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Article

## Bohm's Implicate Order, Wheeler's Participatory Universe, Stapp's Mindful Universe, Zurek's Quantum Darwinism and the Buddhist Mind-Only Ground Consciousness

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### Abstract

The fundamental Buddhist definition of consciousness is 'clarity that cognizes.' This primordial nature is an essentially unified field of clarity, or emptiness, which is not the same as nothingness but, rather can be conceived of as a field of potential experience, which has the core function of perception or cognition. Because of this fundamental nature there is an inner tension at the heart of reality. The fundamental nature of awareness-consciousness is undivided (*jnana*) but its function is cognition, and cognition is a process which involves duality. This is why nondual awareness-wisdom (*jnana*) spontaneously divides itself into dualistic appearances in the illusory divided realm of dualistic consciousness (*vijnana*). The prefix 'vi' indicates a cut or division; cognition cannot take place without a rift, a division, in the basic nature of the fundamental awareness (*jnana*). Within this paradoxical nature of the self-perceiving ground of reality lies the solution to the riddle of existence. And within the mechanism of 'quantum karma' lies the understanding of the process of experiential dualistic seeming reality which really is just a cycle of endless perception, giving rise to manifestation, driven by the universe's 'craving' to perceive its own nature.

**Keywords:** quantum karma, David Bohm, implicate order, John Wheeler, participatory universe, Henry Stapp, mindful universe, Wojciech Zurek, quantum Darwinism, Buddhist, mind-only, ground consciousness.

According to quantum physicist Erich Joos the following three issues are *the* outstanding quantum conundrums of deep significance:

1. The meaning of the wavefunction;
2. The exact nature of the mechanism of the collapse;
3. The connection between the quantum and classical realm.<sup>1</sup>

In this paper I shall attempt to elucidate a possible approach to these central issues by drawing parallels between David Bohm's notion of the implicate order, John Wheeler's vision of the 'Participatory Universe', Henry Stapp's account of the Heisenberg-von Neumann quantum 'ontology', Wojciech Zurek's 'Quantum Darwinism' proposal and the Buddhist Mind-Only (Yogachara-Chittamatra) concept of the *alayavijnana*, the ground or store consciousness. Of course in this paper it will only be possible to provide a sketch of the interconnections and implications. The full details are fully presented in my recently

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published book *Quantum Buddhism: Dancing in Emptiness-Reality Revealed at the Interface of Quantum Physics and Buddhist Philosophy*.

The Bohmian ‘implicate order’ can be conceived of as a universal field of non-local potential experiential proto-information which has been ‘enfolded,’ in a manner not fully articulated by Bohm, into the field of potentiality by events and activities which have occurred previously within the operation of the field:

The quantum field contains information about the whole environment and about the whole past, which regulates the present activity of the electron in much the same way that information about the whole past and our whole environment regulates our own activity as human beings, through consciousness.<sup>2</sup>

This field of potentiality, which is Bohm’s generalization of the quantum wavefunction, is posited as being the common ground of the dualistic realm of subject-object experience, the experiential poles of mind and matter. However, Bohm makes it quite clear that he conceives of the implicate order as being ‘closer to the order of consciousness’ than that of the material world. Thus Bohm clearly leans towards the view that the ground of the dualistic world is *of the nature* of consciousness, although this must not be taken to imply that the type of consciousness which is the nature of the implicate order is on the same level as the consciousness exhibited by individuated sentient beings. It is, rather, a deeper level of unified implicit awareness which has the potentiality of ‘unfolding’ into the ‘explicate order’ of the dualistic realm of individuated mind and experienced matter. This fundamental perspective has been adopted by Stuart Hameroff who suggests that a ‘basic field of proto-consciousness’ underlies the realms of consciousness and the material world.<sup>3</sup>

The psychologist Karl Pribram, with whom Bohm collaborated in the development of a holonomic brain theory, referred to the basic field of potentiality from which holographic brain structures, which are stored non-locally within the brain’s quantum field, ‘unfold’ experience, as the ‘frequency domain.’ Pribram and Bohm posited a model of cognitive functioning as being facilitated by an interference effect between individualized cognitive neurological quantum wavefunction structures, which are individuated aspects of the frequency domain, interacting with the global ‘frequency domain’ that is shared by all sentient beings; although, of course, differing individual quantum brain structures would, to various degrees, ‘unfold’ different aspects from the global possibilities contained within the frequency domain. Bohm gave the example of the way in which one of the frequencies within a superposed assemble of radio waves can be tuned into, and thereby activated, an example which naturally leads to the view that the primary mechanism in the activation of experience from the potentialities within the frequency domain is a kind of holographic resonance.

A similar approach is advanced by Henry Stapp’s presentation of the Heisenberg-von Neumann perspective:

The basic structure of orthodox (Heisenberg, von Neumann) quantum mechanics is very simple. The primary reality is a sequence of psychophysical events. Each such event has a psychological aspect and an associated physiological aspect. The connective support that links these events together is a *field of potentialities* that

determines the *objective tendencies* (expressed in terms of probabilities) for specified psychophysical events to occur.<sup>4</sup>

In this depiction Stapp's characterization of the basic field which gives rise to the psychophysical duality is the 'field of potentialities', which clearly denotes a global wavefunction which is somehow triggered to produce a sequence of moments of perception and experience. Furthermore Stapp suggests that it is quite clear that this process involves a 'gap' which provides the necessity for conscious choices to be made that have a determining effect upon the nature of the immediate experience as well as the pool of potential experiences projected into the future:

...choices are not fixed by quantum laws; nonetheless each choice is intrinsically meaningful: each quantum choice injects meaning, in the form of enduring structure into the physical universe.

