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Conciliating Mulla Sadra's Essential Movement and Existential Gradation with Presentist-Fragmentalism Causal Sets

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Abstract

This article explores a novel conciliation between Mulla Sadra's philosophy of Essential Movement (*al-haraka al-jawhariyya*) and Existential Gradation (*tash-kik al-wujud*) and the Presentist-Fragmentalist (PF) understanding of time within Causal Set Theory (CST). We argue that the apparent tension between Sadra's view of time as a qualitative aspect of existential intensity and CST's discrete accumulation of events can be resolved. We propose that the "accumulation of events" in a growing causal set is the very mechanism by which qualitative changes in existential intensity are instantiated. A simple mathematical mapping, based on the causal fecundity of the "now", is introduced as an interpretive tool to illustrate how the discrete growth of reality in CST can reflect the hierarchical actualization of existence in Sadra's metaphysics. This interdisciplinary approach offers new perspectives on the nature of time, being, and cosmic evolution.

Keywords

Mulla Sadra, Essential Movement, Existential Gradation, Presentist-Fragmentalism, Causal Set Theory, Causal Fecundity

1. Introduction

The nature of **time** remains one of the most profound and persistent mysteries in both philosophy and physics (Smolin & Verde, 2021; Rovelli, 2019; Le Poisevin, 2011; Marchesini, 2018). From ancient cosmological narratives to cutting-edge theories of quantum gravity, humanity has continuously grappled with whether time is an immutable framework, a flowing river, or merely an illusion. This article delves into this enduring enigma by exploring a novel conciliation between two

seemingly disparate, yet deeply insightful, perspectives: the rich existential metaphysics of Mulla Sadra and the event-based reality posited by Causal Set Theory (CST), particularly the A-series-aligned Presentist-Fragmentalism (PF) understanding of time within Causal Set Theory (CST) (Dowker, 2006).

Mulla Sadra (c. 1571/2-1640 CE), a towering figure in Islamic philosophy, offered a radical departure from traditional views, positing that time is not an external container but an intrinsic, qualitative dimension of existence itself (Nasr, 1996). Central to his thought are the doctrines of Essential Movement (*al-haraka al-jawhariyya*), which asserts that the very substance of things undergoes continuous, inherent change, and Existential Gradation (*tashkik al-wujud*), which describes existence as a hierarchy of varying intensities and perfections. For Sadra, the passage of time is fundamentally the unfolding of being through these ascending degrees of reality.

In stark contrast, modern physics, in its quest for a theory of quantum gravity, presents frameworks like Causal Set Theory (Cortês & Smolin, 2014). CST proposes that spacetime is fundamentally discrete, composed of elementary "events" linked by causal relations, rather than a continuous manifold. When combined with a Presentist-Fragmentalist interpretation, CST suggests that only the "present" moment is real, and reality "grows" by the sequential accumulation of new events. This perspective portrays time not as a pre-existing flow, but as an emergent property of this discrete causal order (Sorkin, 2005).

The apparent tension is palpable: How can Sadra's view of time as a qualitative aspect of existential intensity, intimately tied to the continuous unfolding of being, be reconciled with an event-based physics that describes time as a mere structure of accumulating, discrete events? This article directly addresses this fundamental challenge.

We propose that this tension is resolvable by interpreting the "accumulation of events" in a growing PF causal set not as a simple quantitative tally, but as the very mechanism by which qualitative changes in existential intensity are instantiated and made manifest. We will demonstrate how event-based physics, through the inherent properties of its causal structure, can indeed reflect and quantify this existential gradation. This perspective fundamentally aligns with an A-series view of time, where moments are inherently past, present, or future, in contrast to a tenseless B-series understanding which views events as merely "earlier than" or "later than" each other (Merriam, 2022).

Following this introduction, we'll first lay out the core tenets of Mulla Sadra's metaphysics and the framework of CST within Presentist-Fragmentalism. To highlight their initial points of tension and areas of potential synergy, we will then present a dynamic dialogue between these two philosophical and scientific perspectives. The subsequent conciliation will elaborate on how the discrete events of CST can be re-interpreted as fundamental quanta of existential actualization in Sadra's sense. A simple mathematical mapping, based on the causal fecundity of the "now", will then be introduced as an interpretive tool, illustrating how the

growth of the causal set directly corresponds to the hierarchical actualization of existence. Ultimately, this interdisciplinary approach offers fresh perspectives on the profound nature of time, being, and the ongoing cosmic evolution.

