# Quantum Reality and the importance of consciousness in the universe

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**Resumo**

A referência frequente à mente no contexto da física é um fenómeno fascinante. Em muitos fenómenos a mente e os "aspectos" mentais da realidade tornaram-se importantes. Neste texto, descrevem-se detalhadamente os argumentos que se referem à natureza mental do universo, sugerindo-se que os aspecto da realidade física oferecem uma oportunidade real para a fundação dos nossos valores e princípios metafisicos, incluindo os nossos valores morais, na ordem do universo. Questiona-se se a estrutura do universo pode assumir uma ordem espiritual, tal como física pode deter uma outra de natureza mental. Em suma, a realidade quântica requer uma nova visão do processo da evolução da vida. As moléculas são a base da vida, e as mesmas são sistemas quânticos. O nosso conhecimento da estrutura quântica das moléculas deve ser integrado na discussão biológica.

## 1. Scope

Up until recently, it was difficult for many to accept science as a source of knowledge about the world, and to consider that anything non-tangible and non-observable could be real. Since the seventeenth century the ruling scientific outlook (one that is still taught in our schools today) was that of Galileo, Descartes, Newton and the Age of the Enlightenment. Newton's physics, in particular, spawned the doctrine that everything in the universe can be explained in terms of moving material particles; that the

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universe is clockwork, closed, and entirely predictable on the basis of unchanging laws. That worldview gave rise to the naive realism of mechanist materialism, and to claims that all aspects of human beings, our loves, hopes, our creativity and spirituality, are nothing but the result of the properties and dynamics of matter. When Darwin combined that same materialism with the laws of chance and natural selection, claiming to have found a comprehensive mechanism for the evolution of life and our existence, it seemed to many that life had lost all meaning and human values were exposed as mere adaptations to a senseless, exclusively material reality.

Now at the dawn of a new era, this older scientific doctrine is being challenged on the basis of discoveries made by quantum physicists during the past century. In its place, a new scientific understanding has arisen which points to transcendent aspects of physical reality, and thus of human nature itself, providing a basis for a life with values that is not in conflict with the science of the world. One of the great achievements of twentieth century physics is the discovery that physical reality is different than we always thought. At the foundation of ordinary things we find entities—the atoms, molecules, elementary particles—which exist in a kind of reality that is different than the reality of the objects that they form. Specifically, elementary particles can act like they are at many places at the same time, they are able to affect each other instantaneously over long distances, they can be meaningfully said to have mind-like properties, and they can exist in superpositions of states which are not quite real but "in the middle between the idea of a thing and a real thing", as Heisenberg wrote (1962). In short, physical reality is not what it looks like and the microscopic constituents of things are not just miniaturized editions of the ordinary objects of our conscious experience, but they are different in essence.

Among the unexpected aspects of twentieth physics, frequent references to mind are a particularly fascinating phenomenon. In many phenomena the mind-like aspects of reality come to the fore. For example, like a mind, quantum systems can react to mere changes in information. Similarly, like a mind, they can act spontaneously. The non-material probability fields of quantum reality are closer to the nature of a thought than a thing, and yet they determine the visible order of the universe. The existence of the periodic table of the elements is not due to any mechanical principle that we know, but it is the result just of the symmetry of the quantum wave functions, a mental property.

In view of such phenomena, many pioneers of twentieth century physics have suggested the presence of mind in the universe, and it has become plausible to assume that the background of the universe is mind-like and consciousness underlies matter, rather than being an epiphenomenon of matter. It is the purpose of this paper to explore, what such a configuration, if true, might mean for our understanding of the nature of human beings and our position in the universe.

## 2. Quantum reality

### 2.1. The constituents of real things are not as real as the things that they make—the basis of the world is non-material

Electrons are ubiquitous elementary particles with a definite mass and electric charge. They are tiny objects, with a diameter less than a billion billionth of a meter, and whenever we see one, it appears as a localized tiny thing, such as a flash on a TV screen, or as a small dot on a photographic film. We know the properties of electrons quite well and make use of them in electronic devices. In particular we are quite sure that they are indivisible; they cannot be broken up into even smaller pieces of matter.

In contrast to their compact nature, when electrons are projected through a barrier with several holes in it, they act as though they were passing through all the holes at the same time. This is electron diffraction. Electron diffraction is a sign of the fact that, when we leave them alone, quantum particles evolve in wave-like forms or fields, often called psi-fields, that are spread out over large areas in space. As it turns out, the nature of the psi--fields is that of probability fields. Probabilities are dimensionless numbers. Thus, the psi-fields do not carry any mass or energy, just information on numerical relations. Nevertheless, their power in the material world is almighty—their interactions determine the visible order of the universe.

In this way, at the foundation of reality we find numerical relations—non-material principles—on which the order of the world is based. Reality is based on phenomena that transcend the monist material views of classical physics, and St. Augustine's thoughts, as expressed in his *Confessions* (book 7), have obtained a new meaning: "The older I got, the more despicable became the emptiness of my thought, because I could think of no entity in any other way than as bodily visible."



