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## Consciousness in the quantum world: An Indian perspective<sup>1</sup>

### Abstract

In the first part of the paper a new interpretative principle for quantum mechanics is applied to two kinds of experimental situation. Applied to situations involving distinctions between regions of space, it implies that the spatial differentiation of the physical world is incomplete. This makes it possible to rigorously define the term “macroscopic” and to attribute measurement-independent reality to the positions of macroscopic objects. Applied to situations involving distinctions between things, it warrants the conclusion that intrinsically each fundamental particle is numerically identical with every other fundamental particle. Reality therefore cannot be modelled from the bottom up. Quantum theory’s explanatory arrow points in the opposite direction: from unity to multiplicity. It is the manifestation of an intrinsically undifferentiated Being. In the second part of the paper the work of the Indian philosopher Sri Aurobindo is made use of to explain how consciousness is present in this Being, how it is involved in each fundamental particle, and how it has evolved into our mental consciousness. The role played by the laws of physics in this evolutionary manifestation of Being is discussed, as is the evolution of free will.

### 1 Introduction

Imagine that both Alice and Bob see a measurement pointer, and that this indicates a particular value. In the good old days of classical physics, they would have agreed that there is a real pointer “out there,” for they would have been in possession of a theoretical model of the world “out there,” and they would have had no problem situating the pointer in that model. The quantum-mechanical situation is strikingly different. The theory’s irreducible empirical core is a probability calculus. Because this presupposes the events to which, and on the basis of which, it serves to assign probabilities, it cannot account for the existence of these events. If one nevertheless tries to perform the classical conjuring trick, which consists in the reification of calculational tools, one obtains a theoretical model that fails to accommodate the very events that the theory serves to correlate. The challenge posed by the measurement problem is to demonstrate the consistency of the theory’s correlation laws with the *measurement*-independent reality of value-indicating events. Whether or not these events have a *mind*-independent reality is an entirely separate issue.

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<sup>1</sup> Paper presented at *Quantum Physics Meets the Philosophy of Mind*, an international conference held at the Catholic University of Milan, June 4–6, 2013; to appear in *Quantum Physics Meets the Philosophy of Mind. New Essays on the Mind-Body Relation in Quantum-Theoretical Perspective*, de Gruyter, Berlin/New York.

Making physical sense of the mathematical formalism of quantum mechanics calls for an interpretative principle, and I know of only one such principle that meets this challenge. In the first part of my paper I shall put this principle to work in two kinds of experimental situation, and I shall arrive at the conclusion that reality cannot be modelled from the bottom up. Quantum theory's explanatory arrow points in the opposite direction: from unity to multiplicity. The quantum world is not put together, it is *manifested*. It is the manifestation of an intrinsically undifferentiated Being. This Being, as I shall argue in the second part of my paper, holds the key to the mysterious commerce between mind and matter.

## Part I

### 2 An interpretative principle

I agree with John Bell (1990) that "measurement" is a bad word. What is bad is the suggestion that quantum mechanics presupposes experimenters who build instruments for a *purpose*, or observers who *take cognizance of* outcomes. The correlata of the quantum-mechanical correlation laws are measurement outcomes only in the restricted sense that they make available information about the values of observables.

Quantum theory is built on two Lorentz-invariant calculational rules (Mohrhoff 2009a). The first rule is consistent with classical probability theory. The second rule instructs us to add the *amplitudes* of alternatives where classically we would add their *probabilities*. We use the first rule if there are events that indicate which alternative has occurred, or if correlations exist that make it possible to predict the outcome of a measurement designed to determine which alternative has occurred. We use the second rule if nothing indicates which alternative has occurred and no such correlations exist.

So what necessitates the use of the second rule? The following interpretative principle provides the answer: *Whenever quantum mechanics instructs us to add the amplitudes of alternatives rather than their probabilities, the distinctions we make between the alternatives correspond to nothing in the physical world. They cannot be objectified. They exist solely in our minds.*

### 3 Alternatives involving distinctions between regions of space

As promised in the introduction, I shall apply this principle to two kinds of alternatives: alternatives involving distinctions between regions of space and alternatives involving distinctions between things.

