Science and Hinduism

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"QUANTUM PHYSICS AND VEDANTA": A PERSPECTIVE FROM BERNARD D'ESPAGNAT'S SCIENTIFIC REALISM

by Jonathan Duquette

Abstract. In the last decades, several rapprochements have been made between quantum physics and the Advaita Vedānta (AV) school of Hinduism. Theoretical issues such as the role of the observer in measurement and physical interconnectedness have been associated with tenets of AV, generating various critical responses. In this study, I propose to address this encounter in the light of recent works on philosophical implications of quantum physics by the physicist and philosopher of science Bernard d'Espagnat.

Keywords: Advaita Vedānta; Bernard d'Espagnat; philosophy of physics; quantum physics; scientific realism

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The relatively recent encounter between quantum physics and Advaita Vedānta (AV) has given rise to a number of interesting debates over the last couple of years. Several proposals for dialogue and integration have been put forth, generating various critical responses. This study is an attempt to address, and in a sense reassess, this encounter in the light of recent works on philosophical implications of quantum physics by the theoretical physicist and philosopher of science Bernard d'Espagnat.

The Vedāntic tradition has its roots in the Hindu tradition of India, and stands as one of its most sophisticated philosophical and theological developments. It has greatly influenced Indian religious and philosophical schools throughout history and continues to attract a significant following all over the world. AV is the oldest extant school of Vedānta, and its foremost teacher was Śaṅkara, a philosopher who lived in India around the seventh–eighth century C.E. Like other Vedānta schools, AV is drawn primarily from the *Upaniṣads*, a group of philosophical texts considered to be an early source of Hindu religion. The term *advaita* means "nondual," and thus AV holds the view that distinctions between things, individuals,

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and Absolute are *ultimately* unreal, and that only one Reality exists, namely *Brahman*, which is conceived as the nondual substratum that runs through all external and internal phenomena. The most important tenet of AV is the essential identity between *Brahman* and the innermost self (*ātman*), whose knowledge is conducive to spiritual freedom or liberation (*mokṣa*). In this school, liberation cannot be acquired on the outside because it is the actual essence of one's being arising once ignorance about the self is removed or destroyed.

Toward the end of the nineteenth century, the Hindu monk and reformer Swami Vivekananda remarked that modern science was inevitably converging toward AV. At Chicago's Parliament of Religions in 1893, he declared that the latest discoveries of science seemed like "echoes" of the "high spiritual flights of the Vedānta philosophy" (Vivekananda 1893). A few years later, after his stay in the West, he added: "It seems to us, and to all who care to know, that the conclusions of modern science are the very conclusions the Vedānta reached ages ago; only, in modern science they are written in the language of matter" (Vivekananda 1897). Although neither quantum physics nor Einstein's relativity—the two pillars of modern theoretical physics—was yet in place at that time, the vision of Vivekananda inspired future generations of Vedānta monks and scholars to pursue some form of reconciliation between modern physics and AV (Jitatmānanda 1986; Mukhyānanda 1997). Another and later influential figure was Fritjof Capra, an Austrian-born American physicist famous for his bestseller *The Tao of Physics* (1975), where he draws a series of "parallels" between modern science and what he calls "Eastern mysticism." In his view, Eastern mysticism—referring here to Hinduism, Buddhism, and Taoism—would provide "a consistent and beautiful philosophical framework which can accommodate our most advanced theories of the physical world" (Capra [1975] 1991, 12). Capra particularly emphasizes parallels with quantum physics, the branch of physics concerned with the basic structures and processes of matter on the atomic and subatomic scales. His attempts to blend principles of quantum physics with doctrinal points of AV were followed by a number of scientists (Chandrasekharayya 2006; Dobson 1983; Goswami 1995; Panda 2005).

Claims of compatibility with AV generally involve two main theoretical issues in quantum physics: (1) the role of the observer in measurement, and the posited implication that consciousness (or mind) would be fundamental to our description of reality; (2) the wholeness of physical reality, that is, the idea that the universe is an undivided whole in which everything is interconnected. Conflating the aforementioned, some authors have held that quantum physics corroborates the Advaita notion of a nondual, undifferentiated, and ubiquitous principle of existence and consciousness called *Brahman* underlying the plurality of phenomena. Naturally, such and similar claims have given rise to a number of criticisms from a number of scholars and scientists (Barbour 1997; Scerri 1989; Stenger 1995; Wilber

1982a). In her book *Prophets Facing Backward*, Meera Nanda describes parallels established between modern physics and AV as:

> . . . most radical declarations that respect neither the integrity of physics nor the authenticity of mysticism that is the heart of Vedānta: physics is turned into mysticism and Vedānta is made to sound as if it were chiefly concerned with understanding the material world, which it never was. (Nanda 2004, 108)

Nanda refers to declarations made by representatives of the Hindutva ideology who would invoke convergence between Vedānta and natural sciences to promote the superiority of Hinduism over other religions. The intent behind such declarations, she says, is not a genuine encounter of Vedāntic thought and modern science but the "creation of a science of nature that does not contradict the sacred teachings of the Vedas" (Nanda 2005, 27). Apologetics for either science or religion indeed constitutes an important aspect of "science and religion," as a number of scholars have aptly demonstrated (Drees 2010; Restivo 1983). But one could also engage a dialogue between modern physics and AV in order to pursue constructive philosophical reflection at their intersection. The present study is a humble attempt in this direction. Assuming that recent studies on "quantum physics and Vedānta" have not duly considered works by philosophers of physics, it aims to demonstrate that it is worthwhile, and hopefully refreshing, to explore how these two disciplines meet in philosophical terms.[1]

The shift toward the philosophical dimension of this encounter is partly motivated by recent advances in modern physics. Quantum physics in particular has given new shape to philosophical ideas on the nature of matter, physical interaction, determinism, and measurement. Especially significant are recent insights into the phenomenon of nonseparability, which have led some philosophers of science to reinvestigate the old problem of *realism* in science and propose new models of scientific realism reevaluating the nature of reality disclosed through scientific knowledge. Though articulated in a different context, the problem of reality and its epistemic access have also occupied the minds of Vedānta scholars.