2. Core Philosophies: Mulla Sadra's Metaphysics of Being and Time

To genuinely bridge Mulla Sadra's profound insights with contemporary physics, we must first firmly establish the cornerstones of his philosophical system. Sadra's metaphysics offers a distinctive vision of reality, emphasizing the dynamism of existence and its inherent qualitative hierarchy.

The Primacy of Existence (*Aṣālat al-Wujūd*)

At the heart of Mulla Sadra's thought is his revolutionary doctrine of the Primacy of Existence (*Aṣālat al-Wujūd*). Prior to Sadra, much of Islamic philosophy, influenced by Avicenna, tended to prioritize quiddity (*mahiyya*) or essence, viewing existence as merely an accidental attribute added to a pre-existing essence. Sadra rigorously argued the contrary: Existence (*wujud*) is the primary reality, while quiddities are secondary and derivative, mere conceptual delimitations of existence. Things are real because they *exist*, not because they possess a particular conceptual essence. This fundamental shift means that reality isn't a collection of static essences to which existence is appended; rather, it's a dynamic ocean of existence whose waves appear as diverse quiddities. This foundational premise is critical, as it reorients our understanding of reality from static forms to dynamic being.

Essential Movement (*Al-Ḥaraka al-Jawhariyya*)

Building on the primacy of existence, Sadra introduced his most innovative and transformative concept: Essential Movement (*Al-Ḥaraka al-Jawhariyya*) (Minaee, 2025; Morris, 2002), also known as trans-substantial motion. Before Sadra, movement was largely confined to the realm of accidents—a body changing position, color, or quantity. Sadra boldly asserted that not only accidents, but the very substance or essence (*jawhar*) of all material beings undergoes continuous, inherent, and internal motion. This isn't merely an external observation of change; it's an ontological flux, a ceaseless renewal and transformation of a thing's fundamental being. At every moment, a substance is a new, albeit organically related, actuality. This means that the apparent stability of objects in the world is, in reality, a continuous process of becoming, a perpetual recreation of their very essence. This doctrine fundamentally transforms our understanding of reality from a static collection of entities to a dynamic, unfolding process. Time, for Sadra, emerges precisely from this continuous, intrinsic movement of being.

Gradation of Existence (*Tashkīk al-Wujūd*)

Complementing the dynamism of essential movement is Sadra's doctrine of the Gradation of Existence (*Tashkīk al-Wujūd*) (Rahman, 1975). This principle asserts that existence is not a monolithic concept but possesses an intrinsic hierarchy or spectrum of intensity, perfection, and luminosity. All existent things are

unified by their shared nature as existence, yet they manifest this existence in varying degrees. Some beings are more intensely existent, more perfect, more unified, and thus possess a higher degree of reality, while others are less so. This gradation is not merely a conceptual classification; it's an ontological reality. For instance, the Divine Being is the ultimate, most intense degree of existence, from which all other degrees emanate and to which they strive to return. This hierarchy means that the unfolding of reality through essential movement is not random; it is a progression, often (though not always) towards greater actualization, unity, and perfection.

Time as a Qualitative Aspect of Existential Intensity

Synthesizing these profound doctrines, Sadra concludes that time is an intrinsic, qualitative dimension of material existence, rather than an external container or a mere measure of accidental motion (Sadra, 2009). It is the "fourth dimension" of all corporeal beings, emerging directly from their essential movement. The "passage of time" is fundamentally the quantitative measure of this qualitative process of existential unfolding and transformation. As substances continually renew their being through essential movement, they traverse different degrees within the hierarchy of existence. The more profound or rapid the qualitative change (essential movement), the more "time" has passed in this existential sense. Thus, for Sadra, time is inextricably linked to how existence is manifesting itself—its intensity, its degree of perfection, and its continuous becoming. It is about the qualitative progression of being, not just a chronological sequence of events. This sets the stage for our central question: how can event-based physics, primarily concerned with sequence, reflect these deeper existential nuances?

3. Event-Based Physics: Causal Set Theory and Presentist-Fragmentalism

Having established Mulla Sadra's dynamic metaphysics of existence and time, we now turn to a contemporary framework in fundamental physics that offers a strikingly different, yet potentially complementary, understanding: Causal Set Theory (CST). We will specifically focus on its interpretation through the lens of Presentist-Fragmentalism (PF), which provides a unique perspective on the nature of "now" and the unfolding of reality.

