



A Comparative Study of the Concept of Manifestation in Mullā Ṣadrā's Philosophy and the Notion of Fields in David Bohm's Physics: Toward a Holistic Worldview¹

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Abstract

This paper presents a comparative study of two distinct yet converging perspectives on the unity of existence: the metaphysical framework of Mulla Sadra in Islamic philosophy and the theoretical propositions of David Bohm in modern physics. Mulla Sadra, through his doctrines of *tajallī* (manifestation) and *wahdat al-wujūd* (the unity of being), offers a philosophical vision in which all entities are grounded in a single, divine reality. In parallel, Bohm, through his theory of the implicate order within quantum field theory, articulates a holistic model of reality that seeks to unify consciousness and matter at a fundamental level. This article explores the conceptual parallels between these two approaches, particularly in their treatment of the unity of the cosmos, the source of existence, and causality. It highlights a potential convergence between metaphysical reflection and quantum theory. Although these perspectives emerge from different epistemological traditions, both propose models of reality in which apparent multiplicity is rooted in a deeper, unified order.

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1. Introduction

Philosophy and physics represent two distinct yet complementary domains of human inquiry, each seeking to understand the truth of the universe through its own methods. Modern science, particularly in its contemporary form, emphasizes empirical investigation and experimental verification. Philosophy, by contrast, engages in metaphysical and rational analysis, aiming to uncover the underlying nature of reality and the essence of existence. Within this broader context, two influential thinkers, Mulla Sadra in Islamic philosophy and David Bohm in modern physics, have each attempted, from their respective perspectives, to articulate a vision of the unity and wholeness of the universe.

The question of the unity of the world has long occupied Islamic philosophers. In many cases, the concept of *gradation* (*tashkīk*) serves as a key explanatory principle for reconciling unity with multiplicity. In the Peripatetic (*mashā'i*) tradition, associated with figures such as Avicenna, gradation is understood primarily at the level of the concept of existence. In Illuminationist (*ishrāqī*) philosophy, developed by Suhrawardi, gradation is instead applied to the essential reality of light. In the framework of Transcendent Philosophy (*ḥikmat al-muta'āliyah*), elaborated by Mulla Sadra and further developed by thinkers such as Allameh Tabatabai, gradation pertains to the very reality of existence itself and becomes the key to resolving the tension between unity and multiplicity.

Mulla Sadra conceives the universe as a continuous series of manifestations (*tajalliyāt*) of a single divine reality. Through the doctrines of the unity of existence and manifestation, he explains how beings emerge through processes of determination (*ta'ayyun*), forming a causal chain grounded in existence itself. In contrast, David Bohm, a prominent twentieth-century physicist, sought to articulate a unified account of reality that bridges consciousness and matter. His theoretical framework posits a deeper underlying field from which all phenomena arise.

It is important to note that the standard Copenhagen interpretation of quantum mechanics, often associated with Niels Bohr, emphasizes indeterminacy and, in some readings, undermines classical notions of causality. This makes it difficult to align with Sadrian philosophy, which maintains a robust commitment to causal order. For this reason, the present

study adopts Bohmian mechanics as its comparative framework, since it preserves a causal interpretation of quantum phenomena.

Bohm's attempt to establish a meaningful relationship between mind and matter is particularly significant. His model offers a more accessible conceptual framework than the standard interpretation by providing causal explanations for quantum behavior (Golshani, 2006, p 222). Moreover, his rejection of Cartesian dualism allows him to articulate a unified vision of reality that resists the idealistic tendencies sometimes associated with mainstream quantum theory. By emphasizing a reality independent of the observer's mind, Bohm advances a form of philosophical realism that aligns more closely with metaphysical traditions such as that of Mulla Sadra.

Although recent studies have explored philosophical dimensions of Bohmian physics, there remains a lack of detailed comparative analysis between Bohm's conception of a unified universe and Mulla Sadra's metaphysical account. This paper seeks to fill that gap by examining points of convergence between the two, particularly with respect to the unity of being and causality. Accordingly, this study addresses the following questions:

1. How is the concept of the unified whole of the universe articulated in Mulla Sadra's philosophy?
2. Through which concepts does David Bohm present his holistic view of reality?
3. In what ways do these two approaches converge or align?