And this view clearly resonates harmoniously with John Wheeler's assertion that:

Directly opposite to the concept of universe as machine built on law is the vision of *a world self-synthesized*. On this view, the notes struck out on a piano by the observer participants of all times and all places, bits though they are in and by themselves, constitute the great wide world of space and time and things.<sup>5</sup>

An observation which clearly indicates that Wheeler, in his later approach to the interpretation of the quantum evidence, considered that the all the phenomena of the material world, space and time were the result of the congealed perceptions, so to speak, of all the sentient beings who have previously inhabited the Universe, presumably over vast time periods.

This observation by Wheeler resonates spectacularly with the following Yogachara-Chittamatra perspective on the process of reality:

...the mind is the principle creator of everything because sentient beings accumulate predisposing potencies through their actions, and these actions are directed by mental motivation. These potencies are what create not only their own lives but also the physical world around them. All environments are formed by *karma*, that is actions and the potencies they establish. The wind, sun, earth, trees, what is enjoyed, used, and suffered-all are produced from actions.<sup>6</sup>

Karma, a term often misunderstood in the West, simply means intentional activity of any kind on the part of sentient beings, or 'observer-participants,' and such intentional activity will have future effects. Even minimalist perceptions of the seemingly material world are such intentional activities which have karmic effects, in this case the effect being the production of a latency, or 'seed' for a similar perception to occur at a future time. Karma is the universal law of cause and effect which operates on all levels of reality, including the production of the structure of the seemingly independent material world. According to the Buddhist Mind-Only perspective the type of 'action' which is primarily responsible for the creation of apparent materiality is perception or cognition, which is also suggested by Wheeler's use of the term 'observer-participants.'

The Mind-Only mechanism which accounts for this remarkable achievement, the transformation of mind into *the appearance* of matter, as opposed to the impossible materialist alchemical dream of vivifying mindless matter into mind, can be called *karmic resonance*. All actions and perceptions leave potencies within a deep level of collective mind called the *alayavijnana*, or ground-consciousness, a level of the process of reality which can be shown to correspond to the realm of quantum emptiness (which does not mean ‘nothingness’) or potentiality. When these potencies are activated through being combined with potencies within the mind-streams of vast numbers of other sentient beings an intersubjective creation of a shared material environment comes into being. This description of the process of reality, including the production of the intersubjective illusion of the material world, involves the mechanism of karmic cause and effect or quantum resonance, the carrying forward and subsequent inter-subjective activation of potencies within a deep collective mind-stream. When the subjective potencies resonate together in a reinforcing manner due their overall similarity the collective experiential solidity of the apparently independent material world emerges. From this perspective the ‘objective’ world of apparent material reality is an inter-subjective creation on the part of all sentient beings who have ever existed and exist within the universe.

This Buddhist metaphysical perspective corresponds remarkably well with the work of Bohm. In his work *Wholeness and the Implicate Order* Bohm indicates that reality encompasses both the objective aspects and the subjective aspects of what is essentially an interconnected and undivided ‘wholeness’; Bohm calls this totality the ‘holomovement,’ a notion which fits well with that of a ground consciousness:

...what carries the implicate order is the *holomovement*, which is unbroken and undivided totality. In certain cases we can abstract particular aspects of the holomovement ..., but more generally, all forms of the holomovement merge and are inseparable.<sup>7</sup>

Another term that Bohm used for the realm of potentiality from which the world of experience emerges is the ‘implicate order,’ a nondual ground of potential experience which is activated in some manner to produce the dualistic realm of experience, which Bohm termed the ‘explicate order.’ The ‘implicate order’ is actually another label for some quantum physicists call the universal wavefunction, which is a quantum description of all the potentialities encompassing the manifestation of the experiential web of the entire universe. Such a wavefunction includes both the objective potentialities for experience and also the multitude of sentient experiencers moving through the wavefunction and thereby unfolding the experiences.

As mentioned previously Bohm also suggested a mechanism by which potentialities are unfolded as experienced actualities in the ‘classical’ dualistic world. An example that Bohm gave is that of the way in which a radio electromagnetic wave encodes the transmitted content within, or on top of, another frequency. The original content is ‘unfolded’ by tuning to the carrier frequency. We can think of various radio frequencies for instance as superposed into a global environmental composite waveform which becomes the overall radio electro-magnetic wave environment, thus the radio environment contains multiple possibilities which can be tuned into and thus unfolded. Different tunings unfold different potentialities from the environmental frequency superposition (figure 1). In this picture

different experiences are unfolded out of the overall environmental frequency set through the mechanism of resonance, the actual resonance frequency depending on the tuning of the radio.