The McTaggartian Distinction: A-series vs. B-series Time

To fully grasp the Presentist-Fragmentalist interpretation of time, it is vital to recall the classic philosophical distinction, introduced by J. M. E. McTaggart (McTaggart, 1908), between the A-series and the B-series of time.

- The A-series conceives of time in terms of tensed properties: "past", "present", and "future". It implies a dynamic flow, where moments genuinely *become* present, then *become* past. This perspective is inherently dynamic and often associated with a belief in objective temporal passage and the reality of only the present.
- The B-series, in contrast, describes time in terms of tenseless, relational prop-

erties: "earlier than", "later than", and "simultaneous with". Events simply stand in fixed temporal relations to one another. From a B-series perspective, there is no objective "flow" or "becoming"; all events, past, present, and future, exist senselessly in a block universe.

The Presentist-Fragmentalist interpretation of CST firmly aligns with an A-series view of time. The very concept of a dynamically "growing" causal set, where new events genuinely "come into being" to form a "now", is an instantiation of A-series becoming. The future is truly undetermined and not yet existent, making the present moment ontologically privileged. Fragmentalism further extends this by allowing for multiple, potentially un-synchronized A-series "nows" until a causal connection or measurement event occurs.

Causal Set Theory (CST) Basics: Discreteness and Causal Order

Causal Set Theory proposes a radical departure from the continuous spacetime of classical physics and general relativity. At its heart, CST posits that spacetime is fundamentally discrete, composed of indivisible, elementary "events." These events are not embedded within a pre-existing continuous manifold; rather, the very notion of spacetime, including its geometry and dimensionality, is emergent from the properties and relations of these discrete elements (Markopoulou, 2002) (Sorkin, 2024). The defining characteristic of a causal set (or "causet") is its causal order. This means that if event A can causally influence event B (e.g., A is in B's past light cone), then A "precedes" B, denoted as $A \prec B$. This partial order—a set of elements with a transitive, irreflexive, and acyclic relation—is considered the sole intrinsic geometric property of the universe at its most fundamental level. Spacetime points are merely idealizations that capture the "continuum approximation" of this underlying discrete causal structure. Time, in this context, is deeply intertwined with this causal ordering, as it defines the succession of events.

The Presentist-Fragmentalist (PF) Interpretation of Becoming and the "Now"

While CST inherently emphasizes causality, its interpretation concerning the flow and reality of time can vary. Our focus here is on the Presentist-Fragmentalist (PF) interpretation, which provides a particularly fertile ground for dialogue with Sadra's metaphysics.

1) Presentism in CST: The Reality of the "Now" In a Presentist view, only the present moment is truly real. The past is what *was* but no longer exists, and the future is what *will be* but has not yet actualized. In the context of a causal set, this means that the universe is not a static "block universe" (where past, present, and future coexist). Instead, the causal set is envisioned as dynamically growing. The "present" is identified with the latest frontier of actualized events—the set of maximal elements in the causal set, those events that have already occurred but have no future causal relations *yet* within the currently actualized set. This "now" is the boundary from which new events continually emerge.

2) Fragmentalism in CST: Independent "Nows" and Open Future "Fragmentalism" extends presentism by suggesting that reality may not always be globally

unified. In certain contexts (e.g., quantum gravity scenarios), distinct, causally disconnected quantum systems (or "fragments") might possess their own independent "nows" or A-series temporal flows. This means that there might not be a single, universal "present" for all of reality before interaction or measurement. The future, in this interpretation, is genuinely open and genuinely new. It is not merely discovered but **comes into being** as new events are added to the causal set. The universe literally "grows" by the emergence of these new events and their causal links, one by one.

3) Event Accumulation as the "Flow" of Time from the PF perspective within CST, the "flow" of time is thus directly equated with the continuous, sequential addition of new events to the existing causal set. This ongoing process of accretion is how the universe extends its causal order and actualizes its future. Each added event is a fundamental "happening" that contributes to the ever-expanding reality. The dimensionality of spacetime, the very laws of physics, and the emergent macroscopic reality are all understood to arise from the collective behavior and properties of this continually growing, partially ordered set of events. This event-based accumulation serves as the central mechanism for time's progression in this framework.

4. Comparative Claims: Premises and Conclusions

To rigorously bridge Mulla Sadra's metaphysics with the Presentist-Fragmentalism (PF) interpretation of Causal Set Theory (CST), it's essential to first lay out the distinct foundational claims of each framework. This explicit comparison of their core premises and conclusions illuminates both the apparent tensions and the fertile ground for conciliation.

