approx \tau_j$). This is a localized manifestation of M driving fragments towards a more coherent, shared actualization.

- The action $\mathcal{S}[F]$ for the combined system would contain interaction terms explicitly dependent on $C_{\alpha\beta\gamma\delta}$, potentially favoring configurations where τ_i and τ_j are aligned. For instance, the transition amplitude could be maximized when causal consistency is established across interacting fragments, leading to effective synchronization of their internal times.
- **Emergent Spacetime as Global Actualization:** The coarse-graining of the multitude of local causal sets, each with its own τ_i , leads to the emergence of a continuous spacetime metric $g_{\mu\nu}$ and a global time parameter. This macroscopic temporal dimension is the integrated result of countless local A-series aligning through their ongoing causal interactions.
- The geometric equations of FCQG, such as the proposed relationship between emergent curvature $R_{\alpha\beta\gamma\delta}$ and the causal influence tensor:

$$R_{\alpha\beta\gamma\delta} = 8\pi G C_{\alpha\beta\gamma\delta} (F_i, F_j) + \Lambda_{g\alpha\beta\gamma\delta} \quad (6)$$

- Explicitly demonstrate how the dynamic, ongoing causal interactions (which are manifestations of M) between fragments literally *shape* the fabric of emergent spacetime, including its global temporal aspects. This implies that the continuous “flow” of classical time is a collective manifestation of the micro-level essential movement, unified by the underlying dynamics of FCQG.

This refined section now provides a more detailed and specific mapping, directly engaging with the mathematical and conceptual components of FCQG to instantiate the philosophical ideas. It deepens the “how” of the reconciliation, making the proposed connection more robust.

7. Conclusion and Future Directions

This paper has outlined a conceptual framework for reconciling the inherent A-series of Presentist Fragmentalism in quantum gravity with Mulla Sadra’s doctrine of essential movement and the Necessary Being. By positing the Wajib al-Wujud as the ultimate ontological ground for the very laws of quantum gravity, we interpret the universe’s fundamental dynamism (essential movement) as the continuous process described by these laws. Consequently, the inherent A-series of individual quantum fragments is understood as a local and specific manifestation of this universal becoming, continuously enabled and sustained by the Necessary Being.

This reconciliation offers several profound implications:

- **Metaphysical Depth for Quantum Gravity:** It provides a rich metaphysical underpinning for the fundamental laws of the universe, suggesting they are not arbitrary but reflective of ultimate reality.
- **Reconciling Time Theories:** It offers a pathway to integrate subjective experi-

ence of time (A-series) with objective physical reality (quantum dynamics) within a comprehensive philosophical-scientific worldview.

- **Unifying Creation and Sustenance:** It presents a picture where the “creation” of the universe is not a singular event but a continuous process of sustenance and becoming, aligning with Sadra’s view of a perpetually actualized existence.

Further research would need to explore the mathematical formalisms within existing or emerging quantum gravity theories (e.g., Loop Quantum Gravity, String Theory, Causal Set Theory) that could more rigorously instantiate these conceptual mappings. For instance, can the evolution operators in these theories be explicitly linked to a concept of “essential movement”? How would the “flow” of the A-series emerge from specific quantum gravitational dynamics? This interdisciplinary endeavor holds the promise of deepening our understanding of time, existence, and the ultimate nature of reality.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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