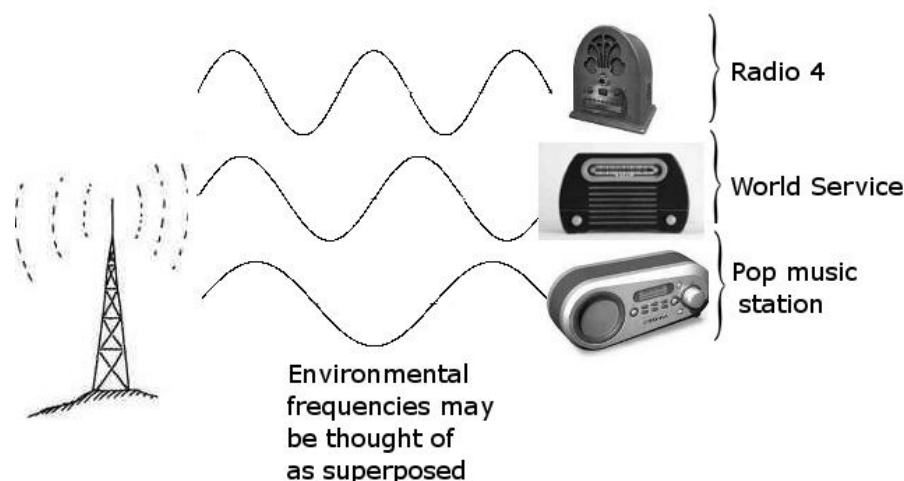


Figure 1

This viewpoint corresponds to Max Tegmark's more recent presentation of the famous Everett's Many-Worlds scenario according to which it must be the case that there are a vast number of sentient beings trapped, so to speak, inside the global wavefunction. These can be thought of as quantum experiencing substructures which move through the overall wavefunction and in so doing unfold into experiential reality the potentialities within the wavefunction. It took the genius of Everett, Tegmark tells us:

... to realise that a single deterministically evolving wavefunction ... contains within it a vast number of ... perspectives where certain events appear to occur randomly.<sup>8</sup>

Tegmark actually uses the term 'frog perspectives' because his original metaphor involved the notion of a frog being trapped inside the wavefunction, as opposed to the bird perspective adopted by theoretical 'external' observers (physicists – or God?), as shown in Figure 2.

But to be more precise, however, we must say that there are a vast number of frog perspectives, dog perspectives, cat perspectives, bird perspectives, fish perspectives, human perspectives and so on within the universal wavefunction. In fact each sentient being is a 'subjective' quantum substructure moving, in fact cycling, through the universal wavefunction of quantum potentiality matrix of reality.

The process of reality is of the nature of consciousness. The fundamental field of awareness-consciousness, which creates the appearance of a material world, contains encoded, or enfolded, to use Bohm's terminology, tendencies, or potentialities, for matter-like experiences to occur. It is these potentialities, when manifested, which build up the illusion

of an external material reality. This is precisely the view proposed as early as 1944 by the historical founder of quantum theory Max Planck, who said in a lecture that:

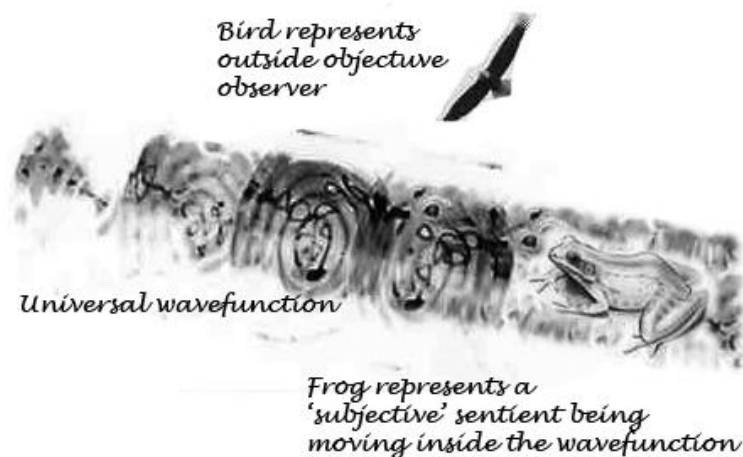


Figure 2.

All matter originates and exists only by virtue of a force... We must assume behind this force the existence of a conscious and intelligent Mind. This Mind is the matrix of all matter.<sup>9</sup>

This is an observation which is worth contemplating alongside the following distillation from the fourteenth century Tibetan Buddhist masterpiece *The Mountain Doctrine: Ocean of Definitive Meaning: Final Unique Quintessential Instructions* by Dolpopa Sherab Gyaltsen:

I am called the matrix of attributes....  
I am called the pure matrix....  
The essence of ... of cyclic existence  
Is only I, self-arisen.  
Phenomena in which cyclic existence exists  
Do not exist-even particles-  
Because of being unreal ideation.<sup>10</sup>

This exposition is devoted to a lengthy and comprehensive elucidation of the nature of the 'matrix of phenomena', a fundamental Buddhist concept which is clearly analogous to the quantum wavefunction. When the above fragment is unraveled and explicated from within its own context, it turns out to be saying basically the same thing as Planck. 'Unreal ideation' is a Mind-Only term for the functioning of the fundamental mind-nature of reality. It is called 'unreal' because Buddhist philosophy attributes full reality to the nondual matrix. The term 'phenomena of cyclic existence' refers to the appearances of the apparent entities of the dualistic world, including the 'material' world. The 'matrix of attributes', or 'matrix of phenomena' corresponds to what quantum physicists call the 'wavefunction' of potentiality which underlies the manifestation of the appearance of the many worlds of cyclic existence, including the appearance of materiality.