The universe, once closed by Newtonian materialism, has opened again. The world of mass-energy is not completely sealed anymore, and cracks have opened in its mechanistic cortex to a type of reality that is different than the reality of ordinary things. A person entering a room with several entrances always will come through just one of them, never through all of them simultaneously. But electrons seem to do just that. *No ordinary thing can behave like the elementary particles it is made off.*

### 2.2. Elementary particles can act instantaneously over long-distances

In the common sense reality of our consciousness no signal, no influence is able to move at a speed faster than the speed of light. It means that, if one intends to start some action somewhere else and far away, one has to wait for an effect at least as long as it takes for a signal to get there. For the same reason there is always an unavoidable delay between question and answer when one talks to an astronaut far out in space.

In contrast, in the quantum world influences can act instantaneously over arbitrarily long distances. Experiments involving Bell's theorem have shown that, under certain conditions, decisions made by an experimenter in one laboratory can have an instantaneous effect on the results of an experiment in another laboratory a long distance away. In experiments of this kind, two particles which at one time interact and then move away from one another are found to stay connected, as though they were one thing, no matter how far apart in space they are.

*This is the non-locality of the quantum world. If the universe is non-local, something that is proceeding in its depth may have an instantaneous effect on us right now and right here.*

### 2.3. Elementary particles have mind-like properties

Whenever we want to physically affect a thing, we have to spend some energy to do so. For example, to move an object from one place to another we have to push it; that is, impart some energy to it. Just thinking about such an action will not get it done.

Elementary particles are different. Experiments show that these things change their behavior when what we know about them changes. Thus, in an observable way, quantum systems may react to the flow of information, as though what someone might think about them could affect them. "It is not

unreasonable to imagine," Wheeler wrote (1999), "that information sits at the core of physics, just as it sits at the core of a computer. Information may not be just be what we learn about the world. It may be what makes the world".

The only other thing that we know that can react to the flow of information is the human mind. In this sense we can say that, at the foundation of ordinary things, we find entities that have mind-like properties. Considering phenomena of this kind, already in the 1930s, Arthur Stanley Eddington wrote (1930, 1939): "The universe is of the nature of a thought or sensation in a universal Mind ... To put the conclusions crudely—the stuff of the world is mind-stuff. As is often the way with crude statements, I shall have to explain that by 'mind' I do not here exactly mean mind and by 'stuff' I do not at all mean stuff. Still this is as near as we can get to the idea in a simple phrase."

The mind-like nature of quantum reality appears in many guises. The probability fields are closer to the nature of a thought than a thing. Occupied orbital avoidance is the basis of chemistry and the visible order of the universe. It is the result, not of any mechanical force, but of a mental principle; that is, the symmetry of the wave functions of quantum states. "There is indeed something quasi-mental, non-physical about it," Margenau wrote (1984). Furthermore, when quantum systems undergo transitions from one state to another in quantum jumps, they do so spontaneously, without being prompted by any cause. Again, a mind is the only other thing that we know that has the power to initiate, on its own drive, a chain of causal events.

More recently, Kafatos and Nadeau (1990) have argued that the vision of contemporary physics allows us to infer that "the universe is conscious". Goswami et al. (1993) have used the quantum phenomena as a basis for proposing that "consciousness, not matter, is the ground of all being." In view of the power of mathematics to penetrate the nature of reality, Omnès (1999) was "led to the conclusion that the existence of Logos is an entirely plausible hypothesis."

## 3. Quantum reality and the challenge to darwin

### 3.1. Nature makes nothing but jumps

The classical universe is a closed system. Its future is closed, because it is totally determined by the present. The present is closed, because it is totally determined by the past. Within that classical framework the doctrine of evolution was first formulated. Accordingly, Darwinian evolution is a closed



process, descendence with variation is the result of strictly local agents and (Darwin, 1872) 'nature does not make any jumps.'

In reality, nature makes nothing but jumps and the universe is not an aggregate of disconnected fragments, but a network with possible non-local connections. We must expect that DNA molecules, like all quantum systems, exist in quantum states, and nothing is known about whether or not DNA states are sensitive to non-locality. Of course, Darwin cannot be blamed for disregarding aspects of reality which physics discovered during the century following his death. But his disciples can be blamed for insisting to excuse him from the matter, instead of exploring what it means for Darwinian theory that its author did not know about these things?

Molecules are the basis of life and molecules are quantum systems. We must, therefore, enter our knowledge of the quantum structure of molecules into the discussion of biology. No comprehensive view of evolution will be possible without taking into account that quantum reality is the basis for all observable phenomena.

In *The Extended Phenotype* Dawkins describes the merits of theories which help us to change the way we see (1982): "We look at life", he writes, "and begin by seeing a collection of interacting individual organisms. Then suddenly the image flips. The individual bodies are still there; they have not moved, but they seem to have gone transparent. We see through them to the replicating fragments of DNA within." From this process new viewpoints emerge which make us "see animals and their behavior differently."