An example of the first kind is the well-known two-slit experiment with electrons (Feynman *et al.* 1965).<sup>2</sup> When we are required to use the second rule, the distinction

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<sup>2</sup> Chapter 1, *Quantum Behaviour*.

between “the electron went through the left slit” and “the electron went through the right slit” cannot be objectified. All we can say is that it went through the union of the two slits. But if an electron can pass through the union of two regions of space without passing through either region, then the distinctions we make between parts of space cannot be intrinsic to space.

So what furnishes space with its so-called parts? The short answer is: detectors. By means of its measurement-independent macroscopic properties a detector realizes a “region of space,” and thereby it makes it possible to attribute to a microscopic object the property of being in that region.

But if it is impossible to attribute to a physical object the property of being in a “region of space” unless this property is made available for attribution by a detector, then the spatial differentiation of the physical world cannot be complete — it cannot go “all the way down.” Because the uncertainty principle rules out the existence of definite relative positions (except non-relativistically, in the unphysical limit of infinite momentum dispersion), detectors cannot realize definite positions, and this makes it impossible to attribute a definite position to anything else. We can therefore conceive of a partition of space into *finite* regions so small that none of them is available for attribution.

But if the spatial differentiation of the physical world is incomplete, then there are objects whose positions are indefinite only in relation to an imagined spatial background that is more differentiated than the physical world (Mohrhoff 2009b). If we reserve the adjective “macroscopic” for these objects and their positions, then every outcome of a measurement of a macroscopic position is *necessarily* consistent with both quantum mechanics *and* the laws of motion that quantum mechanics yields in the classical limit — to the extent that they are testable. (The only exception occurs when a macroscopic object — the proverbial pointer needle — indicates the value of an observable.) Nothing therefore stands in the way of attributing measurement-independent reality to the positions of macroscopic objects.

#### **4 Alternatives involving distinctions between things**

What can we learn by applying the above interpretative principle to alternatives involving distinctions between things?

Consider four non-overlapping regions. Initial measurements indicate the presence of one particle in region A and one particle in region B. We wish to calculate the probability of finding one particle in region C and one particle in region D. There are two alternatives. In situations in which we are required to add amplitudes, the distinctions we make between the alternatives cannot be objectified. In these situations the particles are neither individuating substances nor do they carry individuating properties.



Quantum mechanics challenges us to think in ways that do not give rise to unanswerable questions. If we take for granted that space is an intrinsically differentiated expanse, we are led to ask the unanswerable question, “Through which slit did the electron go?” If we take for granted that initially there are *two* things, and that subsequently there are again *two* things, we are led to ask the unanswerable question, “Which incoming particle is identical with which outgoing particle?” On the other hand, if we adopt the view that initially there is *one* thing present in both region A and region B, and that subsequently there again is *one* thing present in both region C and region D, this unanswerable question can no longer be asked.

At any rate, nothing prevents me from taking the view that what is simultaneously present in two places, both initially and the next time we check, is one and the same thing. Nor need the numerical identity of what presents itself *here* and what presents itself *there* be confined to particles of the same type. There is no compelling reason to believe that this identity ceases just because it ceases to have observable consequences when persistent distinguishing characteristics exist. What can be present in different places can also be present with different properties other than position. Nothing therefore stands in the way of the view that *intrinsically* each fundamental particle is numerically identical with every other fundamental particle.

## 5 Manifestation

If this is the case, and if in addition the spatial differentiation of the physical world is incomplete, then reality cannot be modelled from the bottom up, whether on the basis of an intrinsically and completely differentiated space or spacetime or out of a multitude of separate building blocks. Quantum theory’s explanatory arrow points in the opposite direction: from unity to multiplicity, from a single undifferentiated Being, which exists in an anterior relationship to spatial distinctions, to a world of forms — forms that resolve themselves into spatial relations between formless particles, relations that at bottom are self-relations, particles that intrinsically are identical in the strong sense of numerical identity.