In the following Dzogchen (the Buddhist 'Great Perfection' teachings) passage 'intrinsic rigpa' refers to the fundamental awareness which resides as the ground quality of the

universal wavefunction, and ‘spaciousness’ refers to the open potentiality of the wavefunction ground of reality to produce experiences in a coordinated manner:

The one intrinsic rigpa binds all experience:  
environments and lifeforms, infinite and unconfined,  
whether of samsara or nirvana, arise in spaciousness;  
spaciousness, therefore, embraces all experience at its origin.<sup>11</sup>

In other words the awareness which is mathematically described by the universal wavefunction is the timeless source and origin of all the experiential continuums of lifeforms within their respective environments, which, of course, to a large extent overlap. *Samsara* indicates the experience of the process of reality from an unenlightened, or dualistic, perspective whilst *nirvana* is the experience from an enlightened, nondual, perspective.

According to the Wheeler-DeWitt equation the universal wavefunction is timeless or ‘frozen in time’<sup>12</sup> and furthermore:

From a God’s-eye view, we can suppose, there is just a timeless universal state, which consists of a vast entangled superposition ... of states of subsystems of the universe. In these entangled superpositions, however, observables of certain subsystems of the universe are correlated with observables of other systems.<sup>13</sup>

It is these ‘subsystems of the universe’ which are sentient beings, the agents through which the universe perceives its own potentialities and creates the flow of time within the dualistic realms of existence. In other words all sentient beings are agents through which the potentialities of the universal wavefunction of reality are unfolded. This is what Buddhist philosophy refers to as *samsara*, the endless cycle of conditioned and interdependent existence, which is driven by the causal karmic resonance mechanism of *karma-vipaka*, intentional actions or movements of consciousness and the subsequent effects (fig 3).

Each sentient being ‘unfolds’ a continuum of experience from out of the holomovement which takes place within the mindnature of the quantum implicate order. For Bohm the process of reality is the unfolding of an experienced world from the potentialities within the holomovement; the unfolding of lived experience from the implicate order. This unfolding from the implicate order Bohm considered to occur through the operation of the same mechanism as a hologram is activated. In other words our reality manifests as an interference pattern of wavefunctions interacting with each other in the same way as images are ‘unfolded’ from holograms. For Bohm, then, the nature of pre-experienced reality is considered to be an incredibly complex holographic wavefunction which encodes the potential experiences of a material world, and, of course, much more.

When a subjective subsystem of consciousness resonantly interacts at the quantum level with the objective possibilities a fleeting evanescent ‘moment of experience;’ and this process is continuous and operates at a Plank scale frequency so produces the illusion of a continuous experienced world of illusion. This in turn leaves further traces in the ground consciousness and thereby the cycle of the ‘self-excited’ and ‘self-synthesized’ manifestation of the infinite multiplicity of the worlds of reality is kept cycling around a hub of emptiness. As Donald D. Hoffman, Professor of Cognitive Science, University of California, says:

The world of our daily experience – the world of tables, chairs, stars and people, with their attendant shapes, smells, feels and sounds – is a species specific user interface between ourselves and a realm far more complex, whose essential character is conscious.<sup>14</sup>

The totality of all the different experiential continuums, which exist on many levels: species, race and individual are obvious examples of levels of manifestation for instance, make up the many-worlds of illusion (figure 3).

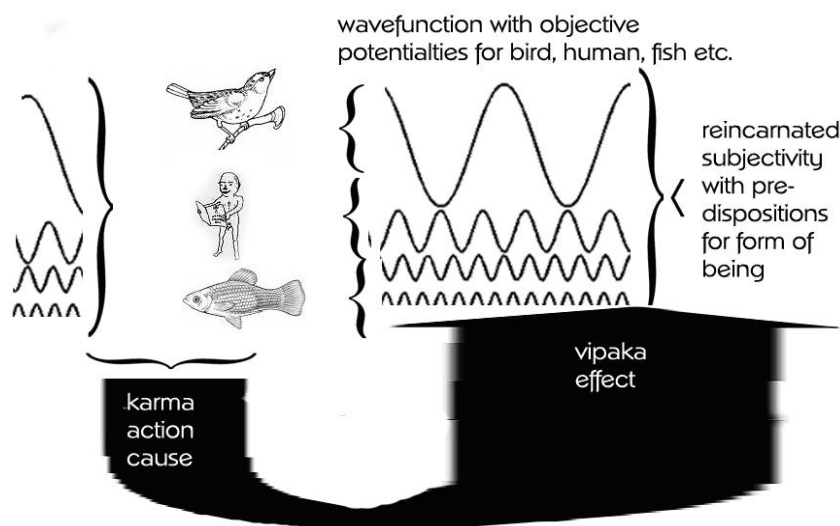


Figure 3

Speaking in April 2003 to the American Physical Society, he made the following remarkable; perhaps one might say ‘mystical’, sequence of remarks:

The Question is what is the Question?  
Is it all a Magic Show?  
Is Reality an Illusion?  
What is the framework of the Machine?  
Darwin’s Puzzle: Natural Selection?  
Where does Space-Time come from?  
Is there any answer except that it comes from consciousness?  
What is Out There?  
T’is Ourselves?  
Or, is IT all just a Magic Show?<sup>15</sup>

As we shall see, Buddhist Mind-Only (Yogachara-Chittamatra) philosophers had come up with an affirmative answer to Wheeler’s question as to the possibility that reality might be an illusory ‘Magic Show’ roughly two thousand years ago:

Phenomena as they appear and resound  
Are neither established or real in these ways,  
Since they keep changing in all possible and various manners  
Just like appearances in magical illusions.<sup>16</sup>



The Yogachara Mind-Only ‘contemplative-philosophers’ conceived of the epistemological-ontological process of reality as fundamentally consisting of an exquisitely sensitive and responsive experiential field within which all sentient beings were immersed and had their being. This field – the *alayavijnana* or ground consciousness, which was conceived of as being of the fundamental nature of cognitive-awareness, is the ‘stuff’ from which all sentient beings, and the objects that they appear to experience, are constructed, and this ‘stuff’ is fundamentally experiential in nature and responds with great sensitivity to all intentional activity carried out by all sentient beings. Such actions can be performed by body, speech or mind but it is the intentionality behind any such action which is paramount in the mechanism by which all such activities leave traces within the fundamental cognitive-experiential field of reality, traces which will be activated at later moments when surrounding conditions within the field are resonantly conducive for the potentiality of the ‘seed’ to emerge into full experiential reality. This metaphysical perspective anticipates some of the recent interpretations of the quantum evidence by some two thousand years. For instance in a recent paper *Founding Quantum Theory on the Basis of Consciousness* Efstratios Manousakis writes:

First, we conjecture that all human beings and the other living organisms have their own streams of consciousness. In order to gain an understanding of all of these related streams of consciousness together, and what precedes our human thoughts, and binds them together, we postulate the existence of the Universal/Global stream of consciousness, as the primary reality that contains all of our individual streams, (which are sub-streams of the Universal conscious flow of events) and also conscious events that are not members of any human stream, but are like certain of our conscious events ... Note that the set of conscious events in consciousness must include all those that anyone has ever had, and for any personal stream of consciousness, all the events that have appeared in that person’s stream of consciousness.<sup>17</sup>

This quantum perspective maps exactly on the Yogachara metaphysical worldview within which all sentient beings have their own continuum of consciousness cycling within the overall universal pool. In fact in some presentations of Yogachara the *alayavijnana* is identified with the individual ground consciousness of sentient beings, whilst the all encompassing, or ‘Universal/Global.’ stream is called the *Alaya*.

From the Yogachara perspective the collective epistemological activity on the part of all sentient beings determines ontology, an insight which clearly prefigured the later quantum insights of John Wheeler and others. Furthermore the Yogachara viewpoint requires that we assume that the ‘ultimate’ nature of all phenomena is cognitive in nature:

Nothing, such as atoms and so on, exist externally,  
As anything other than cognition.<sup>18</sup>

It follows therefore that all phenomena are of the nature of consciousness:

..all these various appearances,  
Do not exist as sensory objects which are other than consciousness.  
Their arising is like the experience of self knowledge.  
All appearances, from indivisible particles to vast forms, are mind.<sup>19</sup>

The Yogachara cognitive ‘stuff’ which is conceived of as forming the fabric of reality bears an uncanny resemblance to the quantum ‘dream stuff’ of reality as portrayed by Wojciech Zurek:

...quantum states, by their very nature share an epistemological and ontological role – are simultaneously a description of the state, and the ‘dream stuff is made of.’ One might say that they are *epiontic*. These two aspects may seem contradictory, but at least in the quantum setting, there is a union of these two functions.<sup>20</sup>

Here Zurek characterizes the quantum ‘dream stuff’ as being exactly the kind of cognitive medium capable of creating the appearance of a ‘solidified’ classical world through its own infinite web of internal acts of cognition, acts which may be considered equivalent to ‘collapses’ of wavefunctions. Zurek refers to the inner process of quantum realm as consisting of the ‘union’ of the two functions of epistemology - the process of perception and knowing, and ontology - the actuality of being. The quantum ‘epiontic principle’, then, indicates that perception creates being. It is vital in this connection, however, not to run away with the idea that the isolated conscious or unconscious (both being part of a structure of consciousness) perceptions of individual sentient beings create reality by lone whim or preference. As Zurek points out:

...while the ultimate evidence for the choice of one alternative resides in our elusive ‘consciousness,’ there is every indication that the choice occurs much before consciousness gets involved...<sup>21</sup>

An observation that is echoed by Penrose in his 1994 book *Shadows of the Mind*:

At the large end of things, the place where ‘the buck stops’ is provided by our *conscious perceptions*.<sup>22</sup>

Like Zurek, however, Penrose discounts the notion that ‘consciousness’ actually does ‘collapse’ the wavefunction of possibilities into one actuality. In Penrose’s case this is because he considers that ‘consciousness is a rather rare phenomenon throughout the Universe.’<sup>23</sup>

Such a view, however, derives from the pervasive hold that a subtle materialism seems to have on the perspectives of most physicists even today. Even though there are intrepid physicists such as Amit Goswami, Henry Stapp and others who are advancing the seemingly inescapable conclusion that consciousness in some form, not necessarily fully fledged individual consciousness, is implicated in the appearance of the material realm, on the whole it still remains the case that the overall prejudice within both science and philosophy is towards a subtle materialism which seems to prefer to think of consciousness as arising from some kind of subtle ‘matter’ which has aspects of both the epistemological poles of experience. Thus Bruce Rosenblum and Fred Kuttner, in their important work *Quantum Enigma: Physics encounters consciousness* remain very cagey about just how significant this encounter is, apparently for fear of being branded as ‘new age’ fantasy merchants.