Continuing where Dawkins stopped prematurely, I suggest that, when looking at life, we begin by looking at bodies and their DNA. Then suddenly the image flips, the DNA will become transparent, and we see the underlying quantum structure. Looking at a given stretch of DNA is like looking at the tip of an iceberg. Underlying the visible part is a quantum structure with countless empty, invisible states. Simply by changing the way we observe, a new understanding of living organisms and their behavior can arise.

When I refer to the quantum nature of molecules, I do not mean that, in the blood and sweat of living organisms, genes necessarily perform any fancy quantum acrobatics, such as evolving in superpositions of states or making non-local connections. However, important conclusions follow from the simple fact that molecules exist in quantum states with a fixed energy and an associated wave function (or waveform) or probability distribution.

### 3.2. Mutations are quantum jumps, not errors

The First Evolutionary Relevant Aspect of the Quantum World concerns the fact that any activity at the molecular level is restricted to jumps from one state to another. Quantum jumps are spontaneous, seemingly caused by nothing and ruled by transition probabilities, which in turn are determined by the state wave functions. When processes are ruled by probabilities, one can never be sure of the outcome of a specific event.

In living cells, the synthesis of genes—DNA molecules—is a quantum process. Thus, when a particular stretch of DNA is synthesized, the probability may be overwhelming that the resulting product sequence of nucleotides is the same as that of a DNA template that is present, but that need not be so. When the product is not the same as the template, we say an error was made in copying a gene, and a mutation occurred.

In contrast, the quantum world knows no copying and no errors. In the synthesis of DNA a group of nucleotides simply forms a common quantum state. In a mutation, a group of nucleotides populates a vacant quantum state with a different nuclear distribution that was not actualized before. When the new state leads to variations in phenotypic effects, this is when natural selection takes control.

In this way one is led to consider that the units of natural selection are not stretches of chromosomes, but the waveforms of quantum states, which actualize in chromosomes. Exit: the theory of selfish genes (Dawkins 1976).

The objection is often made that gene-size stretches of DNA are too large to be regarded as quantum systems. However, that is not so. All things, large and small, exist in quantum states. In 1998, Chris van Alsenoy and I and members of our groups cooperated in the first geometry determination of a protein using quantum mechanical calculations (van Alsenoy et al., 1998). In quantum mechanical calculations of molecules, electrons in molecules are considered as standing waves. The nature of these waves is that of probability fields, from which all molecular properties can be derived.

We used the protein, crambin, which has just 642 atoms, but it is far above the size biologists accept for quantum systems. More recently, we performed quantum calculations on crystalline clay, in which the size of the crystals is extrapolated to infinity (Teppen et al. 2002). The success of the quantum formalism in predicting molecular properties shows that all molecules, large and small, are quantum systems and anything they do involves transitions between states, or quantum jumps.



In DNA mutations, the breaking and formation of chemical bonds is always a quantum process. It involves transitions between quantum states, and cannot be understood in any other way.

There is an important consequence for the concept of descent, which is directly based on the view that, in the process of sexual reproduction, copies are made of parental DNA and transmitted to offspring. If genes are not copies of other genes but just repeated actualizations of the same quantum state, the concept of descent loses its meaning. When the image flips, species do not change, but genes change quantum states. One species is in this sense not descended from another, but a previous species merely served as a state, from which the state of another species was accessible. *Since the quantum states that give rise to living organisms do not descend from one another, their phenotypic effects do not do that either.*

### 3.3. The actualization of transcendent order by virtual state actualization

The Second Evolutionary Relevant Aspect of the Quantum World concerns the fact that the state in which a molecule is observed is part of a manifold of empty states that it can access by quantum jumps. Quantum chemists call empty states ‘virtual’.

In molecular quantum mechanics, virtual states are a well-known concept. When atoms form a molecule, they create a system of molecular states, or a ladder of energy levels, each of which can accept two electrons. The electrons in a molecule will fill into the states with the lowest energy, leaving empty a large number of states, which are also available. Quantum physics tells us that there is an abundance of empty states in things. Since they are empty, they are not real in a material sense, and they are called ‘virtual states’. Virtual states are mathematical forms, complex patterns of order, pieces of information, something mind-like, but they are more than a mere mathematical form and the best way to describe their peculiar way of being is by Heisenberg’s concept (Heisenberg 1962) of something “between the idea of a thing and a real thing”. Since they are not real in the ordinary sense, the order of virtual states is a transcendent order.

In quantum jumps, molecules can make transitions to virtual states, which then become real like ordinary things. By jumping into a virtual state, a system can transform transcendent order into real order. This simple

process can serve as a model of how invisible and virtual, but pre-established order in the universe can be expressed spontaneously in the material world. In principle, the entire universe must be considered a quantum system with visible-real and invisible-virtual states and Virtual State Actualization is the mechanism by which the transcendent, mind-like order of the universe can express itself naturally in the material world. At the foundation of things the equilibrium is dynamic between transcendent order and Reality.

