

# NONEMPIRICAL REALITY: TRANSCENDING THE PHYSICAL AND SPIRITUAL IN THE ORDER OF THE ONE

by *Lothar Schäfer*

*Abstract.* I describe characteristic phenomena of quantum physics that suggest that reality appears to us in two domains: the open and well-known domain of empirical, material things—the realm of actuality—and a hidden and invisible domain of nonempirical, non-material forms—the realm of potentiality. The nonempirical forms are part of physical reality because they contain the empirical possibilities of the universe and *can* manifest themselves in the empirical world. Two classes of nonempirical states are discussed: the superposition states of microphysical entities, which are nonempirical because observation destroys them, and the virtual states of material systems, which are nonempirical because they are empty. The nonempirical part to physical reality represents a predetermined and hidden order that exists before it is empirical, and the visible world is an emanation out of it. I discuss consequences for our understanding of human nature, the origin of life, and human values. Reality is an indivisible wholeness that is aware of its processes, like a Cosmic Spirit, and it reveals its awareness in the mindlike properties of elementary processes as well as in the human consciousness. Thus, one is led to G. W. F. Hegel's thesis that the Cosmic Spirit is thinking in us.

*Keywords:* Cosmic Consciousness; emanation; emergence of complexity; forms as metaphysical principle of being; German Idealism; Leibniz monads; nonempirical reality; nonmaterial entities; pre-Darwinian concepts of evolution; quantum coherence; quantum perspective of evolution; quantum reality; superposition states; transcendent order; virtual state actualization; virtual states

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Quantum physics is characterized by a certain “underdetermination by possible empirical data” (Redhead [1988] 2003, 11) that makes it difficult to arrive at a cogent view of reality. In many phenomena quantum reality

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has revealed itself as a *transcendent* part of reality—transcending, that is, human experience (Schäfer 1997; 2004; 2006a). Therefore, quantum theory must assume a “level behind the phenomena” (Cushing [1988] 2003, 30) that is inaccessible to us; it must “refer to the non-empirical in order to explain the empirical” (Nesteruk 2006). Reality has a “dual structure of potentiality and actuality” (Fischbeck 2005, 20); or even, “reality reveals itself primarily only as potentiality” (Dürr 2004, 12).

It is important to realize that the true nature of reality does not rest in the visible order of the world. Reality appears to us in two domains. One is open and visible, the other hidden and invisible. The former consists of the material things of our conscious experience. The latter consists of non-material, nonempirical forms.

The true nature of reality cannot be derived from the experience of the visible order of the world, because that order appears to us in isolated actual and material objects, whereas the supporting ground has the nature of an indivisible wholeness and represents, in the sense of Aristotelian *potentia*, the realm of potentiality in physical reality. The visible world conceals or covers up, as it were, the realm of the nonempirical forms from which it was secreted. These forms are also real, because they can manifest themselves in the empirical world and act in it.

The assumption of a realm of forms in physical reality follows from the phenomena of quantum physics, but it is not an invention of quantum physicists. Already in the sixteenth century Giordano Bruno (1548–1600) proposed about the structure of reality that there is “coincidence of matter and form, potency and act, so that being, logically divided into what it is and what it can be, is physically undivided and one” (Bruno 1998, 10). Remembering Bruno’s hapless fate illustrates the social progress that we have made: A young biologist today operating in the framework of a materialist mechanist establishment might find herself fired from her job, but she will not actually be set on fire, as Bruno was.

The reference to a nonempirical realm to physical reality has no equivalent in the classical physics of common sense. Therefore, many human beings accept only the visible part of the reality of material things and refuse to acknowledge as real anything that is nonmaterial and nonempirical. This attitude is unfortunate, because the nature of reality applies to human beings, too, and the participation in an invisible wholeness has psychological implications the denial of which can lead to pathological conditions.

It is obvious that the discovery of a nonempirical part to reality must have consequences for our views of the origin of life, its evolution, and the nature of human beings. Because the observation of the visible world cannot reveal the true nature of reality, no surface science can provide an understanding of the true meaning of the same phenomena that it otherwise so effectively brings to logical order.

The existence of a nonempirical part to reality is tacitly assumed in any religious faith. Thus, in taking the step from a mechanistic and materialistic outlook to a more enlightened view of reality, physics has dramatically changed its relationship with theology.

#### NONEMPIRICAL REALITY

The concept of a nonempirical part to physical reality seems at first self-contradictory—or is it even a scandal to suggest it in the context of the empirical sciences? How could something be real if it is not material and cannot even be experienced? However, as the following paragraphs show, entities do exist of which we can have no experience, and yet they are real because they can express themselves in the empirical world and have an effect on us.

Among the nonempirical entities we have to list all quantum systems in superposition states. The *superposition* concept denotes the characteristic ability of quantum systems to evolve in states in which a given system is in a state not of actuality but of potentiality. In such a state a particular property, such as the position in space, does not have a single actual value but a multiplicity (a superposition) of potential values (Villars 1984). For example, when an electron leaves an atom and becomes a free electron, it can evolve in a superposition of possibilities to be found in many positions in space. Thus, the system is not part of the actual (empirical) world, but it has the potential to appear in it. Such states are nonempirical because observation destroys them. In an observation, the superposition of states collapses to a single one of the states that is included in it, and that state then appears as the observed, actual one. In general, all states that observation transforms into different states are nonempirical. Degenerate states, for example (states that have the same energy), are of this kind. All attempts to make them distinguishable must first destroy their degeneracy.

Another class of nonempirical entities is found in the empty states of atoms and molecules, which quantum chemists call *virtual*. Virtual states have no empirical properties, because they are empty. There is nothing there to observe. Nevertheless, virtual states are real, because they have the potential, *potentia*, to express their logical order in the empirical world in a quantized and a priori precisely predictable way.