Relying on the views of theoretical physicist and philosopher of science Bernard d'Espagnat, a leading authority in the interpretation of quantum physics, this study argues that philosophy of physics and AV overlap to some extent in their understanding of reality as a whole, but differ in their definition of the nature and place of "consciousness" in reality. Such a nuanced encounter may open the door to a renewed inquiry into philosophical problems recently posed by science while also providing an alternative background against which to reassess "parallels" between modern physics and AV.

The "Failure" of Physics: Questioning Reality

It is well known that founders of quantum physics such as Erwin Schrödinger, Werner Heisenberg, and Niels Bohr knew to some extent

about South and East Asian religions.[2] Schrödinger, for his part, was conversant with the writings of German philosopher Arthur Schopenhauer—himself deeply involved in Buddhism and the philosophy of the *Upaniṣads*—and German orientalists such as Paul Deussen, Richard Garbe, Max Müller, and others. He was especially interested by AV, which he described as a "foundation for his life and work" (Moore 1989, 173). In 1925, Schrödinger published a book called *Meine Weltansicht* (*My View of the World*) where he suggests that AV might provide an adequate metaphysical grounding and religious framework to modern Western civilization (Ibid., 168). Such interest for Asian religions from the part of physicists has often been taken as an indication that the worldview derived from physics conjugates with that of Asian religions. But most physicists of that period believed it was wrong to equate insights from physics with mystical and religious ideas, as Ken Wilber aptly demonstrated in his book *Quantum Questions: Mystical Writings of the World's Great Physicists*. Relying on the writings of the foremost physicists from the last century on mysticism, religion, and philosophy, Wilber concludes that it is "the radical *failure* of [the "new"] physics, and not its supposed similarities to mysticism, that paradoxically led so many physicists to a mystical view of the world" (Wilber 1982a, 10). What does Wilber mean by "failure"? He means that, in contrast to those of the previous era, physicists dealing with the "new physics"—that is, quantum physics and Einstein's relativity—were forced to recognize that physics is *necessarily dealing with shadows and illusions, and not reality as it is.*

In the 1920s, at the time when quantum physics was being created, British physicist Arthur Eddington said that "the frank realization that physical science is concerned with a world of shadows is one of the most significant of recent advances" (1929, 282). Three decades later, this insight was reiterated by Schrödinger in his book *Mind and Matter*:

> Please note that the very recent advance [of quantum and relativistic physics] does not lie in the world of physics itself having acquired this shadowy character; it had ever since Democritus and Abdera and even before, but we were not aware of it; we thought we were dealing with the world itself. (1959, 42)

Here Schrödinger means that this "shadowy character" is not peculiar to quantum physics but appertaining to any scientific enterprise. However, the epistemological changes entailed by quantum theory bring it into light. Quantum physics literally shattered in three decades the classical picture of the world and its underlying epistemology. Since it deals with very small systems, interaction between measuring device and observed system takes a crucial importance in this theory. For many physicists, it became clear with the required interaction in measurement that physics deals in essence with a *mediate reality*, that is, a reality filtered through sense organs and conceptual models. As British physicist Sir James Jeans explains:

> Many would hold that, from the broad philosophical standpoint, the outstanding achievement of twentieth-century physics is not the theory of relativity with its welding together of space and time, or the theory of quanta with its present apparent negation of the laws of causation, or the dissection of the atom with the resultant discovery that things are not what they seem; it is the general recognition that we are not yet in contact with ultimate reality. We are still imprisoned in our cave, with our backs to the light, and can only watch the shadows on the wall. (1931, 111)

This might be an important lesson the great physicists of the last century left us. Physics' ability to observe "shadows on the wall" hardly has anything to do with mysticism—a direct and nonmediate approach to reality.[3] Paradoxically, as Wilber's analysis suggests, this lesson has an "opening power": it might be the deep understanding that science has no access to the "Real"—or "ultimate reality" in Jeans's words—but only to *representations* of the "Real," that led some physicists to appreciate other ways of conceiving reality such as those featuring in Asian religions. Thus, insights into quantum physics led early quantum physicists to raise foundational questions about the true nature of reality and the scope of scientific knowledge, an indication that "realism" shifted at that time from a "purely philosophical" problem to a central issue of scientific epistemology.

Bernard d'Espagnat's Scientific Realism

In the next decades, physicists and philosophers of science would continue to question the nature and pertinence of scientific realism in the light of new discoveries in physics. In the philosophical sense of the word, "realism" involves the notion of reality-in-itself, that is, a reality conceived as totally independent of our possible means of knowing it. Every realist conception also involves the belief that we can build a representation of reality on the basis of our experience. This representation is of a varied nature, and thus we find different versions of realism in science. Bernard d'Espagnat figures among the rare physicists who have reflected on the question both as physicist and as philosopher of science. In his book *On Physics and Philosophy* (2006)—hailed by the physicist Roland Omnès as "surely the most complete book to have been written on this subject [quantum physics] and one likely to last a long time. . ."—d'Espagnat discusses whether realism still has relevance in contemporary physics. He concludes saying that quantum physics features are conducive to the adoption of a particular version of scientific realism he calls "veiled realism."