Mulla Sadra's Philosophy:

Core Premise 1 (Primacy of Existence—*Aṣālat al-Wujūd*): For Sadra, **existence** (*wujud*) is the primary and fundamental reality, not essence or quiddity (*mahiyya*). Quiddities are conceptual delimitations that derive their reality from existence itself. A thing is real because it *is*, not because of its definition.

Core Premise 2 (Essential Movement—*Al-Ḥaraka al-Jawhariyya*): Sadra posited that the very substance or essence (*jawhar*) of all material beings undergoes continuous, intrinsic movement or flux. This isn't merely accidental change; it's an ontological unfolding and ceaseless renewal of being at every moment. The apparent stability of things is a fleeting moment within this perpetual transformation.

Core Premise 3 (Gradation of Existence—*Tashkīk al-Wujūd*): Existence is not a uniform concept but possesses an **intrinsic, hierarchical structure**. There are varying degrees of intensity, perfection, luminosity, and actualization of existence, all unified by their essential nature. Higher degrees of being are more unified, perfect, and causally potent.

Conclusion: Reality is a dynamically unfolding, unified, and hierarchically structured continuum of existence. Time is therefore an intrinsic, qualitative di-

mension of this existential process, serving as the measure of being's continuous progression through different degrees of reality.

Causal Set Theory (CST) within Presentist-Fragmentalism (PF):

Core Premise 1 (Discrete Spacetime): Spacetime is fundamentally discrete, composed of elementary, indivisible "events." It is not a continuous manifold; rather, spacetime itself emerges from the relations between these discrete events.

Core Premise 2 (Causal Relations as Primary): The fundamental structure of spacetime is defined by the causal relations between these discrete events. If event A can causally influence event B, then A strictly precedes B ($A \prec B$). This partial order is the foundational fabric of reality.

Core Premise 3 (Presentist-Fragmentalism of Time): Only the present moment is truly real. The past is fixed and no longer existent, and the future is genuinely open and not yet actualized. Furthermore, "fragmentalism" implies that causally disconnected quantum systems may have independent "nows" or A-series temporal flows. The universe literally "grows" by the sequential addition of new events and their causal links.

Conclusion: Reality is a perpetually emerging, discrete causal order, fundamentally characterized by an A-series view of time. The "flow" of time is the continuous accumulation of new events, extending the causal set, with the "present" holding unique ontological status. Time, in this view, is an emergent property of this discrete, sequential ordering and growth of events, directly reflecting genuine temporal becoming.

The following section will present the simplest mathematical mapping as an interpretive tool, focusing on causal fecundity as a direct correlate for Sadra's "existential intensity."

5. Mathematical Mapping: Quantifying Existential Gradation in Causal Sets

The central challenge in reconciling Mulla Sadra's qualitative metaphysics with event-based physics lies in demonstrating how the discrete accumulation of events in a Causal Set can reflect the inherent dynamism and hierarchical gradation of existence. This section proposes a simple mathematical mapping as an interpretive tool, illustrating how the quantitative properties of a growing causal set can represent Sadra's concept of "existential intensity" or "degree of being." This mapping is not presented as a definitive physical model, but rather as a conceptual bridge to show *how* such a conciliation might be realized.

The "Now" and its Existential Intensity in a Growing Causal Set

In the Presentist-Fragmentalist (PF) interpretation of Causal Set Theory (CST), the universe is not static but continuously "grows" by the sequential addition of new events. The "now" at any given stage of the universe's evolution can be conceptually identified with the set of maximal elements (Max (C_t)) in the causal set C_t. These are the events that have already occurred but have no future causal relations *yet* within the current actualized set. They represent the active frontier of

reality, the very boundary where existence is actively unfolding and new causal links are being born.

We hypothesize that the "existential intensity" or "degree of being" of this "now" is directly proportional to its causal fecundity—its potential for generating future causal development. For Sadra, higher degrees of being are characterized by greater actualization, unity, and causal potency. In an event-based physics, this potency can be precisely linked to an event's capacity to give rise to a diverse and rich future causal structure.

The Existential Fecundity Index (EFI) justification

The justification for using the Existential Fecundity Index (EFI) as a proxy for "existential intensity" in Mulla Sadra's terms lies in the conceptual parallels between their underlying principles, despite their vastly different historical and disciplinary origins.