In the nonempirical part of physical reality we encounter a generalization of Jacques Monod's Epistemological Paradox (Monod [1970] 1972, 30), which he formulated for the biological sciences and which can be transcribed in the following way: The cornerstone of the scientific method is the postulate that nature is objective. It means that scientific description of nature must exclude any reference to final causes or purpose. In contrast to this basic postulate, the paradox of biology is that scientific objectivity obliges us to admit that, in their structure and performance, living organisms

pursue a purpose. Generalized to all of science and the current context, Monod's paradox is this: *The cornerstone of the scientific method is the postulate that all of science must be restricted to the study of empirical phenomena. Scientific empiricism nevertheless obliges us to admit that there is a nonempirical realm to physical reality.*

A simple example of a state that is destroyed by observation is the state of a free electron (an electron that moves through space without being subject to potential energy). Quantum theory predicts for such an object a state in which the probability of presence is nonzero and the same everywhere in space. We write symbolically for this probability:  $P=\text{constant}$ . In this state, an electron does not have a definite position in space (position does not have an actual value). The particle is, so to speak, nowhere. Its state is a superposition of a multiplicity of possibilities to be found in different locations in space. No empirical object can exist in such a state. Empirical objects are always somewhere. If an object is at, say, point  $a$  in the universe, the probability to find it there is equal to 1 (unity) or 100% (we write,  $P(a)=1$ ) and zero everywhere else. This is *essentially* different from the state  $P=\text{constant}$ . Indeed, if several detectors are set up in different locations in space in order to search for the electron in  $P=\text{constant}$ , all of sudden it will appear unpredictably in one of them. In this process the state  $P=\text{constant}$  is transformed into the state type  $P(a)=1$ . That is, the former is necessarily destroyed by the observation.

#### THE REVELATION OF NONEMPIRICAL ORDER IN SINGLE PARTICLE INTERFERENCE

Central to the revelation of a nonempirical order in empirical phenomena is the property of *coherence*. Coherence is the ability of single quantum entities to interfere. That ability is apparent in interference phenomena, which are always observed when the same experimental result can be achieved for a single quantum entity in different classically conceivable and indistinguishable ways.

A simple example is found in Young's double-slit experiment. When light waves run against a barrier with two slits in it, each of the slits becomes the source of elementary wavelets that spread out in all directions behind the slits and interfere with each other. Along some lines, the crests of waves coming from one slit superimpose with the crests of waves from the other. The waves reinforce, and an area of brightness results. Along other lines, crests of one will get to lie on valleys of the other, the waves cancel, and an area of darkness results. At a detector behind the slits an interference pattern is observed, a system of fringes of alternating darkness and brightness. The outcome of Young's double-slit experiment with monochromatic light is shown in Figure 1. (A more detailed description of this simple phenomenon is found in, for example, Schäfer 1997, 153.)

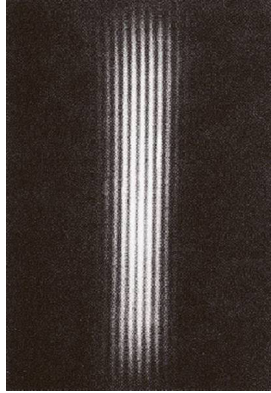


Fig. 1. The outcome of a Young's double-slit experiment with monochromatic light. Photograph courtesy Rueckner and Titcomb 1996.

When Young's experiment is performed with ordinary mass particles (such as bullets or tennis balls) that are propelled through a double slit onto some detector, the outcome of the experiment is totally different. Think of sand grains running through two openings in an hourglass. Below each opening a little pile of sand will be formed. After some time the two piles will simply merge into a single pile. There is no interference pattern because two grains of sand will always add their weight but never cancel, as waves do.

Electrons are in many ways like little bullets or sand grains. They are material particles with a definite mass, they can collide and push like billiard balls, and they always appear as localized events. When electrons are propelled onto a detector through a double slit, one by one will arrive at the detector and each will leave a tiny mark, like a little bullet. But an electron gun cannot aim its bullets at a particular spot of the detector. Aim it up, and the electron may fly down; aim low, and it may fly high. Thus, each single electron will impact the detector in a completely random and unpredictable way. But, when many seemingly random marks accumulate and coalesce, a *complex, hidden, precisely predictable, and deterministic order comes to the fore in an interference pattern*. Figure 2 shows the buildup of an electron interference pattern in the accumulation of single unpredictable and random impacts.

This is the emergence of an invisible order in a simple phenomenon: single particle interference. The accumulation of isolated and seemingly random events reveals an underlying complex order. That order is *nonempirical*, because every attempt to observe it destroys it.

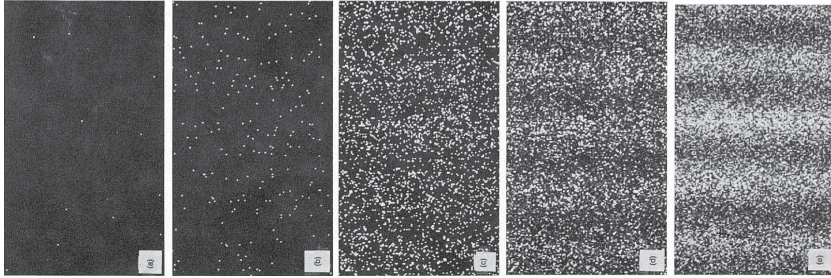


Fig. 2. The outcome of a Young's double-slit experiment with electrons that passed the diffraction apparatus in isolation. The buildup of the interference pattern is observed in the accumulation of single random events. Photos courtesy Tonomura et al. 1989, 117.

### VIRTUAL STATES

A second class of nonempirical states is found in the empty states of atoms and molecules. All material systems exist in quantum states. But every system consists not only of the state it happens to occupy when it is observed but also of countless other, invisible states that are empty. Quantum chemists call empty states *virtual states*. They are part of physical reality but, because they are empty, not of the empirical realm of physical reality.

Virtual states are mathematical forms, patterns of information, but they are more than mere formulae or ideas of mathematical forms. They have the potential—Aristotelian *potentia*—to manifest themselves in the empirical world. When a system makes a transition into a virtual state, that state becomes an empirical state. In this way the virtual states are part of the realm of potentiality in physical reality because they contain the future empirical possibilities of the universe.

In a previous paper in *Zygon* (Schäfer 2006a) I used the hydrogen atom as a simple example. I quickly review the most important points here because my presentation will change in a subtle but important way. Schrödinger's version of quantum theory can be used to calculate the states of the hydrogen atom (H-atom). Because Schrödinger's equation has the form of a wave equation, its solutions often are referred to as *wave functions*. Other terms can be used interchangeably, such as *state vectors* or *state functions*, and, because the electrons at one time were thought to be in orbit around the nucleus in an atom, electronic states in atoms are also referred to as *orbitals*. For the H-atom, the solution of Schrödinger's equation yields infinitely many states and infinitely many wave functions, of which each depends on three quantum numbers  $n$ ,  $l$ , and  $m$ . We write symbolically  $\Psi_{n,l,m}$  for H-atom orbitals. Every mathematically allowed combination of the three numbers defines a state with its characteristic wave form,  $\Psi_{n,l,m}$  which in turn determines the properties of that state.