2. Bohmian Physics and the Unified Structure of the Universe

At the beginning of the twentieth century, the development of quantum mechanics gave rise to multiple competing interpretations. Following debates, most notably those between Niels Bohr and Albert Einstein at the 1927 Solvay Conference, the so-called Standard (Copenhagen) Interpretation came to dominate the field (Khoshbin Khoshnazar, 2012, p113–118).

The Bohmian interpretation, however, offers a fundamentally different perspective. One of its defining features is the introduction of *hidden variables*, entities that are absent from the Copenhagen framework but, in Bohm's theory, play a decisive role in determining particle behavior. These variables allow for a deterministic and causal account of quantum processes. Within this framework, David Bohm develops a holistic vision of reality in which consciousness and matter are deeply interconnected. This vision is articulated through two central concepts: the *implicate order* and the *quantum field*. In his influential work *Wholeness and the Implicate Order*,

Bohm argues that all phenomena are fundamentally interconnected and that no entity exists in isolation. What we ordinarily perceive as the explicit, observable world is merely a surface-level expression of a deeper, hidden structure, the implicate order. This underlying order is characterized by continuous, non-local relationships that bind all elements of the universe together. Such relationships cannot be fully captured through ordinary observation alone but require deeper theoretical and philosophical insight.

A key feature of Bohm's approach is its commitment to causality, in contrast to the indeterministic tendencies of the Copenhagen interpretation. In his reformulation of quantum mechanics, Bohm introduces an additional term into the Schrödinger equation: the *quantum potential*. This potential represents a non-local influence that operates across the entire universe.

Unlike classical fields such as gravity, the quantum potential does not diminish with distance. Instead, it remains equally present throughout all regions of space, suggesting a deeply unified structure of reality. Although the precise physical origin of this potential remains unclear, its theoretical implications are profound: it points toward a universe governed by an underlying, holistic order that transcends spatial separation (Bohm, 1952, p 166–193).

$$\frac{-\hbar^2}{2m} \nabla^2 \Psi + V\Psi = i\hbar \frac{\partial \Psi}{\partial t} \quad (\text{The Standard Schrödinger Equation}) \quad (1)$$

$$\frac{-\hbar^2}{2m} \nabla^2 \Psi + (V + Q)\Psi = i\hbar \frac{\partial \Psi}{\partial t} \quad (2)$$

where $Q = \frac{-\hbar^2}{2m} \frac{\nabla^2 |\Psi|}{|\Psi|}$ is the Bohmian non-local quantum potential.

The causal activity of this subtle and non-local field gives rise to what quantum mechanics describes as hidden variables. Thus, contrary to the views of Werner Heisenberg and Niels Bohr, causality is not abandoned at the subatomic level; rather, it operates within a deeper and more fundamental order. David Bohm conceives reality as consisting of two interconnected dimensions: an outer, manifest level situated within space and time, and a deeper implicate level characterized by a hidden order. The objects and phenomena that appear in the manifest world are, in fact, expressions or unfoldings of this deeper structure. Although Bohm acknowledges that physical laws govern the explicate (observable) order, his central concern is to reveal their connection to the implicate order that underlies them (Bohm, 1980, p 189). In this sense, all entities emerge from an inner and unified

ground of reality (Talbot, 2008, p 96). The source of both the implicate and explicate orders is what Bohm describes as a dynamic and unified flow of reality in which mind and matter exist as distinct yet inseparable aspects of a single process (Talbot, 2008, pp 67–68). From this perspective, classical concepts such as isolated particles or independent fields are no longer sufficient. Bohm therefore calls for a new ontology capable of expressing the intrinsic wholeness of quantum reality (Russell, 2005, p 612).

One of the central features of Bohm's worldview is his comparison of the universe to a hologram. In a holographic system, each part contains information about the whole. Similarly, Bohm argues that every part of the universe reflects the totality of the cosmos. This leads him to emphasize wholeness as the proper framework for understanding reality. Reductionist and purely analytical approaches, which separate parts from the whole, fail to grasp this deeper coherence. As Bohm states: "Thought creates divisions and then claims that these divisions exist in nature" (Bohm, 1992, p 6).