In each molecule a large number of vacant states is available, to which that molecule can make a transition. Each quantum state is not an isolated entity but a member of a whole connected system of states, each with its own quantized energy and characteristic wave function. Stretches of DNA are no different in this regard. A strand of DNA is the actualization of one out of many possible states that its nucleotides can populate. For each chain of nucleotides, there are countless empty states, and finite probabilities for spontaneous transitions to any one of them. Thus, a given DNA molecule may contain in its virtual quantum structure the order of future life forms—not quite real, but with the potential of becoming real.

Two aspects of virtual state actualizations are important. First, quantum jumps into empty states can be spontaneous; that is, not caused by anything. Second, when a molecule jumps into a virtual state, the pattern of virtual order becomes actual, real order. There is determinism in this process in the sense that the pattern of order of a state is precisely determined by the conditions of the system, even before it becomes a real pattern. Conversely, the access to that order is random.

In the case of DNA, a mutation is the transition from an actual state to a virtual state with a different nuclear distribution. That transition may lead to variations in phenotypic effects, which will then be evaluated by natural selection. There is no difference to Darwinism as far as natural selection is concerned. There *is* an essential difference, however, in that a) the order that evolves is not from chaos and not from nothing but from the actualization of the precisely determined patterns of quantum states, which already exist before a transition is made to them; and b) mutations can occur spontaneously.

In a recent lecture at the *Science and the Spiritual Quest II Conference,* Pollack remarked (Pollack 2001): " ... facts from science tell us that our species ... is not the creation of design, but the result of accumulated errors." This is the well-established, conventional view of evolution. In



contrast, the quantum perspective knows of no errors made in the evolution of life. Rather, it suggests that, as an alternative to either intelligent design or blind chance, the revelation of the order of empty quantum states by their actualization is a plausible mechanism for the spontaneous emergence of complex order in the visible world.

In the immediate sense, the states involved in the evolutionary process are those of DNA. In a general sense, the states of DNA are just a part of the quantum structure of the universe, from which all of the visible order of reality evolves by virtual state actualization. Ultimately, life forms are correlated with quantum waveforms. When new life forms evolve from existing species, they are the phenotypic effects of waveforms of quantum states occupied by nucleotides. All systems are constantly exploring their quantum space in random quantum jumps. Natural selection gives the random sampling of quantum states the direction of evolutionary progression. But, as the next section will show, it is not operating alone.

The basis of these hypotheses is the proposal to put the two things together: the discovery of a transcendent order in inanimate quantum systems and the transcendent aspects of living organisms, and it is proposed that the emergence of irreducible order in living organisms is related to the quantum nature of the universe. Like any quantum system the universe does not fill all its states at any one time and must be thought to consist of real states and virtual states. Like the waveforms of the virtual states of elementary systems, cosmic virtual states must be thought to represent complicated forms, which can be expressed in the material world, when they are actualized in cascades of quantum jumps. These patterns emerge as complex order in various forms, particularly in living systems.

Thus, it is reasonable to consider that the molecular processes of evolution provide access to cosmic virtual states and the spontaneous emergence of irreducible order in the biosphere is the emergence of an underlying coherent order of the universe, which we must call transcendent because it does not exist in the storage of visible forms, but in the forms deposited in the cosmic virtual states. The model shares essential features with the structure of observable reality, in that quantum states form a 'hierarchy of levels', as Polanyi (1962) called it, where the pattern of a higher level is not contained in a lower level, but the order of all states is immanent in the whole system. It provides a physical mechanism by which transcendent order materializes from patterns of information, or mental

entities. It shares with Darwinism an element of chance, because the quantum jumps are ruled by nothing but chance, but, in contrast to Darwinism, the emerging order is not random but part of a coherent order that is already preformed in the quantum structure of the universe. The model is also consistent with recent attempts to revive the "Laws of form", or the concept of Platonic forms underlying the diversity of life (Denton and Marshall, 2001).

### 3.4. Quantum selection drives evolution in tandem with natural selection

The Third Evolutionary Relevant Aspect of the Quantum World is that mutations can occur spontaneously without the participation of external causes.

According to Dawkins (1986, p.306 of the 1996 reprint) and the orthodox Darwinian view, mutations are not uncaused (they are caused by mutagens) but they are random in that they are not directed in any way, such as toward improvements. I call mutations caused by mutagens 'stimulated'. Quantum physics shows that, in addition to stimulated transitions, molecules are constantly undergoing spontaneous transitions. Accordingly, mutations can occur spontaneously without the participation of mutagens. Spontaneous mutations are uncaused but they are not unbiased. This is so because, if transitions from a given state are possible to several states whose wave functions are different, the transition probabilities are not the same. Differences in transition probabilities will favor the selection of some states over others. Thus there is a form of selection that is active in mutations in addition to natural selection. It can be adequately termed *quantum selection*.

Even though we have no detailed knowledge about the nature of the quantum states that give rise to living organisms, it is obvious that quantum selection must have some effect on how mutations occur. *Thus, we must consider that, in addition to natural selection, evolutionary progression is affected by the quantum properties of the states involved in mutations.* Statements that the direction of evolution cannot possibly be affected by any other factor than natural selection are now exposed as unverified. To drive evolution, natural selection must work in tandem with quantum selection. Since natural selection does not engender order, but merely tests the efficiency of



systems that already exist, I think that the historic progression of evolution allows the suggestion that quantum transitions of mutations are biased toward states with higher complexity.