However, if the epiontic paradigm is correct, and the evidence most certainly points in that direction, then the only reasonable conclusion must be that the ultimate ground of the appearance of the ‘classical’ realm of materiality must be, as Zurek says, some kind of epiontic quantum ‘dream stuff.’ Furthermore, this dream stuff, according to Zurek, has the

fundamental feature that it is capable of preserving and proliferating cognitive activity, or the quantum states that derive from such activity:

... the appearance of the classical reality can be viewed as the result of the emergence of the preferred states from within the quantum substrate through the Darwinian paradigm, once the survival of the fittest quantum states and selective proliferation of the information about them throughout the universe are properly taken into account.<sup>24</sup>

The insight that Zurek has given is that ‘states that exist are the states that persist’ and this is a persistence within a quantum realm which consists of, as Zurek puts it, ‘the dream stuff which reality is made of’<sup>25</sup>; and the mechanism that underlies this persistence is ‘an objective consequence of the relationship between the state of the observer and the rest of the universe’<sup>26</sup>. Zurek describes his view as follows:

The main idea of quantum Darwinism is that we almost never do any direct measurement on anything ... the environment acts as a witness, or as a communication channel. ... It is like a big advertising billboard, which floats multiple copies of the information about our universe all over the place.<sup>27</sup>

In this billboard advertising metaphor the image is that the more the observing punters buy into the advertisement and thereby make the product, which is in this case the solidified appearance of the apparently material world, more popular, the greater the number of billboards which spring up and, as a consequence, the more punters are enticed to join in the product craze. Thus the process of the multitudinous perceptual creation of the material world takes off in a self-reinforcing, or self-resonating, manner.

This is the metaphor which Zurek is extending to the generation of the classical, macroscopic, material world; the more often a perception of the appearance of materiality is made, the more potent becomes the advertising billboard campaign, or the environmental template, or matrix, for that perception of material reality to occur again at some future point. Stapp made a similar point in the following way:

Each subjective experience injects one bit of information into this objective store of information which then specifies ... the relative probabilities for various possible future subjective experiences to occur.<sup>28</sup>

The emerging epiontic paradigm, derived primarily from the work of Bohm, Wheeler, Stapp and Zurek, bears a remarkable resemblance to the Yogachara-Chittamatra worldview:

...all of the external phenomena-mountains, houses, roads and their perceptions – originated from the mind. They all arose out of the ground consciousness. How is this possible? The answer lies in the fact that since beginningless time we have been perceiving sights, sounds, smells, tastes and bodily sensations and these perceptions have been creating imprints or latencies in the ground consciousness. Habituation of having experienced a certain visual form will create a latency for that very form. Eventually, that latency will manifest from the ground consciousness as a visual form again, but it will be perceived as external to ourselves.<sup>29</sup>

The epiontic quantum Darwinian paradigm is adumbrated within Buddhist philosophy which posits the ultimate nature of reality as being a fundamental ground comprised of ‘emptiness and cognition inseparable’, or ‘empty cognizance’.<sup>30</sup> The field consists of ‘empty’ potentiality for manifested experience, a field of possibility which neither exists nor not exists, and thus hovers indeterminately and interdependently between existence and non-existence in a fashion redolent of the Heisenberg Uncertainty Principle. And it is the inner function of cognizance, a function which is internal to the ground of reality, which activates the potentialities within the ground field. Thus Zurek’s ‘epiontic’ ‘dream stuff’ corresponds precisely with a characterisation of the fundamental ground of the process of reality according to the Buddhist philosophy of the Yogachara-Vijnanavada, the Cognition-Only epistemological-metaphysical view of the process of reality, which refers to the fundamental field as the *alayavijnana*, or ground consciousness:

The ground consciousness is the foundation and location for mind because all karmic latencies are stored in the ground consciousness. A momentary visual consciousness instantly ceases (when the next instant appears). Similarly, a mental consciousness is created and ceases instantly; sometimes a mental consciousness does not appear at all. However, the latencies for the arising of these consciousnesses are contained within the ground consciousness. Thus we can remember a visual perception that occurred in the past; and remembering it, strengthens the latency.<sup>31</sup>

According to the Yogachara view a fundamental feature of consciousness is that even the tiniest movement of energy within the structure of consciousness leaves a trace within the ground consciousness *which increases the probability that the same movement of energy will occur at a later point in time*. This reinforcing process takes place at all levels of consciousness, including those deep structures of psychophysical embodiment not available to direct awareness. This mechanism, described by Yogachara Buddhist philosophy, provides an intriguing, coherent and viable candidate for the quantum mechanism which produces the probability distribution within wavefunctions; the repeated activity of perception acting at the quantum level, a process which is clearly indicated by the collapse of the wavefunction is the mechanism through which meaning is ‘injected’ into the universe; it is, from Wheeler’s perspective, the fundamental mechanism of the self-creation of the universe.