Why *formless* particles? What the usual characterization of a fundamental particle as a pointlike entity amounts to is that it lacks internal structure. The notion that a fundamental particle is literally pointlike is warranted neither empirically nor theoretically. In addition it is inconsistent with the incomplete spatial differentiation of the physical world.

The bottom line: Instead of being put together, the world is *manifested*. If I conceive of space as the totality of existing spatial relations, and of matter as the totality of existing particles, I am in a position to affirm that a single transcendent Being brings into existence both matter and space simply by entering into spatial relations with itself. The multitude of particles in existence is then nothing but the multitude of relata that is implied by the existence of spatial relations. Because the spatial relations that obtain between particles are self-relations, this multitude is effective rather than fundamental. Ultimately there is nothing but Being and relations between Being and Being.

This transcendent Being, to which quantum physics has been trying to draw our attention for nearly a century, is the knot that ties together consciousness and matter. But before I come to the second part of my paper, I still need to attend to an apparent logical circle. On the one hand, macroscopic objects are made of microscopic objects. On the other, macroscopic objects are needed to realize the properties of microscopic objects. How can that be?

The key to the resolution of this apparent circle is that the theoretical description of a microscopic object (such as an atom) is a description not in terms of actually measured properties but in terms of correlations between the possible outcomes of measurements that are not actually made. Our understanding of how fundamental particles constitute nucleons, nuclei, atoms, and molecules does not require that fundamental particles possess actually measured properties. Nor does our understanding of the instrumentality of microscopic objects in the manifestation of the macroworld require the attribution of actually measured properties to microscopic objects. The fact that microscopic *observables* need to be measured in order to possess values therefore in no wise prevents microscopic *objects* from playing the role that they do in the manifestation of the macroworld.

## **Part II**

### **6 Consciousness: “Involution”**

So how is consciousness present in that transcendent Being, and how is it present in each fundamental particle? My views on this matter are indebted to the Indian philosopher (and freedom fighter, and mystic) Sri Aurobindo (2005; Heehs 2008). In keeping with a more than millennium-long philosophical tradition (Phillips 1995), Sri Aurobindo posits an Ultimate Reality whose intrinsic nature is (objectively speaking) infinite Quality and (subjectively speaking) infinite Delight. This has the power to

manifest its inherent Quality/Delight in finite forms, and the closest description of this manifestation is that of a consciousness creating its own content.

In the native poise of this consciousness, its single self is coextensive with its content and identical with the substance that constitutes the content. This self is wherever its objects are. We may call this “the view from everywhere.”

A first self-modification of this *supramental* consciousness leads to a poise in which the self adopts a multitude of standpoints, localizing itself multiply within the content of its consciousness and viewing it in perspective. It is in this secondary poise that the dichotomy between subject and object, or self and substance, becomes a reality.

Probably the most adequate description of the process by which the self assumes a multitude of standpoints is that of a multiple concentration of consciousness. A further self-modification of the original consciousness occurs when this multiple concentration becomes exclusive. We all know the phenomenon of exclusive concentration, when consciousness is focused on a single object or task, while other goings-on are registered subconsciously, if at all. A similar phenomenon transforms individuals who are conscious of their essential mutual identity into individuals who have lost sight of this identity and, as a consequence, have lost access to the supramental “view from everywhere.” Their consciousness is mental, which in Sri Aurobindo’s terminology means, among other things, that it is concerned with the formation of expressive ideas. Although it receives the quality or qualities it serve to express from a source of which it is no longer aware, it nevertheless commands a wholly effective executive force. This consciousness is closer to the one we are familiar with, but it does not suffer from the compromising consequences of an evolutionary past.

Yet another self-modification of the original consciousness produces individuals who are concerned with execution rather than idea-formation, individuals who receive even the ideas they serve to execute from a subliminal source. And when the multiple exclusive concentration of consciousness is carried to its logical conclusion, it results in individuals who lack even the power of executing ideas. And since this power is responsible for the existence of individual forms, the result is a multitude of formless individuals. We call them elementary particles, and we tend to think of them as the fundamental constituents of matter.