There is a general notion that, when transitions to new states (mutations) are random, the nature of the variations caused by mutations must also be random. But the one does not follow from the other. While jumps from one quantum state to another are ruled by chance, the order of the states on which the jumping will land, is not. "Blind chance can lead to anything", Monod wrote, "even vision" (Monod 1972) Monod was right, chance can *lead* to anything. However, whether chance is also able to *create* what it leads to, as he implied, that is another question.

A similar criticism applies to Dawkins' *Blind Watchmaker* (Dawkins 1986, p.21 and p.66 of the 1996 reprint). "Natural selection is the blind watchmaker", Dawkins writes, and "Cumulative selection is an efficient searching procedure, and its consequences look very like creative intelligence." In contrast, when evolution is understood as a process of spontaneous transitions among quantum states, it is seen that natural selection makes nothing and searches for nothing.

The anthropic principle (Barrow and Tipler, 1985) suggests that, since the universe has exactly the kind of properties that it does have, the emergence of intelligent life was inevitable. If that principle is extrapolated to the quantum states of molecules which are involved in genetic mutations, then it is possible to propose the following hypothesis: *Because of the anthropic nature of the universe, the wave functions of the quantum states involved in genetic mutations are such that transition probabilities favor transitions to states which correspond to increasingly complex and intelligent life forms.*

### 3.5. The halfway reductionism of evolutionary biology

The Fourth Evolutionary Relevant Aspect of the Quantum World is that, even though the quantum probability fields carry no mass or energy, their properties and interactions determine the visible order of material things. The visible order of the universe is the phenotypic expression of a deeper order. The entities of this order, however, are not just miniaturized editions of ordinary things, but different in essence.

Therefore genes, lumps of matter are not the terminus of reality and not the authors of any information that they convey. Rather, genes are the

vehicles (modifying one of Dawkins' term) or relay stations by which the messages of an underlying order is revealed. Through genes the order of quantum reality can express itself in the material world. Genes have phenotypic expressions in the way that biologists describe, while at the same time they are themselves phenotypic expressions of quantum waveforms. Among contemporary biologists it is fashionable to stop the process of reductionism at the material level of the genes. That sort of reductionism is *halfway reductionism*. (Schäfer 2001).

In the quantum perspective the true power of Darwin's wonderful insight comes to the fore. A century before the discovery of the unpredictable quantum world, Darwin anticipated a mechanism that allows nature to reach into her transcendent roots.

Evolutionary psychologists and sociobiologists like Ruse and Wilson claim that our values, including moral values, are part of innate, genetic dispositions which construct our minds. "Ethics as we understand it," Ruse and Wilson write, "is an illusion fobbed off on us by our genes to get us to cooperate … Our biology enforces its ends by making us think that there is an objective higher code, to which we are all subject," (Ruse and Wilson, 1993). Similarly, Ruse (2001): "Morality is a collective illusion of humankind put in place by our genes in order to make us good cooperators,"

In contrast, in the quantum world, genes do not pursue any ends, but following the laws of physics and chemistry, they just reveal universal order. Genes are not the great deceivers of humanity, nor selfish impostors, but can be considered messengers. If our moral principles are indeed conveyed by our genes, as Ruse and Wilson claim, then we must assume that, in addition to the physical information needed to build bodies, they also help to transmit the metaphysical principles needed to build human minds. In no case are they the authors of the messages that they transmit, but all genetic instructions derive from some objective source.

At this point the numerous phenomena suggesting the mind-like character of quantum reality attain added significance. If the background of the universe is mind-like, we may have to get used to its unexpected capacity of being the source not only of physical principles but also of principles relating to our mind (Schäfer 2002). This implies that quantum reality is the missing link. If morality has been "put in place by our genes" it must be based on some property of the universal order that produced it—an objective correlate in the order of reality according to which genes operate.



How could it be possible that genes help to transmit principles related to mind? In evolutionary psychology the different forms of animal behavior are considered adaptations. If a behavior is an adaptation, it means that we were selected for it. If morality is an illusion set up by our genes, as Ruse and Wilson claim, then we were all selected for a peculiar type of stupidity; namely the inability to recognize a cheap trick when we see one. In contrast, I propose that the adaptation involved in moral behavior is the capacity of the mind to comprehend the significance of universal principles, which transcend individual needs and selfishness. That capacity can be understood to have evolved as a fitness indicator as described by Miller (2000), advertising the presence of a capable mind as an advantage in courtship and mating. If that is, indeed, how humanity learned morality, the heuristic mechanism should not be confused with the underlying principles. The origins of moral behavior may be in sexual selection, but the underlying principles are nevertheless objective and part of the order of the universe.