In the Guardian obituary for John Wheeler we can read that:

In 2002, he wrote: ‘How come the universe? How come us? How come anything?’ Although Einstein had once asked him whether, if no one looked at it, the moon continued to exist, Wheeler’s answer to his ‘how come?’ questions was ‘that’s us’.<sup>32</sup>

So Wheeler was well aware that acts of perception were the creative force behind the manifestation of the universe, this was clearly embodied in his self-perceiving universe graphic (figure 4). It only remained for the final step, the extraordinary knowledge known and realised by the great mystics of ‘all times and all places’, *the fundamental nature of reality is Universal Self-perception*. The phenomenon of the ‘collapse of the wavefunction’ is a direct indication of the fundamental self-perceiving process of the universe. In other words *the universe uses the perceiving process within the dualistic world of experience in*

*order to explore and also heighten awareness of its own nature, which is pure meaning-awareness. As Bohm says:*

Rather than ask what is the meaning of the universe, we would have to say that the universe *is* its meaning. ... And of course, we are referring not just to the meaning of the universe for us, but its meaning ‘for itself’, or the meaning of the whole for itself.<sup>33</sup>

Without this inner quality of meaning being intrinsic to the universe from the start the universe could never mean anything, to itself or to anything within it. The function of meaning, then, can be looked at as the central source of the experiential polar aspects of mind and matter. Matter is an appearance of objective meaning to mind, and individuated consciousness, or awareness, is the ground of subjectively experienced meaning. This ground of cognitive meaning-awareness is described by the 14<sup>th</sup> century Tibetan Buddhist philosopher Longchenpa:

The founding stratum of meaning antedating the concretization into subject and object  
As stainless sheer lucency, the energizing power of the sun  
Rises in bliss, lucency, conceptual undividedness, having no periphery nor center...<sup>34</sup>

And as a result of the cognitive function which is intrinsic to the ‘founding stratum of meaning ‘:

...all the external things that are appear as external objects  
Appear in mind but are not the mind,  
Nor are they found anyway else than in mind.  
Although through the power of inveterate tendencies  
There seems to be there a duality of subject and object,  
There never has been such a duality in this there-ness.  
It is like a face and its reflection in a mirror.

And through this extraordinary illusion-like manifestation the Universal meaning ground explores its own nature. For Longchenpa the Universe is a meaning machine and sentient beings are embodiments of the meaning ground exploring and deepening its own nature. Human beings occupy a central place in this process because they are the Universe’s agents in the process of Universal self-exploration, self-perfection and self-transcendence.

The way that consciousness operates is according to a law of repetition and habituation. Already established movements of consciousness are more likely to arise at a later point; and it is through a vast cascade of tiny movements within the overall energy field of consciousness that the Universe arises and develops or evolves. According to the Buddhist philosopher-Yogin Manjusrimitra:

Once that intelligence becomes the site of unbounded activity, imprints proliferate endlessly .... With the ripening of these vestigial imprints, further conditions for their production multiply profusely. The ripening of imprints are the cooperating conditions from whence the concatenation of effects resulting in the emergence of organic beings occurs.<sup>35</sup>

The actual mechanism which is responsible for the unfolding of potentialities within the quantum ground meaning-consciousness would have to be some form of quantum resonance.

This is the most appropriate mechanism by which karmic cause and effect operates to unfold the enfolded karmic ‘seeds’. The universe, then, is not only a ‘self-excited’ phenomenon, as John Wheeler describes it, is also a self-resonating universe.

The fundamental Buddhist definition of consciousness is ‘clarity that cognizes.’ This primordial nature is an essentially unified field of clarity, or emptiness, which is not the same as nothingness but, rather can be conceived of as a field of potential experience, which has the core function of perception or cognition. Because of this fundamental nature there is an inner tension at the heart of reality. The fundamental nature of awareness-consciousness is undivided (*jnana*) but its function is cognition, and cognition is a process which involves duality. This is why nondual awareness-wisdom (*jnana*) spontaneously divides itself into dualistic appearances in the illusory divided realm of dualistic consciousness (*vijnana*). The prefix ‘vi’ indicates a cut or division; cognition cannot take place without a rift, a division, in the basic nature of the fundamental awareness (*jnana*). Within this paradoxical nature of the self-perceiving ground of reality lies the solution to the riddle of existence. And within the mechanism of ‘quantum karma’ lies the understanding of the process of experiential dualistic seeming reality which really is just a cycle of endless perception, giving rise to manifestation, driven by the universe’s ‘craving’ to perceive its own nature!

There is within the very nature of the deepest level of awareness-consciousness a function and necessity of perception. Because the inner nature of reality is awareness, or inner luminosity, perception is a necessary activity for the fundamental ground of reality. And because of this, the illusory experience of subject and object must arise. According to the Yogachara perspective the dualistic world of experienced phenomena is driven by a deeply entrenched ‘grasping’ for the manifested experiences of the dualistic world. This primordial desire for experienced existence is intrinsic to the fundamental ground of reality. There is, then, a minimalist intentionality, a ‘teleology without teleology’<sup>36</sup> which lies deep within the heart of the process of reality, and this drives the multitudinous manifestation of the appearances of the dualistic experiential realm of the process of reality, which is termed within Buddhist thought *samsara*, or cyclic existence.

According to Buddhist thought there is latent within the heart of reality a ‘thirst’ (*tanha*) for individuated experience, a concept which easily compares with Schopenhauer’s notion of a Universal foundational ‘Will’ towards existence. Thus Buddhist thought considers that the fundamental ground must be conceived of, insofar as conception can take us towards a limited understanding, as a field of potentiality which is referred to as *sunyata*, or emptiness (which is not nothingness but a proto-informational field hovering between existence and non-existence in conformance with the Heisenberg principle). This fundamental field contains the function of cognition coiled within it so to speak:

The foundation for the site of ... activity is an indeterminate stratum of all and everything,

Similar to a mirror. Since its surface, undisturbed by any ... division

Allows a cognitive capacity, lucent, but as yet not conceptually determined and divided as to content...