Using quantum theory, the wave functions of all atoms and molecules, and in principle of all material systems, can be calculated a priori. Because the  $\Psi$ -functions of a system contain its potential to produce empirical events, C. N. Villars (1987) has proposed to call them *potentiality waves*, replacing the earlier terms of *probability waves* or *probability amplitudes*. The  $\Psi$ -functions are in themselves not visible—they are nonempirical entities—but the squares of their amplitudes correspond to an observable property:  $\Psi^2$  determines the probability of finding an electron in the vicinity of an atom. By determining the probability of presence of quantum entities, the wave functions reveal themselves as nonmaterial entities: numbers or information on numerical relations. A selection of H-atom orbitals is shown in Figure 3.

When a given H-atom is in its most stable (1,0,0) state, we have to think that the other states—(2,0,0), (2,1,0), (3,0,0), (3,1,0), (3,2,0), and so on—also exist in this atom, but not as empirical forms, because they are empty. They exist in the sense that their logical or mathematical order is part of the constitution of the system, contains its empirical possibilities, is completely determined by the conditions of the system, and is a priori predictable. The order of virtual states is preestablished, before it manifests itself in the empirical world. Because it *can* manifest itself in the empirical world, virtual order is part of physical reality.

The careful reader will have noticed that, compared with the previous presentation in *Zygon* (Schäfer 2006a), the wording has changed, albeit not the essence. I acknowledge Ervin Laszlo's critique and suggestion for a "paradigm repair" (Laszlo 2006) that prompted me to think more about

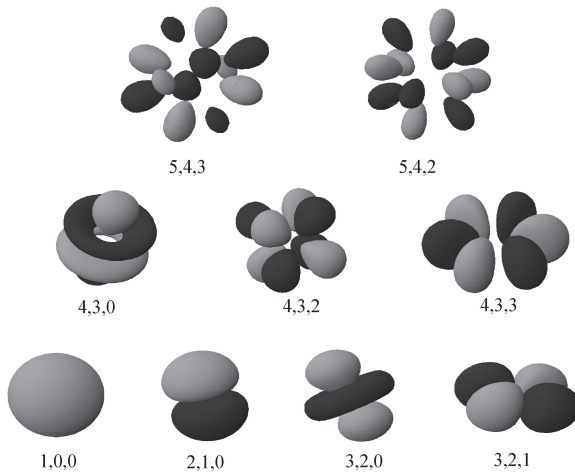


Fig. 3. Atomic orbitals  $|\Psi_{n,l,m}|^2$  for some  $n, l, m$ -states of the H-atom. From the Orbital Viewer program by David Manthey, <http://www.orbitals.com>.



how to describe this matter and to search for an increasingly precise mode of presentation.

Along the same lines, I acknowledge with gratitude Carl Helrich's critique of my previous essay (Helrich 2006) because he prompted me to further explore the question of whether quantum theory affords any kind of quantum ontology or merely allows an epistemological view. In the current context this amounts to the question of whether or not virtual states are real.

#### ARE VIRTUAL STATES REAL?

Niels Bohr was convinced that it was "an error of classical realism" (Cushing [1988] 2003, 29) to believe that the phenomena of human experience can reveal the nature of an underlying, independent reality. In Bohr's spirit it is claimed that "theory is an abstraction whose components, e.g. the state vector, do not represent properties of independent objects (as opposed to the case in classical mechanics)" (Cushing [1988] 2003, 30).

In contrast to this view, I am proposing that elements of quantum theory, for example the wave functions, do indeed describe the properties of reality and that it only *appears* that they do not, because they apply to the nonempirical part of reality. If the wave functions seem not to describe the properties of independent objects, this is so because the nonempirical reality they represent consists not of separate objects but of contiguous forms. Inspired by Kant's metaphysics (Harré [1988] 2003, 66), Bohr was convinced that the phenomena of our experience do not describe the nature of reality, because we are forcing a noumenon "to manifest itself in ways that are predetermined by the structure and other properties of the equipment" that we use to make observations (Harré [1988] 2003, 66). For example, if we choose an instrument that can grasp the corpuscular aspects of reality, the description of our experience will involve material particles. If we choose an instrument tuned to the properties of waves, our description of reality will involve the interference of waves. In this way, Bohr thought, the mode of observation spoils any possibility to describe the true nature of reality. "The particles . . . can exist nowhere else but in relation to that kind of apparatus" ([1988] 2003, 66.) Gaining empirical information puts noumena into forms, in agreement with the connotation of information as "the putting of something into a form."

That the modes of our experience will affect the appearance of the elements of empirical reality may be true. However, if the statements of a theory do not refer to the empirical reality but to its nonempirical part, they refer to properties independent of experience and may very well describe aspects of reality that are not corrupted by interactions with instruments. The conclusion is not that state vectors do not represent properties of independent objects but rather that state vectors represent elements of



potentiality, of the nonempirical foundation of reality. For this reason Villars has called state vectors “potentiality waves”:

. . . potentiality waves, as their more concrete name suggests, are conceived as physically real waves which exist in their own right, not merely as representations of the behavior of particles. Microphysical objects are not particles ‘guided’ in some mysterious way by ‘waves of probability’, but rather, microphysical objects *are* waves of potential observation interactions. (Villars 1987, 148)

If, for example, quantum theory postulates  $P = \text{constant}$  for the probability of presence of a free particle, we have to assume that some entity of reality exists that possesses this property, or the theory is completely misleading. The description of such a state does not depend on any measuring instrument, because it is a nonempirical state. It is nevertheless a real state, because it *can* have manifestations in the empirical world in ways that can be predicted a priori from its calculated properties.

Albert Einstein, Boris Podolsky, and Nathan Rosen defined “Elements of Reality” in the following way: “If, without in any way disturbing a system, we can predict with certainty (i.e., with probability equal to unity) the value of a physical quantity, then there exists an element of physical reality corresponding to this physical quantity” (1935, 777). Similarly, Jürgen Audretsch writes: “If the result of the measurement of a quantity (for example the position) for a given quantum state can be predicted with certainty, then one will say that this quantity must be assigned to the object in that state as a property” (2002, 28).