### 3.6. The incompleteness of the darwinian view

The basic premise of my argument, then, is as follows:

*The visible order of the universe is a phenotypic effect of quantum reality. Therefore, every element of the visible reality must have a counterpart in the order of quantum reality.*

Elements of the visible reality are both material and mental, physical and metaphysical, having to do with facts and with values. In view of the quasi-mental, mind-like aspects of quantum reality it is now plausible to assume that all principles of the visible reality, including the non-physical or mental ones have a counterpart in quantum reality. Some waveforms of quantum reality have phenotypic expressions in material phenomena, like brain states. Others have phenotypic expressions in the metaphysical principles emerging in brain states.

When evolution is seen as a process of transitions among cosmic quantum states, then:

1. the order that evolves is not from chaos and not from nothing but from the actualization of virtual states whose order existed a long time before it was actualized.

2. identical DNA molecules are not copies of one another, but repeated actualizations of the same quantum state, so that the concept of descent loses its meaning.

3. natural selection is not the maker of anything, including watches, no matter what popular terms like "*The Blind Watchmaker*" (Dawkins 1986) imply.

4. quantum selection drives evolution in tandem with natural selection. At any given point of the evolutionary process spontaneous transitions are possible to a large number of new states with differences in transition probabilities, which will favor the selection of some states over others.

5. the center of evolutionary activity is shifted from the material level to the level of quantum entities, whose mind-like properties offer the possibility to account for other than adapted principles of conduct at the human level.

The quantum perspective reveals the incompleteness of the Darwinian view, which does not acknowledge uncaused, spontaneous changes; has no room for quantum selection; does not accept non-adapted, universal standards of conduct; and has no access to the virtual order and non--material entities of the quantum level. Like Newtonian physics, orthodox Darwinism operates at the mechanical surface of things, the thin material cortex that covers a deeper and much richer reality. Orthodox Darwinism is totally insufficient to explain all aspects of life.

The consequences of the expanded view of evolution for the spiritual quest are obvious. The fact that nature can be explained in a natural way does not mean that we have to be atheists. When Darwin's hypothesis is placed into the molecular context of quantum reality, Dawkins' claim that Darwin made atheism "intellectually fulfilling"(Dawkins 1986, p.6 of 1996 reprint) is no more logically conclusive than the evangelism of the creationists.

## 4. The mind-like background of the universe transcendent reality

At the foundation of physical reality, the nature of material things reveals itself as non-material. The elementary components of real things



form a kind of reality that is different than the things that they make. Deterministic processes alternate with expressions of choices in creating the visible order. Entities with mind-like properties are found.

At the level of elementary particles, idea-like states become matter--like. The Word is Becoming Flesh. The unobserved, wave-like states of potentia are thought-like; the results of quantum jumps, matter-like. Actualization is materialization. Whatever King Midas touched turned into gold. Whatever human beings touch turns into matter.

Transcendent reality is intrinsically unobservable. As it turns out, physicists are increasingly willing to make use of unobservable entities. We shall never be able to observe virtual particles, degenerate states, probability fields, or molecular virtual states. And yet, modern physics does not hesitate to ascribe to such entities a kind of reality that significantly affects observable reality.

*The message of contemporary physics is that, at its frontiers, observable reality does not fade into nothing, but into the metaphysical.*

In the same way that dead atoms can form living organisms, and stupid molecules can form intelligent brains, metaphysical entities can form physical reality. Such statements seemed unexpected at one time but, with hindsight, they are not really so amazing. If any kind of meaning shall be assigned to metaphysical entities, then the realm of metaphysics must enjoy some status of reality. Where else should such a reality manifest itself than at the frontiers of physical reality? "Nature's fundamental laws", Dirac wrote (1935; quoted by Polanyi, 1962) "do not govern the world as it appears in our mental picture in any very direct way, but instead they control a substratum of which we cannot form a mental picture without introducing irrelevancies."

According to Kant the world is two-fold: there is the world of appearances and of the things in themselves. We know the things only in the way in which they appear to us. This distinguishes the sensible world from the intelligible world. Interestingly, while Kant postulated that nothing can be known about things in themselves, he nevertheless called them *noumena*—implying that they are *mind-like*.

### 4.1. Human beings in a mind-like universe

If the universe is a network of instantaneous, long-distance connections, it is more likely that it will include us, than that it does not. If the universe is

mind-like, it is more likely that it will communicate with our mind, than that it does not.

Insofar as our nature is molecular, we are subject to the non-local quantum effects pervading the universe. Insofar as our nature is mental, we are subject to the activities going on in the mind-like background of the universe. Thus, we are finding ourselves in a reality that is akin to our nature, rather than being alien to it, as materialistic thinking has always claimed.

In the electron diffraction experiments a window has opened to a different kind of reality, to a Divine Reality, where a mind might exist without a material substratum. The openness of the quantum world conveys a feeling of liberation, of being set free from the shackles of ordinary reality. There is a promise of messages—perhaps of benign guidance—from the depths of the universe, affecting our fate incomprehensibly, and there is the excitement of being part of a creative universe, in which the unexpected is constantly coming into being. In short, science is not in conflict anymore with the assumption of a Divine Presence in the universe—the *"Presence of Mind"* (Polkinghorne, 1991), or of Consciousness, or whatever one wishes to call it.