Within this holistic vision, all aspects of the universe, including observers and the instruments they use, belong to a single undivided totality. The quantum potential expresses this totality: the whole is not merely the sum of its parts but actively governs and informs them, both internally and externally. It contains innumerable sub-wholes while remaining present within each of them. An important implication of this holographic perspective is that every fragment of reality reflects the entire universe. Just as each part of a hologram contains the complete image, every aspect of existence contains, in principle, the whole. Bohm therefore suggests that, if properly understood, the entirety of the cosmos could be discerned within even the smallest fragment of reality, a drop of water, a grain of sand, or a particle of dust (Talbot, 2008, p 67).

Within this framework, Bohm also emphasizes the profound interconnectedness and entanglement of all things. The probabilistic nature of quantum phenomena, in his view, does not arise from genuine randomness but from our limited knowledge of hidden variables. Apparent indeterminacy is therefore only a surface-level phenomenon; at a deeper level, reality remains fully ordered within the implicate structure (Bohm, 1980, p 188).

Consequently, the division of reality into separate and independent parts is, for Bohm, a fundamental misconception. Reality should instead be understood as an undivided whole in which even the observer is intrinsically embedded. This perspective strengthens the role of the observer within quantum theory. Similar to the notion of entanglement emphasized in

standard interpretations of quantum mechanics, Bohm's framework rejects any absolute separation between observer and observed. From the standpoint of wholeness, such distinctions ultimately dissolve (Bohm, 1985, Vol. 2, pp 127–129). Another key aspect of Bohm's theory is the claim that consciousness and matter are not separate substances but two dimensions of a single underlying reality. Through the concept of the quantum field, Bohm attempts to overcome the traditional divide between philosophy, understood as the study of consciousness, and physics, understood as the study of matter. In contrast to reductionist materialism, he argues that consciousness and matter are dynamically interconnected within one unified ontological framework.

3. Bohm's Interpretation and the EPR Experiment

Following the debates at the 1927 Solvay Conference, Albert Einstein, Boris Podolsky, and Nathan Rosen proposed a thought experiment intended to challenge the completeness of quantum mechanics. In their 1935 article, *Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?* they introduced what later became known as the EPR paradox (Einstein, Podolsky, & Rosen, 1935, p 777–780). Einstein argued that if quantum mechanics were accepted as a complete theory, one would have to abandon a core principle of relativity: namely, that spatially separated objects possess independent existence and cannot instantaneously influence one another. For Einstein, any form of faster-than-light interaction, what he famously described as “action at a distance”, was philosophically and scientifically unacceptable. The phenomenon of quantum entanglement, however, appears to challenge this assumption. When two quantum systems, such as two photons, become entangled and are later separated, they continue to behave as parts of a single system regardless of the distance between them. A measurement performed on one particle immediately determines the corresponding state of the other. In this sense, the particles remain both distinct and unified at the same time (Hern, 2008, p 100).

Einstein and his collaborators maintained that this phenomenon conflicted with Werner Heisenberg's uncertainty principle, according to which certain pairs of physical properties, such as position and momentum, cannot be simultaneously determined with complete precision. Since entanglement seemed to permit precise knowledge of correlated properties, Einstein concluded that quantum mechanics could not provide a complete account of reality (Khoshbin Khoshnazar, 2012, p 113–118). More fundamentally, Einstein believed that any adequate physical theory must describe reality

independently of observation. He also defended the principle of locality, according to which an object can only be influenced by its immediate surroundings. Any influence between spatially separated events would require faster-than-light communication and would therefore contradict relativity theory (Golshani, 2006, p 222). On this basis, Einstein rejected non-locality.

Mainstream quantum mechanics, by contrast, accepts non-locality as an inherent feature of reality. The EPR argument itself presupposes a realist framework in which physical properties exist prior to observation, whereas the Copenhagen interpretation denies this assumption and treats such properties as undefined until they are measured (Razmi, 2011, p 41).

David Bohm approaches these tensions differently. In his interpretation, non-locality operates at a deeper level of reality, even if it appears incompatible with relativity at the observable level. Bohm argues that violations of locality occur within the implicate order, while the explicate or observable order remains consistent with relativistic principles. An important feature of Bohmian mechanics is that it reproduces the same empirical predictions as standard quantum mechanics in non-relativistic contexts, while offering a more intuitive and causally structured interpretation. Although Bohm's model implies a deeper-level non-locality, this cannot be used operationally to transmit information faster than light. Observable phenomena therefore remain compatible with relativity. In this way, Bohm's interpretation preserves the empirical results associated with the EPR experiment while providing a holistic and causal account of quantum reality (Mansoury & Sarkardehi, 2000, p 110–129).