Now, in molecular spectroscopy, transition probabilities between stationary states can be predicted and experimentally tested to be either identically equal to zero (and then the transition is said to be forbidden) or not equal to zero (transition allowed). The predictions are based on integrals the calculation of which requires the precise mathematical forms of the state vectors of all the states involved, including the virtual states. Thus, the properties of a virtual state determine an empirical property, *before that state is an empirical state*. In accordance with Einstein, Podolsky, and Rosen, the precise prediction of a physical quantity—transition probabilities of zero or not zero—allow the conclusion that the elements involved—occupied and empty states—are elements of reality.

Many similar examples can be found. For example, the appearance of molecular fluorescence spectra can be predicted by the Franck-Condon Principle on the basis of calculations, in which the exact forms of virtual, nonempirical state vectors come into play, before these states are empirical. These examples show that empty states are real and, hence, that a nonempirical part to physical reality exists.

The nonreality of state vectors has been the topic of many mathematical analyses. Asher Peres writes: “The state vector cannot be an attribute of a physical system. . . . The  $\Psi$ -symbol (the so-called ‘state’ or ‘wavefunction’) is not an attribute of a *system* but of a *procedure*. A single physical system

has no state” (1984, 646). Peres’s remarks represent an extreme form of skepticism that is as stunning as it is delightful. But it is hard to reconcile with the chemical properties of molecules. For example, when transition metals are reduced or oxidized in chemical Red-Ox reactions, the measured magnetic properties of the products of a reaction are in exact agreement with the predictions based on the properties of their virtual states. In general, the chemical properties of molecules depend on their electronic configurations, which in turn depend on their orbital structure, including their virtual orbitals. Oxygen molecules could not serve their function in the metabolism of organic life if each of them did not have unpaired electrons due to the existence of degenerate states.

In recent years, powerful techniques were developed of single-molecule spectroscopy. In this kind of spectroscopy light quanta are recorded that are emitted by individual molecules. The emission of quanta by a molecule cannot be understood in any other way than by concluding that a single physical system makes a transition from one stationary state to another. This is in direct contrast to Peres’s claim that a “single physical system has no state.” Thus, one has to begin to accept that “the state vector refers directly to real single objects and their properties” (Audretsch 2002, 28).

In Field-Ion Microscopy, it is possible to image individual atoms in solid state materials. (See, for example, images of individual atoms in a tungsten needle in Rezeq, Pitters, and Wolkow 2006.) It is difficult to accept that the imaged atoms “can exist nowhere else but in relation to that kind of apparatus” (Harré [1988] 2003, 66), so that the atoms cease to exist when the needle is taken out of the microscope.

The Copenhagen Interpretation (Bohr’s interpretation) of quantum theory is a form of skepticism. I suspect that Bertrand Russell’s general verdict applies: “Skepticism is logically impeccable, but psychologically impossible” (Russell 1948, xi). In agreement with this view, Audretsch writes: “The Copenhagen Interpretation . . . is today merely of historic significance. It places a statement by Niels Bohr in its center that ‘there is no quantum world’” (2002, 27).

#### QUANTUM REALITY AS A BASIS OF THE PRE-DARWINIAN CONCEPTION OF EVOLUTION BY NATURAL LAW

In Figure 2 the emergence of a complex, hidden, precisely predictable, and deterministic order is shown as it emerges out of the accumulation of a large number of seemingly isolated, random events. Do we have to believe that this order comes out of nothing, that it is the creation of chance?

Because the same interference pattern can be repeatedly generated at will in such processes, the belief in its creation out of nothing and by chance is untenable. In my earlier *Zygon* essay (Schäfer 2006a) I argued that the emergence of complex order in the biosphere is not out of nothing but

proceeds by the actualization of virtual states. All ordinary material systems exist in stationary states, and all that molecules can do is to make a transition from an occupied state to a virtual state. Thus, when new structures emerge in material systems that have no precedent, it must be assumed that the actualization of virtual states is involved. My main argument used the hydrogen atom as an example (see Figure 3). In the (1,0,0) state, the probability distribution of an H-atom is approximately that of a sphere. When the atom makes a transition to, say, the (4,3,0) state, that state becomes an empirical state, while the former becomes virtual; the spherical probability distribution abruptly vanishes and doughnut-like forms appear. In the (4,3,3) state, forms like a bracelet come to the fore. Increasingly complex forms can emerge, like the gothic shapes of (5,4,3) and (5,4,2). Thus we see that at the atomic and molecular levels, the emergence of new and complex forms is not from nothing but from the actualization of virtual states whose logical order already exists before it is empirical. Because all chemical systems consist of atoms and molecules, none of them can be claimed to achieve the emergence of complex order out of nothing.

From this simple consideration I generalize that it is possible to consider the entire universe as a quantum system. Its occupied states form the visible part of reality. Its virtual states form the nonempirical realm of potentiality. The former contain everything that is actual; the latter, everything that is possible. Virtual cosmic states form a realm of Platonic Ideas. The actualization of empty states is a simple model of how nonempirical and virtual but preestablished cosmic order can express itself spontaneously in the material world. The emergence of complex order in the universe proceeds by bringing empty forms (states) into empirical reality.

Michael J. Denton, Craig J. Marshall, and Michael Legge (2002) have proposed that the protein folds can be considered as Platonic forms, providing new support for the pre-Darwinian conception of evolution by natural law. The main points of their argument are as follows. The basis of the pre-Darwinian view of life was the observation that there is a “unity which underlies the diversity of animal structures” (Owen 1866, v) and which is apparent in certain recurrent forms. Among them these authors list, following Richard Owen (1849), the body plan of the major phyla, the forms of leaves, and the pentadactyl design of the vertebrate limb. The *Naturphilosophie* of the late eighteenth century was inspired by this unity to consider the forms of living organisms as structures determined by natural law in the same way in which other recurrent forms in nature, such as atoms, molecules, and crystals, are determined by natural law. At the basis of this philosophy was the desire of the pre-Darwinian biologists to explain the diversity of life forms in a rational and lawful way, unifying physics and biology, and searching for a special class of biological laws, the “*Laws of Form*” (Denton, Marshall, and Legge 2002, 326).