## **7 Why?**

While quantum physics tells us how the probabilities of the possible outcomes of measurements are correlated, it offers no clue to the mechanism or process by which measurement outcomes determine the probabilities of measurement outcomes. What is more, such explanations appear to be ruled out by a growing number of “no-go theorems” (Bell 1964, 1966; Kochen and Specker 1967; Greenberger *et al.* 1989; Mermin 1985, 1990, 1993; Klyachko *et al.* 2008). If the force at work in the world is an

*infinite* force, this should be no cause for concern, for it would be self-contradictory to explain the working of such a force in terms of physical mechanisms or natural processes. If this force works under self-imposed constraints, what we need to know is why it does so, and why under one particular set of constraints rather than another.

So why would an infinite consciousness render its powers of creation and cognition latent in a multitude of formless particles, and why do the spatial relations between these particles appear to be governed, at least effectively, by general relativity and the theories that make up the Standard Model of particle physics? Here is Sri Aurobindo's answer to the first question:

a play of self-concealing and self-finding is one of the most strenuous joys that conscious being can give to itself, a play of extreme attractiveness. There is no greater pleasure for man himself than a victory which is in its very principle a conquest over difficulties, a victory in knowledge, a victory in power, a victory in creation over the impossibilities of creation.... There is an attraction in ignorance itself because it provides us with the joy of discovery, the surprise of new and unforeseen creation.... If delight of existence be the secret of creation, this too is one delight of existence; it can be regarded as the reason or at least one reason of this apparently paradoxical and contrary Lila. (2005, 426–427)

Lila is a term of Indian philosophy that describes the manifested world as the field for a joyful sporting game made possible by self-imposed limitations.

So how is it that our best descriptions of these limitations are Einstein's theory of gravity and the Standard Model? As I have argued in a couple of papers (Mohrhoff 2002, 2009a) and in my book (2011), these theories formulate preconditions for an evolving manifestation of the infinite Quality/Delight that is the very nature of Being. Quantum physics in particular is entailed by the fact that the objects of everyday experience (i) occupy space, (ii) are manifested by means of finite numbers of objects that do not occupy space, and (iii) neither collapse nor explode as soon as they are created. The existence of such objects is an obvious precondition for an evolutionary manifestation of Being, and the fact that such objects are manifested by means of formless particles (which obviously do not occupy space) is a consequence of the *involution* of the ideative and executive powers of Being in formless particles.

## **8 Consciousness: Evolution**

By "evolution" Sri Aurobindo means neither "descent with modification" nor the Darwinist explanation of this historical fact. Essentially, evolution consists in the gradual reversal of the exclusive concentration of consciousness that culminated in the creation of matter. But evolution does not simply retrace the steps that led to the creation of matter, for if it had done so, particles would have acquired forms. What happened instead is that spatial relations between formless particles came to manifest

forms. Instead of reversing the transition from formed to formless individuals, evolution uses the outcome of this transition to manifest what has been lost in the transition.

When life appears, what is essentially added to formed individuals is the power to execute ideas, and when mind appears, what is essentially added to living organisms is the power of idea formation. What has yet to evolve is a consciousness that is not exclusively concentrated in the individual, a consciousness aware of the essential mutual identity of all individuals, a consciousness no longer confined to the perspectival outlook of a localized individual but capable of integrating its perspectival outlook with the supramental “view from everywhere.”

What about our brains? What necessitated their evolution, and what roles do they play in cognition and volition?

Brains did evolve for a *purpose*: the release of consciousness from its latency in formless particles. Whatever Darwinists may say, this cannot be accomplished without purposeful modifications of the correlations that are encapsulated in our physical theories. As I have argued in my contribution to *The Volitional Brain* (Mohrhoff 1999), such modifications cannot be effected through the loopholes offered by quantum-mechanical indeterminism, without breaching physical laws. Nonphysical influences that preserve the quantum-mechanical probability distributions are causally ineffective, and influences that alter the probability distributions predicted by quantum mechanics breach physical laws. What nevertheless saves the appearances for physicalists and Darwinists alike, at least for the time being, is the Houdiniesque nature of this evolving manifestation, for it still limits the scope of purposeful modifications to such an extent that no experiment can reveal statistically significant departures from the physically determined behaviour of matter or from a purely Darwinian mechanism of evolution.