D'Espagnat makes the claim that reality as a whole is at least composed of two distinct "levels of reality": *empirical reality*, which refers to the set of phenomena accessible through the totality of human experience; and *ontological reality*, or reality-in-itself, "what exists independently of our existence" (2006, 4). D'Espagnat defines the quantum physics statements as

weakly objective, as opposed to classical physics' *strongly objective* statements. While the latter refer to things-in-themselves without reference to human agency, the former statements involve the notion of an observer—but in such a form that they are implicitly true for any observer.[4] Because it essentially involves human interaction, quantum physics is not concerned with reality-in-itself but only with empirical reality. As d'Espagnat explains, extending his conclusions to science in general:

> I think that our scientific knowledge finally bears, not on reality-in-itself—alias "the Real," alias "the ground of everything"—but just on empirical reality, that is, on the picture that, in virtue of its structure and finite intellectual capacities, the human mind is induced to form of reality-in-itself.[5]

In other words, quantum physics is not dealing with "objects-per-se" but with representations—conceptual, symbolic, or mathematical—of these objects. Electrons, quarks, and their composite objects cannot be thought of as "self-existent" entities. That is not to say, however, that reality is a purely mind-made construct as radical idealism would believe, and that there is no place in d'Espagnat's thought for reality-in-itself. In fact, over against antirealists and idealists, he argues for what he calls *open realism*, a view that considers "there is something the existence of which does not hinge on thought" (d'Espagnat, 2006, 28). One argument in favor of open realism is that some laws of physics are still valid despite changes in physical theories, and that descriptive and predictive laws of physics have been discovered, not invented. Although scientists shape the laws of physics in some ways (let us think of the different versions of Maxwell's equations), laws cannot be *arbitrary*. In other words, "the physical laws do not totally depend on us, which means that they depend on something else" (Ibid., 118).

Another argument advocating for open realism derives from d'Espagnat's analysis of Bell's theorem and nonseparability in quantum physics. Nonseparability appeared for the first time in a series of rigorous experiments conducted by the French physicist Alain Aspect in the early 1980s. These experiments aimed to test the predictions of John Bell's theorem formulated in 1964. The theorem was itself a response to questions raised by the famous EPR thought experiment proposed in 1935 by Albert Einstein, Boris Podolsky, and Nathan Rosen. To put it simply, nonseparability states that two (or more) particles originating in the same "quantum state" are linked in such a way that the quantum state of one particle cannot be adequately described without full consideration of the other particle(s), even when the particles are spatially separated. The correlated particles behave as if each particle is instantaneously aware of the measurement obtained on the other(s), and adapts accordingly. Different interpretations of this puzzling phenomenon are possible. In line with Niels Bohr and others, d'Espagnat holds that nonseparability implies that

prior to measurement it is impossible to ascribe individual properties to systems that have interacted. The particles constitute a single correlated whole: "nonseparable" from each other, they remain so until measurement "separates" them. Individuality is not an objective feature of reality but only a manifestation of the observer's knowledge of reality. An alternative explanation, first suggested by David Bohm, is that particles are individual entities that can somehow "communicate" with each other at a distance via an *implicate realm* or *implicate order* (Bohm 1980). Though Bohm's theory remains a good candidate for the explanation of nonseparability, d'Espagnat's interpretation (which is in line with the orthodox Copenhagen interpretation on several points) remains the one favored by the majority of physicists today. It is important to note that nonseparability is a property that remains valid independently of any theory (d'Espagnat, 2006, 51). This means that were quantum physics to be replaced in the future by some other theory based on different concepts, the implications of nonseparability would still be valid.

The philosophical implications of nonseparability are far-reaching. Firstly, since nonseparability holds that the universe cannot fundamentally be constituted of separate entities, we must come up with the concept of *empirical reality*. If we hold to the view of naïve realism, according to which what we apprehend are things-in-themselves, we can hardly explain why at the level of observable phenomena everything occurs as if the universe was constituted of parts isolated from each other. Thus, it appears necessary to cast naïve realism aside, and look into the prospect of an empirical reality, that is, a reality envisaged as a set of perceived and "constructed" phenomena. Secondly, since most of empirical reality phenomena exhibit no features that qualify as "nonseparable," we are compelled to introduce the notion of a mind-independent reality—an *ontological reality*—not constituted of distinct parts (d'Espagnat, 2006, 4). In d'Espagnat's view, we have to consider at least two "levels" or "orders" of reality, ontologically distinct from each other.[6]

To be sure, d'Espagnat does not claim ontological reality as a kind of inseparable and positive whole interconnecting everything. In fact, he is reluctant to ascribe any positive attribute to ontological reality because he sees the implications of Bell's theorem as essentially *negative*:

> . . . Bell's theorem does not infer from the phenomena the existence of some property that, transcending the said phenomena, would be ascribable to mind-independent [i.e., ontological] reality. It merely shows that if we build up too naive a representation of the latter . . . we get results that experiment falsifies. Aiming at changing this essentially negative statement into a positive one might well result in a description of some alleged property of mind-independent reality. For the above stated reasons, such a move would not be justifiable. (d'Espagnat, 2006, 78–79)

D'Espagnat situates ontological reality beyond the scope of scientific inquiry. Science cannot make any cognitive claim about reality-in-itself

because its domain of inquiry is strictly restricted to empirical reality. He emphasizes that in virtue of nonseparability, reality-in-itself cannot be separated into distinct parts by thought; otherwise, it would amount to nothing less than empirical reality. What "really is" can only be described indirectly with negative statements such as "not constituted of parts" and "not conceptualizable" (d'Espagnat, 2006, 455).