The pre-Darwinian view is a Platonic view, because anatomy is described in terms of “archetypes” and organization is seen to rise “from the general to the particular” (Owen 1866, xxv and vi). Furthermore, form was considered primary and function secondary (Denton, Marshall, and Legge 2002, 326). It follows that, if life forms are expressions of natural laws, one can think that the course of evolution has followed a lawful path, and if life exists in other parts of the universe, it can be expected to appear in forms similar to those encountered on our planet.

The pre-Darwinian biologists ultimately failed, because it was not possible to identify the laws of form that lead from single cells to body plans or to identify the depository realm where the Platonic forms exist.

Therefore, with every disposition to acquire information and receive instruction as to how species become such, I am still compelled, as in 1849, to confess ignorance of the mode of operation of the natural law or secondary cause of their succession on the earth. But that it is an “orderly succession,” or according to law, and also “progressive” or in the ascending course, is evident from actual knowledge of extinct species. (Owen 1866, xxxvi)

Thus, the Platonic view was abruptly replaced by Darwin’s theory. “Necessity was replaced by contingency and natural law was replaced by natural selection.” At the same time, the Platonic principle “form first, function second” was inverted to “selection for function” (Denton, Marshall, and Legge 2002, 328). At this point the authors propose to revive the pre-Darwinian view because they think that they discovered in the protein folds forms of a Platonic nature. Their thesis is based on the considerations (pp. 330–34) that (1) there are millions of proteins but only a small number of distinct classes or families of protein folds; (2) the three-dimensional structures of individual folds have essentially remained unchanged for billions of years, and (3) when the structural subunits of proteins—dipeptides and fragment mesomers—are considered in isolation, they are not stable in the forms in which they exist in the polymer structures.

Early quantum chemical calculations of the structures of the basic protein components, the dipeptides (Schäfer et al. 1982; 1984), were thought to be inaccurate because the  $\alpha$ -helical region was found to be unstable, but it is one of the most highly populated (most stable) conformational regions in proteins. Also, the  $C_{\gamma}^{eq}$  conformation is the global energy minimum of dipeptides but is rarely found in proteins. Now it is realized that the calculations were not flawed but revealed an important aspect of the structures of proteins. Proteins are not “contingent assemblages of matter like Lego constructs, watches or other sorts of artifacts—where the parts are the primary things and pre-exist the whole” (Denton, Marshall, and Legge 2002, 334); rather, proteins are made up of structural units, which act like the cog wheels of a clock that coil up to little balls outside of the mechanism.

Because of the difficulty in finding an evolutionary mechanism with step-by-step selection for function that leads to holistic systems whose parts are without any known intermediate function and whose properties in isolation differ from their properties in the whole, the authors conclude:

No one has yet been able to provide a credible constructional sequence from simple motif to final fold to show how the fold might have come about via a series of stable intermediate forms. . . . The protein folds . . . do not conform in any way to the Darwinian conception of organic forms as contingent “Lego-like” functionally contrived assemblages of matter. On the contrary, they are wonderful exemplars of the pre-Darwinian and Platonic conception of organic forms as abstract, lawful and rational features of the eternal world order . . . perfect exemplars of the pre-Darwinian Platonic cosmogony. . . . There is no doubt that the universe of protein folds represents a Platonic universe of precisely the kind sought after by pre-Darwinian biology. There is no question that in this universe . . . evolution is by *law* not *selection for function*. . . . Biology may in the end be unified with physics in Plato’s timeless realm of the gods. (p. 337–41)

At this point the authors leave the reader with the question, Where is the timeless realm of the gods? The answer suggested by the quantum phenomena: That realm is in the nonempirical part of physical reality, and the virtual states are its ideas.

The discovery of the nonempirical part of reality revives the Platonic view of evolution. The realm of forms out of which life is evolving is the realm of the cosmic potentiality. In its material forms, life is becoming empirical. The laws that rule this process are not special but are the ordinary laws by which actuality emanates out of potentiality.

Menas Kafatos and Robert Nadeau (1990) have used the fact that the nature of reality is that of indivisible wholeness as a basis to conclude that an element of consciousness is active in the universe. Applying the Kafatos-Nadeau argument to Life, it is possible to conclude that, since life in its empirical forms has emerged from the wholeness, the background of reality contains the proto-elements of Life; that is, in some indescribable way, the background of the universe is alive.

#### POTENTIALITY AS PRIMARY REALITY

If one pursues the nature of matter to its roots, at the level of atoms and molecules all of a sudden one finds oneself in a realm of nonmaterial forms where the notion of matter has been lost and actuality turns into potentiality. In this way one is led to the conclusion that, at its foundation, reality consists of nonmaterial, nonempirical, and interconnected forms, whose exact nature we will probably never fully comprehend, like the nature of God, but which can be thought to be like the potentiality waves (Villars 1987) of quantum theory.

In his fascinating book *Die Wahrheit und das Leben* (Truth and Life) physicist Hans-Jürgen Fischbeck writes that reality has a “Dual Structure:

Potentiality and Actuality” (2005, 20). In the equally inspiring book *Die Wissenschaft spricht auch nur in Gleichnissen* (Science, too, speaks only in metaphors), physicist Hans-Peter Dürr proposes: “Reality reveals itself primarily as nothing but potentiality. . . . Potentiality appears as the One—better yet, as the Not-Twofold—which cannot be dissected or separated into parts” (Dürr 2004, 12). Through the realm of potentiality, “the world predetermines ‘in the past moment’ the possibilities of future worlds, the tendency of its possible transformations” (p. 32). In this, potentiality is taken in the sense of Aristotle’s *potentia*, following the earlier suggestion by Werner Heisenberg ([1958] 2000, 61).

The German language has two words, *Wirklichkeit* and *Realität*, for a concept for which many other languages have only one—for example, *reality* in English, or *le réel* in French. The German terms are not synonymous but describe different modes of being real. The first is derived from the German verb *wirken* (to have an effect) and the second from the Latin word for things, *res*. All material things are of course real, but nonmaterial entities also can be real, if they can have an effect in the empirical world. The entities of the realm of potentiality in nature are of the latter kind; they are not things but forms. Nevertheless they are real, because they have the potential to manifest themselves in the empirical world and act in it.