4. “Unity of Existence” in Mulla Sadra's Philosophy

Before Mulla Sadra, Islamic philosophers generally explained the emergence of beings through a framework of causal creation. Within this model, each being possessed its own distinct, though dependent, existence, while God functioned as the ultimate cause and creator of all things (Suhrawardi, 1996, p 62). Islamic mysticism (*ʿirfān*), however, approached the issue differently. In the mystical tradition, multiplicity is not considered ultimately real. Rather, all beings are understood as manifestations or modes of a single divine existence. Consequently, concepts such as “cause,” “effect,” and “causation” are reinterpreted not as external acts of production, but as forms of manifestation (*tajallī*) and self-disclosure.

The doctrine of the Unity of Existence (*wahdat al-wujūd*) forms one of the central foundations of Mulla Sadra's philosophical system. According to this

doctrine, all beings, despite their apparent multiplicity, arise from one unified and transcendent reality. Existence (*wujūd*) is the fundamental principle of reality, while everything else represents a manifestation or modulation of it. Nothing possesses independent existence apart from God; all entities, including mental and physical realities, are ultimately expressions of divine being. To articulate this vision, Mulla Sadra draws upon several foundational principles, including the doctrine of the “simple reality of all things” (*baṣīṭ al-ḥaqīqa*), the theory of the personal unity of existence, and the gradational structure of being (*tashkīk*). Within this framework, causality is no longer understood as external production but as a process of manifestation and existential gradation. God is therefore the source of manifestation, while everything other than God (*mā siwā Allāh*) constitutes varying modes of divine self-disclosure. The unfolding of existence is described as a continuous emanation or effusion of divine reality into the realm of contingent beings. This process has been characterized in different ways, as emanation, manifestation, divine self-disclosure, or causality (Mulla Sadra, 2009, vol. 2, p 357). At its highest created level, it gives rise to the First Intellect, the noblest of created beings, through which lower levels of existence emerge (Tabatabai, 2021, p 1217). In this ontology, causality is not a relation between separate and self-subsisting entities, but the continuous unfolding of a single reality. Every being derives its existence, directly or indirectly, from God and remains dependent upon the perpetual flow of divine grace (*fayḍ*).

One of the key concepts in this regard is “expanded existence” (*wujūd munbasit*), which Mulla Sadra identifies as the first determination proceeding from divine existence. Expanded existence encompasses all possible beings within a unified yet gradational structure. Multiplicity, therefore, possesses no independent ontological status; it consists instead of differentiated modes within a single, comprehensive reality.

Accordingly, the relationship between God and the world is neither one of union (*ittiḥād*) nor incarnation (*ḥulūl*), but one of manifestation. What philosophers traditionally call the “cause” is, in reality, the originating principle, while the “effect” is simply one of its modes or expressions (Mulla Sadra, 1981, p 50). This leads Mulla Sadra to a profound reinterpretation of causality. Earlier philosophers regarded the effect as possessing a dependent yet still distinct existence. Mulla Sadra radicalizes this position by arguing that the effect has no independent existence whatsoever. Its entire reality consists in its relation to the cause; indeed, it is nothing other than that

relation. From this perspective, multiplicity has no share in self-subsistent existence. Reality is instead a dynamic and graded system of manifestation rather than a collection of separate entities connected through external causal relations. The Necessary Being (wājib al-wujūd) stands as the "Cause of causes," while all other beings represent varying degrees of existential intensity and dependence.

An important implication of this ontology is the unity of existence and awareness. Mulla Sadra maintains that awareness (shu'ūr) is not something added to existence but is identical with existence at certain levels of intensity. Consciousness, therefore, is itself a manifestation of existence and ultimately rooted in divine reality (Mulla Sadra, 2006: 230).

5. Comparative Study of Wholeness in Sadrian Philosophy and Bohmian Physics

Having outlined the central features of both frameworks, we can now examine the major points of convergence between Mulla Sadra's metaphysics and David Bohm's physics, especially regarding the concept of wholeness.