Here it could be pointed out that ontological reality remaining far beyond the reach of scientific knowledge, there is nothing else to be said about it. As opposed to phenomena, ontological reality would be akin to Kant's noumenon, an unknown and unknowable "something" forever concealed to empirical knowledge. But d'Espagnat does not hold true that reality-in-itself is *totally* unknowable. He argues instead that reality is "veiled," not hidden in the Kantian sense, and that science *can* get glimpses of reality's "structure" through the great physical and mathematical laws we find valid. When reality-in-itself "resists" certain theories making them false, we acquire knowledge about this reality in a negative manner. For d'Espagnat, this is the kind of knowledge nonseparability refers to when, for instance, it holds that reality-in-itself *cannot* be constituted of parts. D'Espagnat's "veiled realism" is thus in line with open realism, but brings it further because it endows the "Real" with some kind of general structural traits available to scientific inquiry. In contrast with Kant, d'Espagnat leaves room for a "beyond" or some form of transcendence *in science*. Science might not be in a position to totally comprehend what lies "beyond" empirical reality, but it does reveal the profound mystery at the core of our existence. This mystery is what d'Espagnat calls "veiled reality": the "ground of things," reality-in-itself or Being, which is existent yet whose hidden structures and qualities are not totally accessible to scientific knowledge. It is "something" toward which the mind constantly *tends* with wonder—through science, spirituality, and perhaps arts such as poetry and music—but never fully reaches, and which therefore, "same as horizon, partakes of transcendence" (d'Espagnat, 2006, 463).

But not all physicists and philosophers of science are realists in the sense of Bernard d'Espagnat. Among others, philosophers of science Michel Bitbol and Hervé Zwirn have criticized d'Espagnat's "veiled realism." Bitbol does not believe that quantum physics, and science in general, can "grasp" in any sense the general structural features of reality-in-itself. Since knowledge is *a priori* relative to something, scientific inquiry must be in *relation* with reality-in-itself, which amounts to say the latter is identical with empirical reality (Bitbol 1998, 101). Hence, Bitbol tends to dismiss the very concept of a prestructured and independent reality. Zwirn admits the need for "something" along the lines of open realism but hesitates to ascribe it some kind of "existence," the way d'Espagnat equates his "veiled reality" with Being. If there is "something" beyond empirical reality, it cannot be spoken of, even in terms of "existence": it can only be characterized negatively, or pointed to, in a metaphoric manner (Zwirn 2000, 365).

D'Espagnat's "Coemergence" and Consciousness

At this time, quantum physics supplies the most fundamental scientific description of the material world. Since consciousness seems physically correlated to the material brain, it is relevant to examine how quantum physics can contribute to an understanding of consciousness and other mental phenomena. Several quantum approaches to consciousness have been put forth in the last decades, and some of them have given consciousness a prominent role for the explanation of certain features in quantum physics. Quantum theory claims that prior to measurement the wavefunction of a quantum system evolves into a linear superposition of different states, but that actual measurements always find the system in a definite state. Several attempts have been made to understand how this transition takes place. One approach, initiated by von Neumann (1955) in the 1930s and later taken up by Wigner (1967), correlates conscious acts and wavefunctions to explain how the "collapse" to a single state actually occurs. Since nothing can "measure" consciousness—self-awareness being self-sufficient—only the conscious act of observation can complete quantum measurement and collapse the wavefunction. More recently, Stapp (1993, 1999) has also championed this approach while proposing that intentional psychological acts are correlated to reductions of superposition states of neuronal assemblies. Along similar lines, Amit Goswami has proposed (1995) that the collapse could be explained by a nondual type of consciousness as featured in AV.

In turn, a number of models have used quantum theory (and particularly the randomness of quantum events) to account for specific neuronal processes. Ricciardi and Umezawa (1967), and more recently Vitiello (2001, 2002), have conjectured that memory states could be conceived in terms of vacuum states similar to those of quantum field theory. Beck and Eccles (1992) and Beck (2001) have tried to explain how information circulates between neurons in chemical synapses using the statistical features of quantum theory. The scenario developed by Penrose and Hameroff in the 1990s follows similar lines. Based on the assumption that the brain cannot be driven solely by (computable) algorithms, Penrose (1989) argued that only the randomness associated with wavefunction collapse can account for brain processes. With Hameroff, Penrose later proposed that microtubules within neurons could explain how quantum processing actually takes place in the brain (1994). Nonalgorithmic conscious events would be neurophysiologically induced through gravitation-induced reductions of quantum states in microtubules. Although the idea of a nonalgorithmic consciousness is certainly worth considering, the model proposed by Penrose and Hameroff remains highly speculative until a full-blown theory of quantum gravity is developed.

Most of these models rely on two assumptions: (1) consciousness (or mind) and matter (brain, neurons, synapses) are essentially two

distinct realities, ontologically unrelated to each other; (2) matter has primacy over conscious events (except perhaps in Goswami's model) so that consciousness is either identified to some material structure internal to or involving neurons, or envisaged as a sophisticated product of neuronal activity. However, other approaches reject the primacy either of matter or consciousness, and consider instead "mental" and "material" as ontologically unseparated aspects of an underlying reality. Proposals along these lines have been put forth by Jung and Pauli (1955), Bohm and Hiley (1993), and Primas (2003); d'Espagnat's "coemergence" model would fall under this category as well.