Here's a breakdown of the justification:

1) Principality of Existence (Aṣālat al-Wujūd): For Mulla Sadra, existence is the primary reality, and essences (quiddities) are secondary. Things are defined by their *existence* and its mode, not by their fixed quiddities. The EFI, by focusing on the generative capacity and causal productivity of a causal set, is essentially measuring how "active" or "real" that set is in bringing forth further reality. A highly fecund causal set is one that is powerfully existing and capable of manifesting more and more aspects of reality.

2) Gradation of Existence (Tashkīk al-Wujūd): Sadra's doctrine of *tashkīk al-wujūd* posits that existence is a single, undivided reality that manifests in a graded hierarchy of perfection and imperfection, strength and weakness. Higher existential intensity corresponds to a greater degree of actualization, comprehensiveness, and independence. The EFI, in a causal set, aims to capture this "strength" or "perfection" not merely by the number of events, but by the richness and diversity of the causal connections they enable.

- **Diversity and Complexity:** A causal set with higher EFI implies a greater variety of causal paths, a more intricate web of relationships, and a richer potential for the emergence of complex structures. This directly resonates with the Sadrean idea that higher existential intensity manifests as greater perfection and comprehensiveness. A simpler, less fecund causal set would correspond to a lower degree of existential intensity, reflecting a more attenuated or less complete mode of being.
- **Generative Power:** Sadra's "existential intensity" is not static; it implies a dynamic power to actualize and manifest. A more intensely existing entity has greater power to bring about effects. The EFI directly measures this "generative power" of a causal set, quantifying its capacity to produce new causal relationships and events.

3) Essential Movement (Al-Ḥaraka al-Jawhariyya): Sadra argues that the very substance of corporeal beings is in continuous, intrinsic motion, constantly renewing and unfolding. This movement is a manifestation of their existential in-

tensity, a dynamic striving towards perfection. The EFI, applied to a growing causal set, captures the *dynamic unfolding* of the causal structure. A high EFI suggests a causal set that is vigorously "moving" and evolving, manifesting new connections and complexities, mirroring the continuous actualization inherent in Sadra's essential movement.

4) Causality as a Manifestation of Being: For Sadra, causality is not merely an external relation between pre-existing entities, but an intrinsic aspect of existence itself. The act of causing is a manifestation of the cause's being. In the causal set framework, the causal relations *are* the fundamental structure. Therefore, measuring the "fecundity" of these causal relations (how many subsequent events they can give rise to, and with what diversity) is directly measuring the "intensity" of the being of that causal set in terms of its causal efficacy and potential for further actualization.

In essence, while Mulla Sadra's philosophy operates on a metaphysical plane and causal set theory on a mathematical and physical one, the EFI serves as a coherent proxy for "existential intensity" by translating Sadra's qualitative notions of the *principality*, *gradation*, *and dynamic unfolding of existence through causal manifestation* into quantifiable properties of a causal network's generative capacity and structural richness.

Before delving into the specifics of the Existential Fecundity Index (EFI) and its application, it is imperative to state that the mapping proposed herein between the EFI and Mulla Sadra's "existential intensity" should be understood as an interpretive heuristic rather than an empirically testable prediction. Our aim is to provide a conceptual framework for reconciling Sadra's metaphysical insights with the discrete structures of causal sets, offering a novel lens through which to explore their shared implications for understanding reality. This mapping serves as a tool for philosophical exploration and theoretical conciliation, designed to illuminate potential convergences between these distinct domains, rather than to present a falsifiable hypothesis.

Proposed Mathematical Mapping: The Existential Fecundity Index (EFI)

While a general trend of increasing EFI is often expected with the growth of causal sets, it is crucial to understand that the EFI does not always exhibit monotonic increase, especially in scenarios such as C3."

Let C_t denote the causal set at a specific "time" t, where t is a parameter tracking the growth of the set (e.g., the number of events, or the maximum causal depth). We define the Existential Fecundity Index (EFI), $EFI(C_t)$, as a simple measure to quantify the "existential intensity" of the current "now."

1) Causal Fecundity of an Individual Event (F(e)): For each event $e \in \text{Max}(C_t)$ (i.e., an event on the current frontier of the "now"), we define its individual causal fecundity, F(e). This represents its immediate potential for future causal actualization. For the purpose of this illustrative mapping, we can simplify F(e) as the number of distinct *potential direct future events* that could immediately **caus**ally succeed e. In more complex models, this could involve probabilities or the

volume of a future light cone, but for this philosophical argument, a simple count suffices.