The Houdiniesque nature of this manifestation also explains why something as complex as the human brain had to evolve. Evolution was not meant to be a rapid transformation scene. As yet only very weak nonphysical influences are consistent with the constraints imposed by “this apparently paradoxical and contrary Lila.” The complexity of the brain is needed to make such influences physically effective, be it via the brain’s trillions of synaptic interconnections or via the intricate system of neural oscillations that it supports. There can be a cumulative non-physical action that contributes to determine the brain’s “default” mode of operation, as well as a concerted synchronic action that modifies the “default” mode.

The possibility of nonphysical influences modifying the physical laws is readily understood: an infinite force that can subject itself to the laws of physics can also modify them. But are we the initiators of such influences, and if so, in what sense? Those who believe in a genuinely free will — not compatible with determinism — are likely to attribute it to the intentions or volitions of our waking conscious selves. Most systems of Indian philosophy disagree. They share the fundamental distinction between a



deterministic nature (Prakriti) and a self (or Purusha) the extent of whose freedom varies from one philosophical system to another. Prakriti, which includes not only our bodies but also our minds, evolves deterministically. Purusha, identifying himself with certain physical and certain mental operations of Prakriti, wrongly believes that *he* chooses when in fact *she* (Prakriti) chooses. But the Purusha is also capable of becoming aware of his independent identity and of adopting the attitude of a detached witness, who experiences thoughts, feelings, and actions impersonally and undistorted by any sense of authorship, ownership, or responsibility.

This attitude — a widely acknowledged foundational spiritual experience (Blackmore 1986; Bricklin 1999; Claxton 1999) — is the result of a first reversal of the exclusive concentration by which most of us are confined to their surface waking selves. Adopting it, we can become aware of the actual determinants of our thoughts, our feelings, and our actions, and becoming aware of them, we are once and for all disabused of whatever libertarian illusions we may have harboured. Paradoxically, this disillusionment is the first step towards genuine freedom. For the Purusha then finds that Prakriti functions as she does only by his permission. It becomes possible for him to exert an inner control, which has nothing to do with his erstwhile libertarian imaginations. In the words of Sri Aurobindo:

If the Purusha in us becomes aware of itself as the Witness and stands back from Nature, that is the first step to the soul's freedom; for it becomes detached, and it is possible then to know Nature and her processes and in all independence... to accept or not to accept...; we can choose what she shall do or not do in us, or we can stand back altogether from her works and withdraw into the Self's spiritual silence, or we can reject her present formations and rise to a spiritual level of existence and from there re-create our existence. (2005, 363)

According to the standard argument against free will, the only alternative to determinism is indeterminism. If determinism is true, we are not free, and if indeterminism is true, freedom is tantamount to randomness. According to the standard argument against this argument, rational decision-making takes place in two stages.

The first stage — the generation of possible courses of action — contains the element of randomness implied by the denial of determinism, while the making of deliberate, non-random decisions takes place in the second stage.

If the deep psychological explorations that have shaped the predominant currents in Indian metaphysics can be trusted, there is no randomness in the making of a decision. Once we have learned to step back from our surface waking selves, we can observe what fills the apparent gaps in the phenomenology of rational decision making. In the words of Sri Aurobindo (2005, 552), “we can observe the springs of our thoughts and feelings, the sources and motives of our action, the operative energies that build up our surface

personality.” There remains no room for randomness. Which means, in particular, that quantum-mechanical indeterminism has nothing to do with decision making.

Yet Sri Aurobindo (2005, 4) also affirms that “the goal of Nature in her terrestrial evolution” is, *inter alia*, “to establish an infinite freedom in a world which presents itself as a group of mechanical necessities.” Arguably, the evolution of infinite freedom begins with the illusion of freedom, which even a paramecium may share with us, and it involves a growing genuine freedom, which only begins to unfold when our now subliminal self — the Purusha — ceases to be subliminal and begins to actively control the operations of Prakriti.