In Chapter 18 of his book *On Physics and Philosophy*, d'Espagnat discusses consciousness and its place in veiled realism. He first argues, in line with Chalmers (1996), that even if all mental events were given adequate neurophysiological explanations, there would still be a "radical conceptual gap" between those events and one's own conscious experience (d'Espagnat 2006, 412). For d'Espagnat, this means that should an understanding of the physical correlates of consciousness be available, an appropriate description of human subjectivity (thoughts, will, emotions) would not be entailed directly. He further argues that all parts of the body, including neurons, are essentially elements of empirical reality (assuming that quantum physics can be applied to macroscopic objects as well). Neurons, synapses, etc. are *weakly objective* components of reality, that is, they cannot be considered as objects-per-se. Consequently, since empirical reality, as a *representation* of reality-in-itself, is *a priori* relative to consciousness, it cannot possibly generate the latter or be identified with it, as suggested in the models above. But this does not mean that consciousness has primacy over empirical reality. States of consciousness involved in quantum measurements are also *relative* insofar as they constitute "points of view" adopted by different observers in different contexts.[7] In d'Espagnat's view, neither the phenomena apprehended nor states of consciousness involved in measurement are absolute: they exist in relation to each other, or "generate" reciprocally one another (2006, 424).

That empirical reality is "generated" from consciousness is easily understood—from its definition as the set of things, events, etc. "built up" with sense organs and reasoning—but it appears misplaced to claim that consciousness is "generated" from empirical reality given that d'Espagnat rejects the idea of consciousness being the same as neuronal processes (which are part of empirical reality) or their outcome. How could appearances to consciousness generate consciousness itself? Besides, d'Espagnat notes that one should understand "generation" (French *engendrement*) as an allegory, and that "coemergence" better conveys his ideas. In his words, "coemergence is to be thought of as (atemporally) taking place out of a 'mind-independent reality' [i.e., ontological reality] that itself presumably lies beyond our intersubjective abilities at describing"

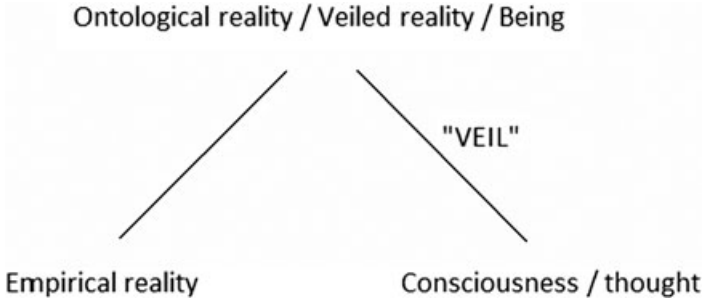

Figure 1. Bernard d'Espagnat's "Coemergence" Scheme.

(d'Espagnat 2006, 425). Empirical reality and states of consciousness featuring in measurement coemerge from ontological reality. As the ground for scientific laws characterizing empirical phenomena, ontological reality precedes empirical reality (in a conceptual sense). In turn, specific states of consciousness take their source in ontological reality because different observers can agree on the same "observed" experimental results. In d'Espagnat's veiled realism, the "veil" does not lie between the two cogenerated terms but between consciousness and ontological reality (2006, 388) (Figure 1).

D'Espagnat's proposal hardly belongs among the approaches that give primacy to matter over consciousness; its place would rather be with approaches that consider mental and material as "dual" aspects of an underlying reality. Although nothing about this underlying reality is positively stated in d'Espagnat's model, his notion of "coemergence" clearly suggests that consciousness and matter (empirical reality) are unseparated aspects, or manifestations, of a single reality. However, "dual-aspect" approaches based on insights from quantum physics remain unsatisfactory from a scientific perspective. Highly speculative, they do not provide any concrete scenario to understand consciousness as a physically correlated phenomenon. But if they do not break new ground scientifically speaking, d'Espagnat's views offer an interesting way to integrate consciousness in a philosophical framework that takes into account foundational problems related to "reality" in quantum physics.

Levels of Knowledge and Reality in AV

Reality, knowledge, and consciousness are interrelated in Vedāntic thought as well. On the basis of *Upaniṣads*, AV presents a hierarchical conception of knowledge and reality closely intertwined with notions of consciousness. In the *Muṇḍaka Upaniṣad* (I.1.4), we are told "there are two kinds of knowledge (*vidyā*) to be attained, the higher (*parā*) and the lower (*aparā*)." *Parāvidyā*, the "higher" knowledge, is that of the Absolute, *Brahman*, which is nondual (*advaita*) and pure consciousness (*cit*). *Aparāvidyā*, the "lower"

knowledge, is knowledge of the empirical world—objects, events, means, ends, causes, effects, and so on. Though this passage is originally set forth in a ritualistic context, its epistemological implications are clear: knowledge of the world is incommensurable with knowledge of the Absolute. *Brahman*-knowledge is *sui generis*, reached all at once, immediately. Ultimate reality, says an *Upaniṣad*, is "that which is direct and immediate" (*Bihadāraṇyaka Upaniṣad* [BrU] III.4.1) because it is identical with pure or nondual consciousness. Since pure consciousness cannot be an *object* for itself, no mediation is involved in *parāvidyā*. In contrast, empirical knowledge is acquired progressively through means of knowledge (*pramāṇas*) such as sense perception, inference, etc. What is involved here is not pure consciousness but an "individualized" consciousness facing the world of phenomena. The soteriology of AV holds that knowledge of *Brahman* should prevail over empirical knowledge because only the former leads to liberation.