The structuring of reality into the empirical and nonempirical, the potential and actual, the material and nonmaterial, is not an attempt to revive some sort of Cartesian dualism of mind and matter. On the contrary. Reality is a homogenous wholeness in which potentiality is entwined with actuality and matter is nothing but “coagulated potentiality” or “coagulated form” (Dürr 2004, 33). It follows that, if the realm of potentiality is thought to be the realm of a Cosmic Consciousness (Schäfer 1997; 2004; 2006a), Consciousness is not disconnected from matter but creates it. It is only in relation to this, the limited human receptor, that the terms *empirical* and *nonempirical*, *spiritual* and *physical*, *material* and *formal*, are perceived like the characters of a dualistic reality.

The potentiality of molecular virtual states is of a special kind because molecular states are stationary states, which endure in time (their measurable properties are constant in time). In general, the potentiality waves of quantum systems evolve in time so that the cosmic potentiality must be understood as a dynamic process.

Ultimate reality is an unknowable wholeness. Physicist David Bohm has emphasized that the wholeness is not being but process: “Undivided Wholeness is Flowing Movement” ([1980] 1981, 11). Out of the constantly changing flux certain temporarily enduring and relatively independent aspects, which are the elements of our direct experience of the world, can be abstracted, or “releveled” (lifted up, made relevant) (p. 151), among them mind and matter. In this view material particles are not eternally enduring structures but rather like ephemeral vortices in the flowing stream.

Moreover, “In this flow, mind and matter are not separate substances. Rather, they are different aspects of one whole and unbroken movement” (p. 11).

Henry Stapp has given a detailed description of how the cosmic potentiality is constantly branching out into new superpositions of possibilities or tendencies for future empirical events to occur (1993, 125). If the background of reality is mindlike, one can think that this process creates not only the tendencies of future physical events but also the appearance of new structures in human consciousness—in our understanding of the world, our comprehension of universal principles, our intuitions, and even our ability to love. We have access to the mindlike background, perhaps because the human mind is its extension—an emanation or effluence, as it were, out of the Cosmic Consciousness. Rupert Sheldrake’s “morphogenetic field” (1981, 76) has properties resembling those of the quantum potentiality field.

Dürer has compared the cosmic potentiality to an ocean. Initially, when the surface is flat and calm, “it symbolizes emptiness” and corresponds to a reality in which Spirit “is still without any expression” (2004, 102). Because the ocean is not being but process, waves begin to show on the surface, superimpose, build up, and get taller, until white crests appear. If one flies across the Atlantic, one sees the white crests from above as isolated patches. The patches seem like separate things but are really part of a single system of contiguous waves. In the same way, the world seems to be made up of separate things and individuals, but they, too, are crests of an interconnected system of waves, separated by nodal planes. In this nonmaterial ocean, which is alive and mindlike, the waves constantly build up to new empirical possibilities and to new forms of thinking, which may find consciousness in us. After each transition from “the possible to the factual,” as Heisenberg called it ([1958] 2000, 80), the evolution of new “tendencies or possibilities” (p. 262) for future actual events starts anew, but now from a different starting point than before. There is a continuous flux from the evolution of tendencies to their actualizations—empirical events—and from empirical events to new tendencies. Each new state of potentiality carries in it, like a stamp, the memory of the last event. For this reason Dürer has compared this process to a learning process (2004, 103).

In the material world, the collapse of the potentiality waves leads to new empirical structures. In our minds, it leads to new elements of consciousness from which the learning process starts out anew. In the same way in which potentiality waves can trigger the visible reaction of a macroscopic measuring instrument, it is possible to think that they can trigger brain states, expressing in this way concepts in our minds. In the same way in which the brain has evolved sensitivity to light waves by developing eyes, it has evolved neuronal networks that are sensitive to potentiality waves. In the evolution of the comic potentiality, the Cosmic Spirit is learning.



Ervin Laszlo proposes that a universal field exists that accounts for the nonlocal coherence revealed at various scales and in various domains of nature. This field is different from the common fields of physics that we know, such as the electromagnetic or gravitational fields, but it can be thought to be identical with the field of forms and the realm of potentiality described in this essay, because it is presented as a highly integrated, coherent information field that at the same time generates, conserves, and conveys information and links all the parts. Laszlo calls it the Akashic Field ([2004] 2007, 75), inspired by the Indian concept of *Akasha*, which denotes an element or “all-encompassing medium that underlies all things and becomes all things” (p. 76). *Akasha* is a nonempirical medium in that it is not accessible to our senses even though the things of the empirical world evolve out of it. Spiritual practice and a spiritual way of life are needed to reach the Akashic field. Contemporary cosmology allows us to consider that our universe was preceded by a string of previous universes, all created out of an enduring Metaverse (p. 83). At its birth, Laszlo suggests, our universe was informed by the preceding universes whose experiences were stored in the Akashic field (p. 85). Thus, the seemingly permanent structures of our world can be thought to be the results of a learning process. They are being retained, albeit emerging from and being part of a flux, because they are in some sense successful, where success is perhaps measured by the ability to serve as a basis for conscious life. In this view, the permanence of enduring structures rests on their ability to serve as a basis for consciousness and life.

It is the metaphor of an enlightened theology that God is the “upholder of all that is” (Polkinghorne 1991, 295). In the notation of this essay, God is the all-encompassing source of cosmic potentiality. It is not very likely that cosmic potentiality as it appears to us is closed in itself and self-consistent; rather, we expect that it is connected with a wholeness at large. If the cosmic source is exhausted, everything will come to a standstill. It appears as though a constant flux of information is needed to maintain and evolve our world, perhaps an emanation out of the Divine, in the same way in which a constant flux of signals is needed to maintain an interference pattern at a double slit. In the pattern of life, each of us is a seemingly accidental appearance, a tiny dot in a giant pattern, like one of the random dots in an electron interference pattern. But when many dots of the cosmic pattern are combined, an underlying systematic order comes to the fore.

Virtual states are thoughtlike. Thoughts, in turn, have inherent aspects of virtuality or potentiality (Schäfer 2006a). A thought exists in the mind of a speaker long before it is expressed as a word. Unexpressed, a thought is a nonempirical entity; expressed in words, it is part of the empirical world. Thus, thoughts have a dual structure of potentiality and actuality.

Elements of information have the same dual structure. Their *meaning* is a nonempirical entity and an element of potentiality; the *code*, in which the meaning is expressed, consists of material things. In this relationship,

meaning is primary and code secondary. If the contents of consciousness—thoughts and information—have a dual structure, consciousness itself can be expected to have a dual structure with a manifestation in the material world and a nonempirical part that is based on states that observation and analysis will destroy.