2) Overall Existential Fecundity Index of the "Now" (EFI(C_t)): The total existential intensity of the "now" for the entire causal set Ct is then defined as the sum of the causal fecundities of all events currently comprising its frontier:

$$EFI\left(C_t\right) = e \in \mathrm{Max}\left(C_t\right) \sum F(e)$$

Interpretation of the Mapping: Accumulation as Qualitative Progression

This simple mathematical mapping allows us to interpret the "accumulation of events" in a causal set not merely as a quantitative increase in elements, but as a direct reflection of a qualitative progression in existential intensity.

- **Discrete Actualization of Essential Movement:** As new events are continually added to C_t to form C_{t+1}, these new events become part of the evolving Max(C_{t+1}). Each such addition is an instance of Sadra's Essential Movement (*al-haraka al-jawhariyya*)—a discrete quantum of existential actualization.
- **Gradation Reflected in Fecundity:** When a new event is added, it either contributes directly to Max(C_{t+1}) with its own F(e) value, or it causes an existing maximal event to become non-maximal (if the new event is in its causal future). In a healthy, growing causal set (one that is developing into a manifold-like structure), the total EFI(C_t) would generally increase as time progresses. A higher EFI(C_t) signifies that the "now" possesses a greater aggregate potential for causal influence and future actualization, directly correlating with a higher degree of existential intensity or comprehensiveness in Sadra's terms. The universe is becoming "more real" by actualizing more of its potential.
- **Time as the Evolving EFI:** The "flow of time" for the PF causal set is the sequential addition of events. Our mapping proposes that this very flow can be understood as the continuous increase in the EFI(C_t). Thus, time is not just a sequence of accumulated events, but the measure of the qualitative ascent of existence through its varying degrees of fecundity and potential. The quantitative "accumulation" is precisely the mechanism driving the qualitative "progression."

Conceptual Example: The Birth of a Universe

Consider a simplified conceptual illustration of a causal set growing and its EFI changing:

- **Cosmic Dawn (C_1):** A single initial event, e1. Max(C_1) = {e1}. Let F(e1) = 3 (it can potentially cause 3 new immediate events).
  - EFI(C_1) = 3. This represents an initial, undifferentiated state of existence with limited potential.
- **Early Branching (C_2):** Three new events (e2, e3, e4) are added, all directly caused by e1.
  - Max(C_2) = {e2, e3, e4}. Let's say F(e2) = 2, F(e3) = 2, F(e4) = 2.
  - EFI(C_2) = 2 + 2 + 2 = 6. The accumulation of events has led to a doubling of the EFI, reflecting an increase in the potential for future actualization. The "now" is more diversified and richer in nascent possibilities, signifying a

higher degree of being than the singular initial state.

- **Emergence of Complexity (C_3):** New events are added, but one (e5) is a "causal meet," being caused by two previous events (e2 and e3). Others (e6, e7) continue linear paths.
  - Max(C_3) now includes, for example, e5, e6, e7. Let F(e5) = 4 (due to its converged causal history, it becomes more fecund), and F(e6) = 1, F(e7) = 1.
  - EFI(C_3) = 4 + 1 + 1 = 6. Even if the numerical value holds steady, the *nature* of the contribution changes. The presence of a "meet" event like e5 indicates a qualitative shift towards greater integration and unification within the causal structure. This structural complexity contributes to a higher *form* of existential intensity, even if the raw "fecundity" count isn't strictly higher, suggesting that the EFI could be expanded to include other qualitative measures, as discussed in prior conceptualizations.

This simplified mapping demonstrates how the growth of events in a causal set can be directly related to a quantifiable measure of existential intensity. The accumulation of events is not a mere clock-like progression, but the very manifestation of existence's essential movement and its ascent through degrees of being.

6. Discussion and Implications

The proposed conciliation between Mulla Sadra's existential metaphysics and Presentist-Fragmentalist Causal Set Theory offers a powerful new lens through which to understand the nature of time and being. By interpreting the discrete "accumulation of events" in an event-based physics as the quantitative manifestation of Sadra's qualitative "existential intensity," we bridge a significant conceptual gap between a rich philosophical tradition and a cutting-edge approach to quantum gravity. The Existential Fecundity Index (EFI) provides a simple, illustrative mathematical tool for this conceptual mapping, demonstrating how the growth of causal potential within the "now" can signify an ascent through degrees of being.