This conception of knowledge is reflected in a hierarchical metaphysics set forth in terms of qualitatively different domains or levels of reality. Śaṅkara explicitly refers to three such domains: (1) *pāramārthika*: the "real," absolute, or nondual Reality, *Brahman*; (2) *vyāvahārika*: the "empirically real," apparent, or transactional reality, associated with worldly entities and processes; (3) *prātibhāsika*: the "unreal," associated with illusory objects such as hare's horns, square circle, etc. By definition, what is real cannot be sublated (or contradicted = Sanskrit *bādha*) by any other knowledge or experience; what is empirically real can be sublated by another knowledge or experience; and what is unreal neither can nor cannot be sublated by another knowledge or experience (Deutsch [1969] 1973, 15). *Brahman* is the only existent that cannot be sublated for it is pure consciousness (*cit*), and consciousness cannot be denied without the aid of consciousness; thus, it stands as the only "real." The horns of a hare or a square circle are illogical constructs that neither can nor cannot be sublated by any other experience; they are "unreal." As for the empirical world, it falls into the second domain for it is neither absolutely real (the knowledge of *Brahman* sublates it) nor unreal (since it appears as an objective datum of experience). It has an apparent (*mithyā*) or transactional reality because its existence is ultimately dependent upon *Brahman*. How absolute and transactional reality become interrelated, and therefore confused with one another, is a central epistemological problem for Advaitins.

Brahman's Unknowability

Brahman is often described as *sadasadbhyām anirvacanīya*, which literally means "indeterminable as to whether it is or is not." *Brahman* is nondual and it would be a mistake to describe it as either existent or not.

Taittirīya Upaniṣad (TU) II.4.1 is a locus classicus for the unknowability and consequent inexpressibility of *Brahman*: "Before they reach it [*Brahman*], words turn back, together with the mind." In a similar fashion, the *Kena Upaniṣad* (I.4–5) describes *Brahman* as something "far different from what's known . . . and farther than the unknown" and as that "which one cannot express by speech." *Brahman* cannot be perceived, described, or thought of in any way. *Brahman* is not a concept or a personal being, but that which "is" when subject/object distinctions are obliterated. Hence, *Upaniṣads* often refer to *Brahman* by stating what it is not rather than what it is: "neither short nor long" (BrU III.8.8), "other than cause and effect" (*Kaṭha Upaniṣad* [KU] I.2.14), "without an inner and an outer" (BrU II.5.19), etc. As the Upaniṣadic sage Yājñavalkya says in BrU II.3.6: "There is no other or better description [of *Brahman*] than this; that it is *not-this*, *not-this* (*neti neti*)." In AV, the "real" is without any quality or attribute (*nirguṇa*) and as such is nothing the mind can actually think or conceive of.

In some passages, *Brahman* is described as being (*sat*) and consciousness (*cit*), and sometimes bliss (*ānanda*). If being points to the ontological principle of unity embodied by *Brahman*, which is the substratum that runs through external as well as internal phenomena, consciousness points to the underlying principle of awareness that informs being. Consciousness and being do not exist side by side in *Brahman* but are alternate descriptions of it. As identical with *Brahman*, consciousness is eternal, pure, something that transcends phenomena. But consciousness also occurs in the empirical realm and as such is described as "witness-consciousness" (*sākṣin*). Witness-consciousness stands as the basic presupposition and pure element of awareness in all individual knowing. It is implied in every act of knowing and yet is different from the object known. Witness-consciousness is the ultimate subject, nondifferent from *Brahman*. It is one, immutable, indivisible but appears to be different from *Brahman* on the account of ignorance (*avidyā*). Accordingly, witness-consciousness is different from the empirical individual (*jīva*) who senses, feels, thinks, and knows (Gupta 1998, 18).

However, positive attributes of being and consciousness are not intended as adjectives or epithets of *Brahman* but as indirect expressions of its essence. Terms such as *sat*, *cit*, and *ānanda* are traditionally used to *exclude* ideas of nonbeing, materiality, and imperfection with regard to *Brahman*, and not to define *Brahman* per se (Satprakashananda [1965] 2005, 199). As an example, we are told in TU II.1.1 that "*Brahman* is truth, knowledge and infinite" (*satyam jñānam anantam brahma*). In his commentary, Śaṅkara holds that words such as *satyam*, *jñānam*, etc. serve only to "differentiate *Brahman* from other entities that possess opposite qualities." The paradox encountered by Advaitins in the attempt to describe the indescribable *Brahman* is well rendered by K. Satchidananda Murty:

> While no description is possible of *Brahman*, the task of the Vedānta is to teach about it, and so logically speaking it is an impropriety; but only in this way can the Vedānta emphasize the mystery of *Brahman*, which eludes all objective language; and yet it can be dealt with only in that way if *Brahman* has to be talked about intelligibly. While thus to talk of *Brahman* is a verbal impropriety, this impropriety is mitigated by means of qualifying epithets, which attempt to reduce or remove the spatio-temporal elements in experience, by either enlarging our conception or narrowing it down. (Murty [1959] 1974, 57)

Murty indicates that the positive descriptions of *Brahman* in the Upaniṣadic-Vedāntic tradition are not so much ontological as experiential: they are meant to direct the seeker's mind toward *Brahman* by "affirming essential qualities that are really only denials of their opposites" (Deutsch [1969] 1973, 11). This methodology makes sense in a system that recognizes empirical knowledge cannot disclose the nature of the "real." An indirect approach is indeed required "to aid those who are searching for *Brahman* but have not yet realized it" (Ibid.).