Thus the consequences of the quantum phenomena for our understanding of human nature are enormous. It can now be accepted that we have spiritual needs because our mind needs to be in touch with what is akin to it in nature—the mind-like background of the universe. Our music is the music of the universe. Mozart is "a touch of transcendence," as Küng put it (1991). Sickness of spirit is the sickness of those who have cut the ties with the mind-like background, who are not in harmony with its principles.

This is the wonderful gift of hope extended to us by the discovery of quantum reality: The universe has opened again, the visible part of reality is only the cortex of something deeper and wider that has room for the spiritual, and religious faith is not in conflict anymore with objective science.

### 4.2. The foundation of metaphysics in the mind-like background of the universe.

At this point it is possible to branch out into ethics, where it has been a general problem for a long time to decide on what basis the moral principles ground their authority. The moral principles are in our mind and we accept their authority, even though we cannot derive them from a process of logic, nor establish them by an experience of external reality. Thus, that question has often been asked: from where do the moral principles



derive their authority? The answer that can now be given is this: Mind gives them authority. Mind can do this because it is an extension of the mind-like background of the universe.

In my introduction to the metaphysics of quantum physics, *In Search of Divine Reality* (Schäfer 1997), I have described why the mind-like aspects of quantum reality make it plausible to consider that the universe has a spiritual order in addition to a physical order.

*If the nature of the universe is mind-like, it must be expected to have a spiritual order as well as a physical order, and* (transcribing Eddington) *in human beings this order rises to the level of morality.*

By interacting with the mind-like background of reality our mind establishes the authority of honesty, morality, responsibility, and purpose. The Human Mind is not self-contained, perhaps not self-sustained, but possibly on-line to a transcendent part of reality. To live in accordance with the essence of things, Socrates taught, is the premise of the moral life. The nature of quantum reality now seems to suggest that, to live in accordance with the order of the universe is the cardinal value on which to build a system of ethics.

When moral laws are viewed as part of the order of the universe, the question of ethics is no longer "how should we act to be good?" but rather, "can we identify rules of conduct that are expressions of universal laws?" Such laws are as imprudent to challenge as it is imprudent to challenge the law of gravity by jumping off the roof of a house.

Like the laws of physics, the basic moral principles—such as honesty, responsibility, truthfulness, and charity—are principles of nature. If they are not respected, there is a price to be paid. That price is well known; it is the peace of mind. To have peace of mind means to live in harmony with the principles of mind; that is, the principles of the mind-like universe. One cannot live in peace with one's own mind, without at the same time being in harmony with its own principles.

Dirac (quoted by Stapp, 1993) characterized the randomness of quantum jumps by saying that, in quantum jumps, "*a choice is made*". A choice can be defined (Stapp, 1993) as *"any fixing of something that is left free by the laws of nature."* This puts quantum jumps outside the laws of nature as we know them. Chance is absence of causality. *"If there is no causality"*, Eddington wrote (1930, 1939), *then there is no clear distinction anymore between the Natural and the Supernatural."* The suggestion is that in the

quantum jumping, the supernatural comes to the fore. At the quantum level of reality, the line of demarcation is blurred between the realm of the Natural and of the Supernatural. The two realms are seen to merge, like the physical with the metaphysical, the mental with the material, and the mechanistic with the teleonomic.

Science will never give up its claim that nature can be explained in a natural way. But at the ultimate level of reductionism that term will mean something entirely different than it does at the level of human consciousness. It may even be found synonymous with the Divine. Barbarians are aliens in a civilized society. The life of barbarians in the realm of values cannot be excused anymore by mechanist materialist claims on reality.

The nature of quantum reality is the basis for considerable hope that a life with meaning and values is not incompatible with an otherwise rational and objective frame of mind. "Monist materialism," Eccles wrote (1979), "is not a basis for a life with values." "A society refusing to be dedicated to transcendent ideals", Polanyi wrote (1962), "chooses to be subjected to servitude". The suggestion is, then, to have something in one's life to hope for, that transcends one's specific individuality. There is no hope for mechanist materialists. It is a wonderful opportunity that knowledge and values may be derivable from the same source; i.e., the transcendent order of the universe. There is great joy and peace of mind in the awareness that our mind may be on-line to a universe with transcendent properties.

We have spiritual needs because the nature of the universe is spiritual and not because we are some aberration of evolution. Since we are a part of this world, we feel the need to live in agreement with its nature. This is the wonderful promise of being able to be, at the same time, logically consistent *and* inspired by a spiritual world. We can combine all the good instincts and expectations of the traditional values - the desire for rational clarity, objectivity, compatibility with experience - with the opening of our minds to a world of purpose, meaning, and truthfulness in a wider sense.

### 4.3. Universal consciousness

Extrapolating from the principles of our mind to their origins in the order of the universe is proposed as a general method. It is not unreasonable to assume that all the universal principles in our mind, which cannot be derived by a process of logic nor verified by an experience of the external



reality, are somehow reflections of a universal order—the order of the transcendent part of reality. In addition to the ethical principles, the set of universals includes the principles that we need in establishing knowledge (i.e., principles such as causality, induction, object permanence), as well as our standards of beauty and justice.