At bottom there is only one way that genuine freedom is possible: to be the sole determinant of this evolving manifestation. In our deepest and truest self we are that. We are the sole determinant of the operations of Prakriti, and this is why we can learn to control and transform them. Needless to say, making this identity fully conscious and wholly effective calls for a series of transformations that extend a good distance into our evolutionary future.

It may be asked: what determines the creative imagination of an all-powerful conscious Self that is also the Substance of its creations? Since the intrinsic nature of this Self and Substance is infinite Delight or Quality, the ultimate purpose of creation can only be to experience this Delight and to express this Quality in finite forms. It deserves to be stressed that such a world-conception has the additional advantage of boldly grounding aesthetic quality and ethical value in the very nature of what is ultimately real.

There also is only one way that knowledge is possible. At bottom all knowledge is knowledge by identity. At their origin, subject and object are one, cognition and will are one, the self for which the world exists is one with the substance by which the world exists. When Being localizes itself multiply within the content of its consciousness, knowledge by identity takes the form of direct knowledge, and when an individual’s direct knowledge is limited to a direct knowledge of some of its own physical attributes, as is the case with us, knowledge of external objects takes the form of a knowledge mediated by representations. This brings up the issue of intentionality: why do we perceive external objects rather than our own mediating physical attributes? The answer is contained in this key passage:

In the surface consciousness knowledge represents itself as a truth seen from outside, thrown on us from the object, or as a response to its touch on the sense, a perceptive reproduction of its objective actuality. Our surface mind is obliged to give to itself this account of its knowledge, because ... it can catch ... the surface of outward objects ... but there is no such ready-made opening between itself and its own inner being. Since it is unable to ... observe the process of the knowledge coming from within, it has no choice but to accept what it does see, the external object, as the cause of its knowledge.... In fact, it is a hidden deeper response to

the contact, a response coming from within that throws up from there an inner knowledge of the object, the object being itself part of our larger self. (Sri Aurobindo 2005, 560–561)

In short, as direct knowledge is supported and made possible by an underlying knowledge by identity, so representational knowledge is supported and made possible by an underlying direct knowledge, which belongs to our subliminal selves.

## 9 Conclusion

I have been asked to address the question: is quantum physics relevant for the philosophy of mind? My answer is: yes and no.

If the spatial differentiation of the world does not “go all the way down,” then neither does its temporal differentiation. In this case quantum states cannot be construed as evolving physical states, and the question of what causes quantum states to collapse does not arise. And if our decisions are fully determined by a combination of physical and non-physical factors, quantum-mechanical indeterminism can have no part in our decisions.

What makes quantum physics relevant to the philosophy of mind is the direction of its explanatory arrow — from unity to multiplicity — and what is implied by it: that material forms are manifested by means of reflexive spatial relations between numerically identical relata. But to bring the relevance of these counterintuitive implications of quantum physics to light, I need to invoke the Vedantic description of Ultimate Reality as something that relates to the world in a threefold manner: as Being (*sat*) it constitutes the world, as Consciousness (*chit*) it contains the world, and as an infinite Quality/Delight (*ānanda*) it expresses and experiences itself in the world. And I need Sri Aurobindo’s description of the process by which that which is now evolving came to be involved in an apparent multitude of formless entities.

One last remark. Our theoretical dealings with the world are conditioned by the manner in which we experience the world — by what it is like to be a 21st-century human. We tend to ignore that the manner in which humans experience the world has changed and will change (Gebser 1985; Barfield 1965). Our present mode of experience has enabled us to discover much that is relevant to understanding the past, but it offers little by way of a clue to its future transformations. We tend to think of the evolution of consciousness as a successive emergence of new ways of experiencing a world that, intrinsically, is independent of how it is experienced. But such a world does not exist. There are only different ways in which Being manifests itself to itself. A transformed consciousness implies a transformed world. Our very concepts of space, time, and matter are bound up with, are creations of our present mode of consciousness. It is not matter that has created consciousness; it is consciousness that has created matter, first by carrying its multiple exclusive concentration to the point of being *involved* in a

multitude of formless particles, and again by *evolving* to our present mode of experiencing the world, for this has given us the ability to integrate images into three-dimensional objects that appear to exist independently of the experiencing subject. Yet the very logic of this evolving manifestation entails that the next mode of experiencing the world will be one in which the subject rather than the object is the primary reality. Seen by this mode, our theoretical dealings with the world may seem as dated as the mythological explanations of the pre-scientific era seem to us.