Discussion

The point of departure, and also the purpose of AV teachings is the profound realization that one's inner self is wholly identical with *Brahman*. *Brahman*-knowledge (or self-knowledge, *ātmavidyā*) is the means (*sādhana*) to the attainment of spiritual freedom (*mokṣa*). Thus, *Brahman* must be taken into consideration for an authentic exchange to develop between AV and modern physics. In this context, it seems all the more relevant to acknowledge the *nonconceptualizable* dimension of *Brahman* given that d'Espagnat's scientific realism also includes such dimension. For d'Espagnat, indeed, scientific knowledge "bears just on empirical reality," that is, on the various representations one makes of ontological reality. Ontological reality is strictly beyond the scope of empirical knowledge because it is nonconceptualizable, not to be apprehended by thought. Similarly, *aparāvidyā* or "lower knowledge" in AV cannot unfold *Brahman*-knowledge because it is based on the dualistic apprehension of objects, events, etc. whereas nondual *Brahman* cannot be an object of thought. Besides, it is remarkable that both systems validate the use of negation—or *via negativa*[8]—as the most appropriate way to describe nonconceptualizable reality. The ways Advaitins emphasize the "impropriety" of ascribing *Brahman* with positive attributes are strikingly akin to d'Espagnat's reluctance to make positive statements about ontological reality.

D'Espagnat's scientific realism and AV make similar claims when it comes to defining the nature of reality as a whole and its epistemic access:

(1) reality is hierarchically structured; it is divided into empirical (or *vyāvahārika*) and ontological (or *pāramārthika*) "levels" or domains of reality;

(2) empirical knowledge (or *aparāvidyā*) has as its content the reality "built up" through sense perception and reasoning, that is, empirical reality (or *vyāvahārika*);

(3) there is a nonconceptualizable element in the structure of reality (ontological reality or *Brahman*) to which empirical knowledge has strictly no access;

(4) from the standpoint of empirical knowledge, *via negativa* is the most adequate way to describe this nonconceptualizable element.

The basic claim in d'Espagnat's coemergence model—that (individual) consciousness and empirical reality (conceptually) coemerge from ontological reality—finds its equivalent in AV in that *Brahman* is envisaged as the fundamental reality underlying both physical and psychical realms. On the one hand, the multifarious external phenomena are grounded in the unity of being that is embodied by *Brahman*. On the other hand, as identical with pure consciousness, *Brahman* is the substratum that runs through all kinds of conscious states experienced by the individual. In that broad sense, "dual-aspect" quantum approaches to consciousness would also share some commonality with AV. However, there is divergence on more specific issues. AV is in line with naïve realism regarding its conception of empirical reality. The objects perceived are conceived as concrete entities existing *independently* of the individual mind and senses, which apprehend objects directly as they are (Satprakashananda [1965] 2005, 66). In contrast, coemergence implies a reciprocal relationship between empirical reality and consciousness; the world perceived is not independent of but "built up" and "generated" out of sense perception and reasoning. Moreover, when d'Espagnat discusses consciousness, he means individual consciousness (especially featuring in quantum measurement) and not the pure, undifferentiated, and "cosmic" kind of consciousness featuring in AV. For d'Espagnat, consciousness "emerges" from ontological reality and is not fundamentally identical with it as in AV. Accordingly, it also differs from the Advaitic "witness-consciousness" insofar as the latter, though it underlies every individual act of knowing, is essentially nondifferent from *Brahman*.

Another point of divergence concerns the epistemic access to the nonconceptualizable element of reality. Can reality be known at all, and if so, how? D'Espagnat holds that ontological reality is "veiled" and not hidden, which involves the conjecture that the universal laws of physics are "highly distorted reflections—or traces impossible to decipher with certainty—of the great structures of the 'the Real'" (d'Espagnat 2006, 455). Thus, ontological reality is structured whereas *Brahman*, by virtue of its nondual nature, is neither structured nor structureless. On this specific point, Hervé Zwirn's conception of a radically unknowable and indescribable "something" seems closer to *Brahman* than d'Espagnat's ontological reality. Also, d'Espagnat's vague "glimpses" of the structures

of the Real through the intermediary of the laws of physics is at variance with AV in that *parāvidyā* is incommensurable with *aparāvidyā*. Empirical knowledge is of no avail to attain knowledge of *Brahman.* However, and this is another departure from d'Espagnat's thought, knowledge of the nonconceptualizable *Brahman can* be fully gained according to AV. Whereas veiled reality, "same as horizon," always remains a mystery beyond the scope of scientific knowledge, *Brahman*-knowledge can be unfolded through an adequate spiritual practice. Through proper ethical discipline, reflection, and meditation, *Brahman* can be realized in the immediate, intuitive, and nonconceptual experience of one's innermost self. It is significant that d'Espagnat relies on specific scientific results of quantum physics to infer his notion of ontological reality. Here, knowledge of the world is conducive to knowledge of the "nonconceptualizable," though there is ultimately no positive truth claim about the latter.

Conclusion

The attempts to bring quantum physics and AV into dialogue have rather neglected the philosophers of science standpoint on the assumptions, foundations, and implications of physical theories. Thus, the present study aimed to offer a new perspective to this encounter on the basis of Bernard d'Espagnat's recent philosophical analysis of quantum physics. Not all philosophers of science share the views of d'Espagnat, yet his interpretation of quantum physics undoubtedly stands today as one of the most lucid and worthy of attention from both the scientific and the philosophical standpoints. His scientific realism suggests two potential areas where a consistent philosophical exchange with AV could take place, namely "reality" and "consciousness." We brought to light a number of meeting points relative to the structure of reality as a whole and to its epistemic access; we also brought forward a few divergences regarding the nature and place of consciousness in their respective scheme of reality. From a comparative philosophical perspective, it is significant that quantum physics and AV face similar epistemological issues in their attempt to define the nature of reality. Here, two distinct traditions of knowledge confront a similar problem but approach it along different lines and with different purposes. To appreciate these differences could only enrich the parties involved insofar as it provides alternative possibilities in philosophical reflection and therefore allows for a dialogue free from the conceptual constraints of specific traditions (Krishna 1988, 83).