If that same method is applied to our sense of free will, the conclusion is straightforward. The notion of a free will is that of an autonomous, conscious mind. Extrapolated to its universal source, we find Autonomous Mind and Universal Consciousness.

At the conclusion of "*In Search of Divine Reality*" (Schäfer, 1997) I had the courage to amend one of Immanuel Kant's famous statements—I have his approval:

*"Two things fill my mind with ever increasing admiration and reverence the more I think about them: the miracle of my consciousness and its covenant with the mind-like background of the universe."*

***References:***


Barrow, J. D. and Tipler, F. J. 1985. *The Anthropic Cosmological Principle*. Oxford University Press. New York.

Dawkins, R. 1976. "The Selfish Gene". Oxford University Press. (reprinted 1989)

Dawkins, R. 1982. *The Extended Phenotype.* Oxford University Press (p.4 of 1999 reprint)

Dawkins, R. 1986. *The Blind Watchmaker*. Norton & Comp., New York.

Darwin, C. 1872. *The Origin of Species*. 6th edition, London: Oxford University Press (reprinted 1956).

Denton, M. and Marshall, C. 2001. *Laws of form revisited.* Nature, *vol. 410*, p. 417.

Eccles, J. C. 1979. *The Human Mystery*, New York: Springer International.

Eddington, A. S. 1930. *Nature of the Physical World.* New York: Cambridge University Press.

Eddington, A. S. 1939. *Philosophy of Physical Science.* London: Athlone Press.

Goswami, A., Reed, R. E. and Goswami, M. 1993. *The Self-Aware Universe*. Penugin Putnam Inc. New York.

Heisenberg, W. 1962. *Physics and Philosophy*. New York: Harper Touchbooks.

Kafatos, M. and Nadeau, R. 1990. *The Conscious Universe*. Springer Verlag, New York.

Küng, H. 1991. *Mozart-Spuren der Transzendenz.* München, Zürich: Piper.

Margenau, H. 1984. *The Miracle of Existence.* Woodbridge, CT: Ox Bow Press.

Miller, G., 2000. *The Mating Mind.* Random House, Anchor Books. New York.

Monod, J. 1972. *Chance and Necessity*, p.96, Collins. London.

Omnès, R. 1999. *Quantum Philosophy*. Princeton University Press. Princeton, NJ.

Polanyi, M. Personal Knowledge. 1962. University of Chicago Press, Chicago.

Polkinghorne, J. C. 1991. God's Action in the World. Cross Currents, (Fall 1991) 293-307.

Pollack, R. E. 2001. "*The Unknown, the Unknowable, and Free Will as Religious Obligation."* Volume of collected Essays; Science and the Spiritual Quest Boston Conference; Harvard University; October 2001.

Ruse, M. 2001a. *"The Confessions of a Skeptic."* Research News and Opportunity in Science and Theology, Vol. 1, no.6, Feb. 2001. p.20.

Ruse, M. 2001b. *"The bad smell of Anti-Reductionism."* Research News and Opportunity in Science and Theology, Vol.1, no.9, May 2001, p.27.

Ruse, M. and Wilson, E. O. 1993. *"The Evolution of Ethics"*, in J. E. Huchingson, ed. *Religion and the Natural Sciences*, HBJ.

Schäfer, L. 1997. *In Search of Divine Reality - Science as a Source of Inspiration*. Fayetteville, AR: University of Arkansas Press. (edição portuguesa: *À procura da realidade divina – a ciência como fonte de inspiração*. Lisboa, Ésquilo Editora, 2003.

Schäfer, L. 2001. *"On the Halfway Reductionism of Michael Ruse".* Research News and Opportunity in Science and Theology, Vol.2, no.4, Dec. 2001, p.16

Schäfer, L. 2002a. *"Quantum View of Evolution".* Research News and Opportunity in Science and Theology, Vol.2, no.8, April 2002, p.26.

Schäfer, L. 2002b. *"Biology Must Consider Quantum Effects ".* Research News and Opportunity in Science and Theology, Vol. 3, no.1, Sept. 2002, p.16.

Stapp, H. P. 1993. *Mind, Matter, and Quantum Mechanics*. New York: Springer Verlag.

Teppen B. J., Yu, C.-H., Newton, S. Q., Miller, D. M., and Schäfer, L. 2002. *Quantum Molecular Dynamics Simulations Regarding the Dechlorination of Trichloro Ethene in*



*the Interlayer Space of the 2:1 Clay Mineral Nontronite*. J. Phys. Chem. A. vol. 106, 5498-5503.

Van Alsenoy, C., Yu, C.-H., Peeters, A., Martin, J. M. L. and Schäfer, L. 1998. *Ab Initio Geometry Determination of Proteins. I. Crambin."* J. Phys. Chem. A.102, 2246--2251.

Wheeler, J. A. 1999. *Geons, Black Holes & Quantum Foam.*