5.1. Unity of Existence and the Bohmian Field

Although the doctrine of the primacy of existence (aṣālat al-wujūd) in Sadrian philosophy encompasses both material and immaterial reality, whereas quantum physics is primarily concerned with the physical world, important conceptual parallels nevertheless emerge between the two perspectives. In Mulla Sadra's philosophy, the doctrine of the Unity of Being maintains that all entities originate from a single, absolute reality. The universe is not a collection of independent parts, but a unified manifestation of divine existence. Every being receives its existence through the continuous flow of divine grace and remains ontologically dependent upon it. A comparable intuition can be found in David Bohm's theory. In Bohmian physics, particles do not exist as isolated and self-contained entities; rather, they are embedded within a deeper, non-local field characterized by continuous interconnection. This underlying field, described through the notion of the implicate order, integrates all phenomena into a unified whole. The similarity between these two views is noteworthy. Both reject the idea of independent, self-subsisting entities and instead affirm an intrinsically interconnected reality. In each framework, multiplicity derives its meaning from a deeper unity, and no element can be fully understood apart from the whole to which it belongs.

5.2. Consciousness and Existence

Another important point of convergence concerns the relationship between consciousness and reality. In Mulla Sadra's philosophy, consciousness is inseparable from existence. Awareness is not an independent faculty added to being; rather, it is one of the manifestations of existence itself. Since existence ultimately originates from the Divine, consciousness is likewise understood as a manifestation of divine reality unfolding across different degrees of existential intensity.

David Bohm similarly rejects the strict separation between consciousness and matter. In his view, they are not fundamentally distinct substances but two dimensions of a single, unified process. Both arise from the deeper and dynamic flow of reality represented by the implicate order.

In this respect, Bohm's position closely resembles the Sadrian notion of manifestation. Just as all beings are expressions of one reality in Mulla Sadra's metaphysics, consciousness and matter in Bohm's theory emerge from a single underlying whole. Their relationship is therefore intrinsic rather than external. Both perspectives ultimately advance a non-dual understanding of reality in which consciousness and the physical world are deeply interconnected. Rather than treating them as separate domains, Mulla Sadra and Bohm each present a worldview grounded in unity, continuity, and ontological interdependence.

5.3. Causality and Manifestation: Wholeness and the Hidden Cause

In Islamic philosophy, especially in the thought of Mulla Sadra, causality occupies a central and highly nuanced role. It is not understood as a mechanical relation between separate entities, but as a dynamic and continuous manifestation of existence across different levels of reality. Causality emerges from the unity of being itself and reflects a hierarchical structure in which all beings originate, directly or indirectly, from the Divine source. A similar reconfiguration of causality appears in David Bohm's work. Through the concept of the implicate order, Bohm reformulates causality within the framework of quantum theory. According to his model, all phenomena emerge from a unified underlying field, the quantum field, in which every aspect of reality is fundamentally interconnected. Particles and systems therefore do not function as isolated units but as expressions of a single undivided whole. This parallel suggests that both Mulla Sadra and Bohm reject the notion of independent, self-sufficient entities. Instead, they conceive reality as grounded in an underlying unity from which multiplicity unfolds. In both systems, causality becomes the principle through which this

unity is expressed, whether as the continuous flow of divine grace (fayḍ) in Sadrian metaphysics or as the holistic and non-local structure of the quantum field in Bohmian physics.

5.4. The Unity of the Universe and Bohm's Inner Layer

From Mulla Sadra's perspective, the universe is a single and unified manifestation of divine existence. All beings are interconnected expressions of one reality, and multiplicity does not negate their underlying unity. A comparable intuition appears in Bohm's conception of the implicate order. Bohm proposes that beneath the observable world lies a deeper "inner layer" of reality in which all things are enfolded within one another. At this level, separateness dissolves and reality reveals itself as an interconnected field of continuity and entanglement. The convergence between these two perspectives is significant. In both, the fragmentation perceived at the empirical level conceals a deeper and more comprehensive unity. Bohm's emphasis on non-locality and entanglement at the deepest level of reality closely parallels Mulla Sadra's conception of a single, all-encompassing existence manifesting itself in diverse forms.