Such a nuanced encounter could stimulate reflections in philosophy of quantum physics in unexpected ways. For instance, the age-old debates on nonduality in the AV tradition could prove helpful to articulate the epistemological implications of a "nonconceptualizable" realm of reality in science, as implied by d'Espagnat's philosophical analysis of

nonseparability. Although it is doubtful that AV could contribute to explaining consciousness as a physically correlated phenomenon, its emphasis on "pure consciousness" could prove relevant in a philosophical context. One important question would be: can we fully solve the problem of consciousness along the lines of quantum approaches to consciousness? Indeed, most models assume the existence of consciousness and try to explain it in terms of quantum processes, or invoke consciousness to explain specific quantum processes. But such accounts of consciousness leave open the question of its very existence, that is, the fact that we experience consciousness in the first place. D'Espagnat goes in that sense when he insightfully remarks that physical correlates of consciousness are components of empirical reality that, as such, *presuppose* the existence of consciousness. The AV tradition responds to this problem by positing consciousness as the ontological foundation of reality, and by affirming that knowledge of this ontological ground of existence is achieved through appropriate spiritual methods involving meditation and contemplation. Such insights suggest that "quantum physics and Vedānta" would also benefit from additional inputs at the intersection of neurosciences, transpersonal psychology, and cognitive sciences of religion.

Notes

1. It must be clear that if we were to take a purely theological stand to AV, chances are great that several practitioners and teachers of this tradition would disagree with (or be indifferent to) our attempt, and the same would probably be true of physicists as well. Modern physics as an empirical science and AV as a theology are radically different enterprises. Both have different relations to reality; the former is about facts, description, and explanation while the latter is about metaphysical knowledge, individual transformation, and spiritual freedom. Thus, it is important to stress here the fact that we are only concerned with philosophical features of AV.
2. Niels Bohr was especially interested in Taoist philosophy, enough to choose the Taoist *yin-yang* symbol for his coat of arms. Heisenberg, famous for his Uncertainty Principle, visited Rabindranath Tagore in India in the 1930s. He later acknowledged that the deep discussions they had on Indian philosophy stimulated his own ideas in physics (found in an interview between Fritjof Capra and Renee Weber in Wilber 1982b, 218).
3. Hence, though deeply committed to AV in his personal life, Schrödinger dismissed the idea that quantum physics reveals or supports a mystical worldview. In *Science, Theory, and Man*, he declares that "physics has nothing to do with it [mysticism]. Physics takes its start from everyday experience, which it continues by more subtle means. It remains akin to it, does not transcend it generically, it cannot enter into another realm" (Schrödinger 1957, 204).
4. The central focus of quantum physics is to provide rules that yield the probabilities that if such or such measurement is made on a system prepared in such and such a way, such and such a result is obtained. Insofar as they yield results that are valid for everybody, the statements of quantum physics are objective; but insofar as these statements necessarily require human agency, they are weakly objective and not strongly objective (d'Espagnat 2006, 93–94).
5. Quoted from an article by Mathew Iredale in *The Philosopher's Magazine*, in June 2009 (http://www.philosophypress.co.uk/?p = 283, accessed January 15, 2011). The question might arise here whether quantum physics is a universal theory or not, that is, whether or not its results also apply to the macroscopic level. If not, then quantum physics is only a theory of the atomic world and its implications cannot be extended to "scientific knowledge" in general. But the facts indicate that quantum physics seems to be such a universal theory. First, the laws of quantum physics apply to practically all fields of physics, from solid-state physics to elementary particle physics. Second, it is a quite precise theory: its observational predictions have most of

the time agreed with observed facts to a high degree of accuracy. Third, there is evidence that we can express the laws of classical (macroscopic) physics in terms of a set of predictive rules, and that these rules follow from those of quantum physics. Fourth, recent studies of "decoherence" in quantum physics might explain the classical appearance of a world essentially governed by quantum rules. For these reasons, d'Espagnat and others tend to believe that the results of quantum physics can reasonably be extended to science in general.

6. If empirical reality cannot be identified with reality-in-itself, it is not mere appearance either. If it were, the results yielded by quantum physics could not be valid for everybody (what d'Espagnat calls "intersubjective agreement"). Therefore, it makes sense to use the word "reality" to designate empirical reality.

7. D'Espagnat discusses the following example involving Peter who is conducting the measurement, and Paul who is looking at an instrument pointer and registering what information he reads on the dial. When Paul observes the dial, this induces a specific and seemingly "absolute" state of consciousness in him: either the pointer is at place A or not. But for Peter, Paul's state of consciousness is unknown and undefined. For him, the system is in a state of quantum superposition because it is not yet measured: it is both in the state "at place A" and in the state "not at place A." Not being measured, the system is in a potentially predictive state. Consequently, Paul's state of consciousness is also in such a superposed state for Peter, and it will become definite for Peter only after interaction of some kind with Paul. If Paul's observation creates in his own mind a definite state of consciousness, this is not the case from Peter's angle so that states of consciousness involved in quantum measurements cannot be considered absolute (2006, 420–21).

8. The *via negativa* is often associated with Christianity and in particular with the apophatic or negative theology. This theology attempts to achieve unity with God by gaining knowledge of what *it is not* rather than what *it is*. Though God is not an issue in philosophy of physics, the term *via negativa* suits well the attempts of some philosophers of physics to describe what lies beyond empirical reality by having recourse to negative statements.

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