Fischbeck sees God as “the all encompassing potentiality of the Good. . . . The potentiality of the Good is not coercion to the Good, which could not be good anymore, but an always renewed offer,” like a standing invitation. This reveals an important function for life: Potentiality allows “life to be alive. In the deterministic reality of classical physics there is no life, but just mindless and meaningless robots” (Fischbeck 2007).

### WORLD ETHOS

According to sociobiologists and evolutionary biologists, all human behaviors are adaptations (see for example Ruse and Wilson 1993, 310). This view implies that there are no human values and, specifically, no universal moral principles (Ruse 2001a, b), only the clever strategies of individuals striving for biological fitness.

I propose that we consider the matter not from the moral perspective of “ought” and “ought not” but under the practical viewpoints of true or false, meaningful or not, wholesome or harmful. Can it be meaningful to lead a life that is in error—not authentic—because it is in conflict with the nature of reality? Can it be healthy to live a life that is focused away from wholeness and onto isolated, selfish, and fragmented needs? We live in a society whose basic attitudes are unethical and hostile to life because it lives away from the nature of reality, denying its nonempirical part and the interconnectedness of all there is. But only such a life is meaningful, healthy, worth living, and authentic that is in harmony with the order of reality. The significance of all realms of reality, the nonempirical as well as the empirical, have to be accepted in human beings, too.

*World Ethos: To live in harmony with the order of reality is the premise of the moral life.* No action or discourse can be considered authentic that is in conflict with the order of the universe. Striving for authenticity enables a life in harmony with nature and is a wonderful guide to human life. It enables a life that is genuine, not counterfeit; it creates a person who is trustworthy, not devious; it connects to other ideals, such as accuracy, sincerity, honesty, truthfulness, and justice. A society is sick when public discourse and actions are inauthentic, not genuine but corrupt.

Cosmic morality cannot prescribe details of lifestyle. In a globalized world, however, where conflicting religions and atheistic views make it impossible to formulate a moral code based on divine authority, cosmic order can be a guide for the basics, providing common ground for diverse cultures to agree on. Its categorical imperative: *Act in such a way that the maxim of your will should become a general law of the Cosmic Wholeness.*

Inexplicably spat out of the wholeness, we have a natural longing to return to it, and it seems that we need contact with it. Expulsion from the wholeness is the meaning of the biblical story of the expulsion from Paradise. But Paradise is not a garden of sensual pleasures, not a land of plenty. It is the nonmaterial realm of the wholeness of reality.

In his book *The Mating Mind* Geoffrey Miller describes the view that “evolution tends to make pleasurable those behaviors that are adaptive” (2000, 259). In contrast, I am proposing here that our mind makes pleasurable all those behaviors that allow us to make contact with the whole. Moral acts are pleasurable, because in a moral act we get in touch with the wholeness. We give with joy, as though we were the recipient. We help a person in need as though we would be helped. Love your neighbor as you love yourself. Everything that seeks the wholeness is good; everything that separates is evil—hatred, lies, violence, greed. “I do not know what your destiny will be,” Albert Schweitzer is often quoted as saying, “but one thing I know: the only ones among you who will truly be happy are those who will have sought and found how to serve.” By serving humanity, we get in touch with the whole.

The true nature of reality does not rest in the visible order of the material world. The true nature of human beings is not found in our bodily functions. In Darwinism, a surface science, nobody can understand the essence of life or the meaning of human values. Because a mechanistic understanding of the surface cannot reveal the true nature of reality, the mechanistic worldview is in the long run not satisfactory. The current crisis of the world is the crisis of the insufficiency of the mechanist-materialist perspective. Peace of mind cannot be found in the mindless satisfaction of bodily needs but only in the active connection with the whole. In this way, the discovery of the quantum world makes it possible to propose a “rational science-based moral theory” (Stapp 2006, 620).

It is now a conclusion from physics that we partake in two different modes of reality: potentiality and actuality. On the one hand, we are separated material bodies; on the other, we are part of the whole. Neglecting the latter makes a person weary of life and listless. Birth into a life of separation from the wholeness is an existential trauma that we can never quite overcome. It brings with it the feeling of loss, an uncertain yearning and melancholy. Inadequate response to this may very well lead to pathological tendencies. Connection with the whole is fulfillment. Perhaps this is the source of love and love the attempt to find fulfillment in the other. The search for fulfillment is the basis of all mystical experiences and the root of our spiritual needs. “What human beings call God springs from an overwhelmingly intense experience which is connected with the feeling of self-abandonment in the sense of the loss of the Ego. It is a turning to the mystical I, a joyous surrender, which is devoid of any fear because, in the deep Ego, the I expands to the unfathomable whole” (Dürr 2004, 101).

## NONEMPIRICAL REALITY: THE ORDER OF THE ONE.

By abandoning a mechanistic view and reverting to a description of nature in terms of forms, contemporary physics has placed itself into the center of powerful historic traditions of spirituality (Schäfer 2006b). Potentiality waves are pure (nonmaterial) forms. For Aristotle, only God was a pure form; everything else was entangled with matter.

Similarly, the empirical world is like an emanation from the nonempirical, indivisible One. For Plotinus, God is the One and the world an emanation from the One. Augustine of Hippo believed that the lasting essence of things lies in eternal forms, which are thoughts in the mind of God. Thus, whether intended or not, whether welcome or not, contemporary physics has revived the ancient idea of “forms as metaphysical principle of being” and “archē of all things” (Hirschberger 1976, 1.24). Nonempirical reality now appears as a liaison reality, where Divine Reality is shining into human reality.

Various traditions of Eastern and Western thought have taught that the ultimate truth cannot be expressed in words. Joseph Campbell has called mythology “the penultimate truth—penultimate because the ultimate cannot be put into words” (1988, 163). The Tao Tê Ching begins, “The Tao that can be expressed is not the eternal Tao. The name that can be defined is not the unchanging name” (Ch’u Ta-Kao [1937] 1978, 11). In the nonempirical world, science has hit on a part to reality that has made it wordless, and in its descriptions it has had to resort to symbols that cannot even be expressed in terms of real numbers but need complex-valued mathematical functions. The need to search for Divine Reality is a basic existential need of all human beings. (I include in this judgment the atheists who display this need with the highest intensity.) Religion, William James wrote in his Gifford lectures, “believes in two worlds and an invisible order” ([1901] 2007, 331). Thus, in discovering the nonempirical part of reality, we have struck gold.