## References

- Barfield, O. 1965, *Saving the Appearances: A Study in Idolatry*, New York: Harcourt, Brace & World.
- Bell, J.S. 1964, On the Einstein Podolsky Rosen paradox, *Physics*, 1: 195–200.
- Bell, J.S. 1966, On the problem of hidden variables in quantum mechanics, *Reviews of Modern Physics*, 38: 447–452.
- Bell, J.S. 1990, Against ‘measurement,’ *Physics World*, August 1990: 33–40.
- Blackmore, S.J. 1986, Who am I? Changing models of reality in meditation, in G. Claxton (ed.), *Beyond Therapy: The Impact of Eastern Religions on Psychological Theory and Practice*, London: Wisdom.
- Bricklin, J. 1999, A variety of religious experience, *Journal of Consciousness Studies*, 6 (8–9): 77–98.
- Claxton, G. 1999, Whodunnit? Unpicking the ‘Seems’ of Free Will, *Journal of Consciousness Studies*, 6 (8–9): 99–113.
- Dirac, P.A.M. 1958, *The Principles of Quantum Mechanics*, Oxford: Clarendon Press.
- Feynman, R.P., Leighton, R.B., & Sands, M. 1965, *The Feynman Lectures in Physics*, Vol. 3, Boston, MA: Addison-Wesley.
- Gebser, J. 1985, *The Ever-Present Origin*, Athens, OH: Ohio University Press.
- Greenberger, D.M., Horne, M., & Zeilinger, A. 1989, Going beyond Bell’s theorem, in M. Kafatos (ed.), *Bell’s Theorem, Quantum Theory, and Conceptions of the Universe*, Dordrecht, The Netherlands: Kluwer.
- Heehs, P. 2008. *The Lives of Sri Aurobindo*, New York: Columbia University Press.
- Klyachko, A.A., Can, M.A., Binicioğlu, S., & Shumovsky, A.S. 2008. A simple test for hidden variables in the spin-1 system, *Physical Review Letters*, 101: 020403.
- Kochen, S., & Specker, E. 1967, The problem of hidden variables in quantum mechanics, *Journal of Mathematics and Mechanics*, 17: 59–87.

- Mermin, N.D. 1985, Is the Moon there when nobody looks? Reality and the quantum theory, *Physics Today*, 38 (4): 38–47.
- Mermin, N.D. 1990, What's Wrong With These Elements of Reality? *Physics Today*, 43 (6): 9–10.
- Mermin, N.D. 1993, Hidden variables and the two theorems of John Bell, *Reviews of Modern Physics*, 65 (3): 803–815.
- Mohrhoff, U. 1999, The Physics of Interactionism, *Journal of Consciousness Studies*, 6 (8–9): 165–184; B. Libet, B. Freeman, & K. Sutherland (eds.) 2000, *The Volitional Brain*, Exeter, UK: Imprint Academic.
- Mohrhoff, U. 2002, Why the laws of physics are just so, *Foundations of Physics*, 32 (8): 1313–1324.
- Mohrhoff, U. 2009a, Quantum mechanics explained, *International Journal of Quantum Information*, 7 (1): 435–458.
- Mohrhoff, U. 2009b, Objective probability and quantum fuzziness, *Foundations of Physics*, 39 (2): 137–155.
- Mohrhoff, U. 2011, *The World According to Quantum Mechanics: Why the Laws of Physics Make Perfect Sense After All*, Singapore: World Scientific.
- Phillips, S. 1995, *Classical Indian Metaphysics*, Chicago/La Salle, IL: Open Court.
- Sri Aurobindo 2005, *The Life Divine*, Pondicherry: Sri Aurobindo Ashram Publication Department.