5.5. The Origin of the Bohmian Quantum Field

Within Mulla Sadra's metaphysical framework, particularly through the doctrine of gradational causality (tashkīk), all levels of reality, including matter, consciousness, and everything other than God (mā siwā Allāh), share a common ontological source. All are manifestations of a single and fundamental existence. David Bohm likewise argues that consciousness and matter emerge from a unified source. However, he characterizes this source in more indeterminate terms, referring to it as the "totality of an unknown and dynamic flow of the universe." Unlike Mulla Sadra, Bohm does not explicitly identify this source with a divine or metaphysical principle. This marks one of the major differences between the two approaches. Mulla Sadra grounds the unity of existence in a clearly articulated metaphysical origin expressed through concepts such as divine grace (fayḍ) and the First Intellect. Bohm, by contrast, leaves the origin of the quantum field largely undefined, preserving a degree of theoretical openness while also introducing a certain metaphysical ambiguity. Moreover, Bohm's approach remains methodologically tied to the horizon of physics. His suggestion that the deeper structure of reality may be investigated at extremely small scales, on the order of 10^{-34} to 10^{-33} meters, in connection with Planck-scale considerations, indicates that his search for the origin of the field remains fundamentally linked to physical inquiry (Bohm, 1980, p 190–191).

5.6. The Relationship between Science and Philosophy

One of the most significant points of convergence between Mulla Sadra and David Bohm is their shared attempt to overcome the divide between science and philosophy. In *al-Hikmah al-Muta'aliyah* (Transcendent Theosophy), Mulla Sadra presents a vision of reality in which philosophical reflection and experiential insight cooperate in uncovering the different levels of existence. Concepts such as gradation (*tashkik*) and manifestation (*tajalli*) provide a metaphysical framework through which scientific inquiry may also be understood as a way of accessing deeper dimensions of reality. David Bohm similarly challenges the separation between scientific and philosophical inquiry. In works such as *Wholeness and the Implicate Order*, he argues that a genuine understanding of the universe requires not only empirical investigation but also a conceptual rethinking of the relationship between mind and matter. For Bohm, science is not merely descriptive; it is interpretive, seeking to reveal the hidden structures underlying observable phenomena. This shared orientation points to a deeper methodological convergence between the two thinkers. Both regard science and philosophy as complementary rather than opposing modes of inquiry. Science uncovers empirical patterns and regularities, while philosophy provides the conceptual framework necessary for understanding their deeper meaning and implications.

6. Conclusion

This study has presented a comparative analysis of two influential frameworks: the doctrine of the Unity of Being in the philosophy of Mulla Sadra and the concept of the quantum field in the physics of David Bohm. Although these perspectives emerge from very different intellectual traditions, both attempt to articulate a comprehensive understanding of reality that integrates existence, consciousness, and the structure of the universe. Despite important differences, particularly the explicitly metaphysical and divine grounding of Mulla Sadra's system in contrast to the more open-ended ontology of Bohm's theory, there are remarkable points of convergence between them. Both emphasize the unity and interconnectedness of reality and reject reductionist approaches that fragment the universe into isolated and independent parts. In both frameworks, consciousness and matter are not treated as fundamentally separate realities. Mulla Sadra regards consciousness as identical with existence at certain levels of intensity and ultimately rooted in divine being. Bohm likewise interprets consciousness and matter as inseparable aspects of

a single underlying process. In each case, dualistic conceptions of reality are replaced by a more integrated and holistic worldview. This holistic perspective also transforms the role of the observer. Unlike conventional interpretations of quantum mechanics that sharply distinguish between observer and observed, Bohm's holographic model, and, in a different manner, Sadra's metaphysics, suggest that such distinctions are secondary rather than ultimate. The observer is not detached from reality but participates within its unfolding structure. Bohm's theory of the holographic universe further reinforces this insight. By emphasizing non-locality and the enfolded nature of reality, it demonstrates the limitations of purely surface-level explanations. The observable world represents only the explicate layer of existence, while beneath it lies a deeper implicate order characterized by unity and interconnectedness.

One of the most important contributions of Bohm's approach is precisely this recognition of a hidden dimension underlying observable phenomena. His interpretation combines a commitment to causality with an acceptance of non-locality, thereby providing a framework in which unity and complexity coexist without contradiction. Ultimately, this comparison shows that philosophy and science need not remain isolated disciplines. When Bohmian physics is brought into dialogue with Sadrian metaphysics, each perspective illuminates the other in meaningful ways. Such interdisciplinary engagement not only deepens our understanding of reality but also opens new directions for future research in the philosophy of science, metaphysics, and the foundations of quantum theory.

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