In the first half of the twentieth century Swiss psychiatrist Carl Gustav Jung (1875–1961) believed to have found empirical evidence for the existence of a realm of nonempirical forms or structures that can appear spontaneously in our consciousness, influencing “our imagination, perception, and thinking” (Jung [1959] 1990, 44). He called these forms or images the *archetypes* ([1959] 1990, 4). As “typical modes of apprehension” (Jung [1960] 1981, 137), the archetypes shape the conscious contents of our mind by regulating, modifying, and motivating them. Thus, in order to be able to live, to give meaning to life, and to develop a conscious Self, human beings constantly need to make visible (conscious) the invisible (unconscious) by reaching into this realm of forms which he called the *collective unconscious*, a “psychic system of a collective, universal, and impersonal nature which is identical in all individuals. . . . It consists of pre-existent

forms, the archetypes, which can only become conscious secondarily and which give definite form to certain psychic events" ([1959] 1990, 43). Beyond the narrow confines of our personal psyche the collective unconscious is

a boundless expanse full of unprecedented uncertainty, with apparently no inside and no outside, no above and no below, no here and no there, no mine and no thine, no good and no bad . . . where I am indivisibly this *and* that; where I experience the other in myself and the other-than-myself experiences me. . . . There I am utterly one with the world, so much a part of it that I forget all too easily who I really am. ([1959] 1990, 21)

In physical measurements nonempirical (unconscious) potentiality states become states of empirical (conscious) phenomena. The measurement problem of physics can be viewed as the problem of how unconscious states appear in consciousness.

By having the potential to become conscious in us, the archetypes form a realm of potentiality. They are nonempirical entities because they "have never been in consciousness" before ([1959] 1990, 42). Accordingly, the birth of the conscious self is from a realm of nonempirical Forms. What a wonderful and precious web reality is spinning out of nonmaterial, nonempirical, mindlike forms out of which the empirical world is emanating, out of which life is emerging, and out of which the conscious Self is born for each one of us. One cannot help but think that the nonempirical reality that Jung discovered, the nonempirical reality that the quantum phenomena reveal, and the nonempirical reality out of which life is emerging are one and the same reality. Thus we are led, again, to the view that the background of the universe is alive and mindlike, that the wholeness is aware of its processes.

The nonempirical forms that physical reality needs to become empirical, that life needs to evolve in the empirical world, and that each individual Self needs for achieving consciousness all are elements of that same indivisible realm of Spirit, the nonempirical potentiality, where science, philosophy, and religion dissolve into the single order of the One, source of the physical principles building our bodies and of the metaphysical principles building our minds: Creator of the human world.

G. W. F. Hegel (1770–1831) believed that the primary structure of reality is "absolute Spirit" and that everything that exists is the actualization of Spirit. Nonempirical reality is the unifying medium where the spiritual and the physical merge and lose the boundaries that exist in human comprehension. In this medium our personal experiences are transformed into the one, unified order of the Cosmic Consciousness.

Many will find such thoughts disturbing. However, we should have the courage to practice a liberated and enlightened science that does more than manipulate nature. "Like the meridians as they approach the poles,"

Pierre Teilhard de Chardin wrote, “science, philosophy and religions are bound to converge as they draw nearer the whole” ([1955] 1959, 30).

Theology is not excused from that process. Like the sciences and philosophy, the concepts of theology are part of a flux. If God is in the world, knowledge of the world is to some extent also knowledge of God. If our image of the world is changed by fundamental scientific discoveries, our image of God also must change. The relationship between the biblical understanding of God and the understanding of God that is needed in our time is comparable to the relationship between the atomic theory of Democritus and Leucippus and the atomic theory of quantum physics.

In our longing for the wholeness lies the significance of sacred places. In sacred places like the Cathedral of Chartres, at one time the Cosmic Spirit burst out of the ground and cast itself into stone. The feeling of a transcendent presence in such places can be overwhelming.

However, Spirit is everywhere. Ram Lakhan Pandey Vimal proposes that all subjective experiences arise out of “elemental proto-experiences”:

We define elemental proto-experiences (PEs) as the properties of elemental interactions. For example, a negative charge experiences attractions towards a positive charge; this “experience” is defined to be the PE of opposite charges during interaction. . . . Thus we introduce experiential entities in elements in terms of characteristics of elemental interactions, which are already present in physics. We are simply interpreting these properties of interactions as PEs. (Vimal 2007)

Promoting elemental interactions to the status of proto-experiences as sources of subjective experiences is synonymous with ascribing mindlike properties to microphysical entities. Such a metaphysical stance suffers from the fact that electrons, protons, and atoms do not in themselves have a psyche or consciousness. How can they possibly act as though they did? The same criticism applies to my own statements regarding the mindlike properties of quantum entities (Schäfer 1997, 49; 2006a, 509).

The answer to this seeming enigma is as follows: Electrons, protons, and atoms do not in themselves have a conscious mind, but their mindlike properties are those of the wholeness of reality; they are expressions of the Cosmic Consciousness. Because the Cosmic Consciousness is wholeness, it *is* everything and *feels* everything. It is aware of all of its processes and reveals its awareness in a rudimentary way in the automatic and mechanical reactions to information at the level of elementary particles, and through all the levels of consciousness up to and including human consciousness. Electrons feel nothing and experience nothing, but they *act* as though they do because the Cosmic Consciousness is acting through them. This is the meaning of the thesis that an element of consciousness is active in the universe: The One is aware of its processes.

On further consideration Vimal’s concept leads to the view that elementary entities are primarily not mass particles but proto-experiences, mental atoms like the monads of Leibniz; they are spiritual elements that can be

understood as quanta of spirit, the true building blocks of reality. From these proto-experiences the Consciousness of the Whole builds its more and more complex experiences, constructing increasingly complex systems, as suggested by Vimal, in which information is used in a systematic and not just automatic way, up to our own consciousness.

Thus, we find ourselves in the position of the German idealists, Hegel in particular, who believed that the Cosmic Spirit is thinking in us. The ultimate human value that follows from this thesis is overwhelming: *We ought to lead our life in such a way that the Cosmic Spirit has a chance to think in us.*

#### NOTE

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