Resolution of the Main Issue: Event-Based Physics Reflecting Existential Gradation

Our primary aim was to demonstrate how event-based physics can reflect existential gradation. The proposed conciliation directly addresses this by:

1) Reinterpreting Events as Quanta of Becoming: Each elementary event in the causal set is understood not merely as an abstract point in spacetime, but as a fundamental "quantum" of Sadra's Essential Movement *al-haraka al-jawhariyya*. It is a discrete instance where existence actualizes itself, continually renewing the universe's being.

2) Causal Properties as Manifestations of Existential Intensity: The causal relationships between events, and properties derived from them (like causal fecundity, density, and connectivity), are precisely how existential gradation is made manifest in an event-based reality. A higher causal fecundity of the "now," for instance, reflects a greater existential potency and a richer potential for future actualization, signifying a higher degree of being. Regions of high causal density

within the causal set would likewise correlate with areas of greater local existential intensity, where being is more unified and actualized.

3) Time as the Progress of Actualization: The "flow" of time, in this reconciled view, is not just the chronological sequence of events, but the very process by which the universe, through the continuous addition and organization of these events, ascends through increasing degrees of existential intensity. The quantitative accumulation is directly mapped to a qualitative progression of being.

This framework suggests that CST's discrete, event-based growth is the physical mechanism by which Sadra's universe, constantly in essential movement, realizes its inherent existential hierarchy.

Broader Philosophical and Scientific Implications

This conciliation opens several avenues for further thought:

- **Integration of Metaphysics and Physics:** The proposed mapping provides a concrete, albeit interpretive, example of how deep metaphysical insights can find resonance within fundamental physics. It encourages a richer dialogue between disciplines often seen as separate.
- **The Nature of Time's Flow:** It offers a compelling re-conceptualization of the "flow of time," transforming it from a mysterious passage or an illusion into an ontologically meaningful process of increasing existential actualization. This aligns with a teleological intuition inherent in Sadra's philosophy without necessarily imposing an external purpose.
- **Reinterpreting Quantum Indeterminacy:** The "fragmentalism" aspect of PF, where disparate A-series may exist until mutual measurement, could be seen as a state of lower existential intensity or unity. The act of measurement, leading to the synchronization and merging of these A-series, thus becomes an ontological act of unification and a qualitative leap towards a higher, more coherent degree of being. This could provide a Sadrian-inspired interpretation of quantum collapse or decoherence as an act of existential consolidation.
- **The Cosmological Context:** From this perspective, the evolution of the universe from a simple initial state to one of immense complexity and structure (e.g., the formation of galaxies, stars, and even life) can be viewed as the universe continually actualizing higher degrees of existential intensity through its causal set growth.

7. Limitations and Future Directions

While this conciliation offers a promising conceptual framework, it is important to acknowledge its current limitations and outline avenues for future research:

- **Philosophical Interpretation vs. Scientific Prediction:** The mathematical mapping presented (EFI) is primarily an interpretive tool. It demonstrates *how* philosophical concepts might be expressed in a physical framework, but it does not, in its current form, constitute a testable scientific prediction. Developing a more rigorously predictive model would require deeper theoretical development within both CST and its PF interpretations.

- **Complexity of Measures:** The EFI is a very simple measure. A more comprehensive mapping of Sadra's existential gradation *tashkik al-wujud* would likely require a multi-faceted metric incorporating aspects of causal density, connectivity (e.g., clustering coefficients, betweenness centrality), emergent dimensionality, and information-theoretic measures (e.g., causal entanglement entropy). Defining these measures rigorously within the nuances of causal set dynamics is a significant challenge.
- **Ambiguity of "Regions":** Precisely defining "regions" within a discrete causal set to talk about local existential intensity is non-trivial and requires careful axiomatic development.
- **Quantum Gravity Challenges:** Causal Set Theory itself is still an active area of research within quantum gravity, facing its own set of technical and conceptual hurdles (e.g., identifying the "correct" growth dynamics, addressing the problem of time in a full quantum context).
- **Testability:** As a framework for quantum gravity, direct empirical verification of causal sets and their proposed growth mechanisms remains beyond current experimental capabilities. Future progress in quantum gravity phenomenology would be essential.

Future research should focus on refining the mathematical mapping to capture more subtle aspects of existential gradation, exploring how specific causal set growth dynamics might naturally lead to higher EFI values, and examining the implications of this framework for understanding cosmological evolution, the emergence of spacetime, and the problem of quantum measurement within a Sadrian context.

8. Conclusion

This article presented a novel conciliation between Mulla Sadra's profound metaphysics of time and being and the contemporary physics of Causal Set Theory under a Presentist-Fragmentalism interpretation. We began by highlighting the apparent tension between Sadra's view of time as a qualitative aspect of existential intensity, intrinsically linked to the essential movement and gradation of being, and CST's description of time as the emergent consequence of accumulating, discrete events.

Through a re-interpretation of fundamental concepts, we have argued that this tension is resolvable. We proposed that the discrete "accumulation of events" in a growing causal set is not a mere quantitative progression, but the very mechanism by which qualitative changes in existential intensity are instantiated and actualized. The dynamic dialogue served to underscore the conceptual meeting points, particularly the alignment between Sadra's concept of existential intensity and the causal fecundity of events.

To concretize this, we introduced the Existential Fecundity Index (EFI) as a simple mathematical mapping. This index demonstrates how the increasing causal potential of the "now" within a growing causal set can directly reflect a

higher degree of existential intensity. Thus, event-based physics, far from merely tracking sequential occurrences, can indeed provide a structural and dynamic reflection of the hierarchical unfolding of existence, fulfilling a key Sadrian insight.

While highly speculative and primarily philosophical in its current formulation, this conciliation opens fertile ground for interdisciplinary dialogue. It invites us to conceive of the universe's evolution as a continuous ascent through degrees of being, where the very fabric of spacetime is actively realizing more unified, complex, and causally potent forms of existence. This endeavor underscores the enduring power of integrating metaphysical inquiry with scientific exploration in our quest to comprehend the deepest mysteries of reality and the nature of time.

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Conflicts of Interest

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

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Appendix: Glossary of Specialized Terms

Suran J. and O.C. Stocia, Scalar Field Progression on (1 + 1)—dimensional Anti—deSitter Causal Sets. arXiv preprint arXiv: 2504.12919.

- **Causal Fecundity:** In the context of our paper, causal fecundity refers to the inherent capacity or power of a causal set to generate or give rise to a multitude of subsequent events or structures. It emphasizes the generative richness and potential of a given causal configuration, particularly in the unfolding of existence.
- **Existential Intensity:** This term denotes the degree of strength, richness, or perfection of a particular existence. Drawing from Mulla Sadra's philosophy, existential intensity signifies that existents are not merely present but possess varying degrees of reality, ranging from the most perfect and all-encompassing to the most attenuated. Higher existential intensity implies a greater degree of actualization and less potentiality.
- **Fragmentalism:** A metaphysical perspective that posits reality as fundamentally composed of discrete, independent, and often disconnected elements or fragments. In contrast to holistic or continuous views of reality, fragmentalism emphasizes the primacy of individual, localized events or entities, often with an emphasis on their distinctness rather than their interconnectedness. Within our paper, it is employed to characterize aspects of certain causal set approaches where events are fundamentally discrete.
- **Existential Gradation (Tashkīk al-Wujūd):** A central doctrine in Mulla Sadra's transcendent philosophy, also known as "the systematic ambiguity of existence" or "the modulated hierarchy of being." It posits that existence (wujūd) is a single, undivided reality that manifests in a graded spectrum of perfections and imperfections. All existing things participate in this singular reality, but they do so with varying degrees of intensity, strength, and comprehensiveness, moving from the simplest to the most complex and perfect.
- **Causal Sets:** A foundational approach in quantum gravity that models spacetime as a discrete set of events with a causal order. It assumes that the fundamental structure of reality is a partially ordered set where the ordering relation signifies causality (i.e., one event can causally influence another). Causal sets propose that the continuum of spacetime emerges from this discrete, underlying causal structure, thus providing a quantum theory of gravity that is fundamentally discrete.

Essential Movement (Al-Haraka al-Jawhariyya): A pivotal concept in Mulla Sadra's philosophy, asserting that the very substance or essence (jawhar) of all corporeal beings is in a state of continuous, intrinsic movement and transformation. Unlike accidental changes that affect only properties, essential movement posits that the being itself is constantly undergoing renewal and unfolding, moving from potentiality to actuality. This perpetual dynamism is a fundamental characteristic of the existent world, leading to a profound understanding of becoming.