From this capacity there comes the five sense perceptions that apprehend their respective objects as color-form and so on.<sup>37</sup>

The fundamental drive towards existence, which is triggered by the cognitive function, operates through a multitude of levels from the most primitive glimmers of subjectivity-objectivity up into the world of seemingly material manifestation. This quantum cascade operates according to the ‘epiontic’ mechanism and thereby builds up through repeated momentary perceptual or cognitive movements within the fundamental layers of quantum awareness-consciousness a complex web of predispositions for experience for each sentient being entering once again the cyclic dualistic realm:

...the mind which has all the seeds ... matures, congeals, grows, develops and increases based upon the twofold appropriation... that is

1. the appropriation of the material sense faculties...
2. and the appropriation which consists of the predispositions towards profuse imaginings in terms of conventional usage of images, names, and concepts...<sup>38</sup>

The term ‘conventional’ here does not merely mean ‘by common agreement’, it indicates the very deep structures of intentionality which can actually create the appearance of the materiality which physics calls the ‘classical’ level of reality and Buddhist thought refers to as ‘conventional’ reality. The ‘material sense faculties’ are actually considered to be gross structures of the ‘epiontic’ cognitive stuff of reality, which has the ultimate nature of consciousness, and the ‘predispositions’ are subtler structures which provide potential experiential templates for experiencing ‘objective’ aspects of the cognitive stuff of reality according to pre-established patterns which have been built up through repetition or habituation:

Buddhists and biologists ... largely concur that the very forms and structures of human life result from the accumulative actions of innumerable beings over countless generations. Like all species, we too have been formed and conditioned by an immensely long and complex series of transformations ... we are ... assemblages of dynamic yet wholly conditioned structures (*samskara*) forged through the crucible of past actions and experience.<sup>39</sup>

The subjective structures of intentionality, which are termed *samskara* – conditioned structural intentional processes produced by previous intentional activities, are embodied within the various types of sentient beings and operate upon an intersubjectively created ‘objective’ field of potentiality fashioned from the ‘epiontic’ stuff of reality. This entire process takes place within the *alayavijnana*, the ground consciousness, the fundamental layer of consciousness which ‘collects’ all the traces from intentional activities performed by sentient beings:

‘The common characteristic of the *alayavijnana* is the seed of the receptacle-world’ means that it is the cause of perceptions which appear as the receptacle world. It is common because these perceptions appear similarly to all who experience them through the force of maturation that is in accordance with their own similar karma.<sup>40</sup>

The term ‘karma’ simply means ‘action’ and it refers to any action of body, speech and mind which leaves a trace within the *alayavijnana*, the ground consciousness of potentiality. These resonant traces, or seeds, will later ‘mature’, or be activated into experiential reality. *Karma-vipaka* is the universal law of action and maturation, cause and effect, which operates at all levels of reality, including the creation of the potentialities, or seeds, within the ground

consciousness which mature or manifest as experiences of a supposedly external ‘material’ reality:

Space, earth, wind, sun,  
The oceanside, and waterfalls  
Are aspects of the true, internal consciousness  
That appear as if being something external.<sup>41</sup>

According to the Yogachara account of the process of reality the vast experiential web of reality is a resonant interactive field of the primordial epiontic dream stuff which is fundamentally of the nature of awareness-consciousness. This account of the functioning of reality involves the interaction of a multitude of subjective experiencing structures of ‘epiontic’ stuff, which is of the nature of consciousness, that interacts with and triggers into manifestation, a field of objectified ‘epiontic’ stuff.

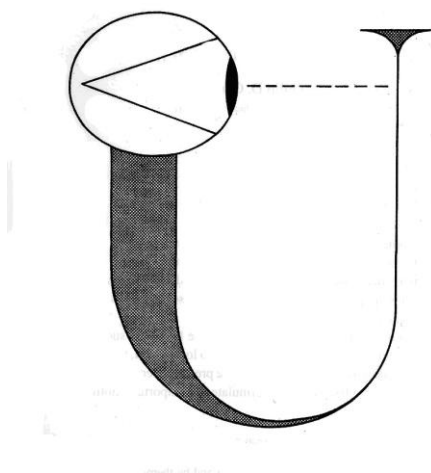


Figure 4

This process is schematically pictured in Wheeler’s famous self-observing universal ‘U’ (figure 4). This graphic image is employed in figure 5 to depict momentary pulses of individuated consciousness, each corresponding to a ‘wavefunction collapse’. Each such quantum event can be conceived of as an internal quantum perception that contributes to the multitudinous task of building up the higher individuated levels of conscious perception. It is through an extraordinary complex hierarchical structure of such quantum processes of meaning-awareness-consciousness that the rich dualistic world of all sentient beings is built up by the unfolding process of reality through what David Bohm called the ‘implicate orders’ from which the ‘explicate’ world unfolds. This picture of the development of levels of consciousness towards greater individuation is implied by Max Tegmark’s understanding of the nature of dualistic consciousness:

I believe that consciousness is the way information feels being processed. Since matter can be arranged to process information in numerous ways of varying complexity, this implies a rich variety of levels and types of consciousness.<sup>42</sup>



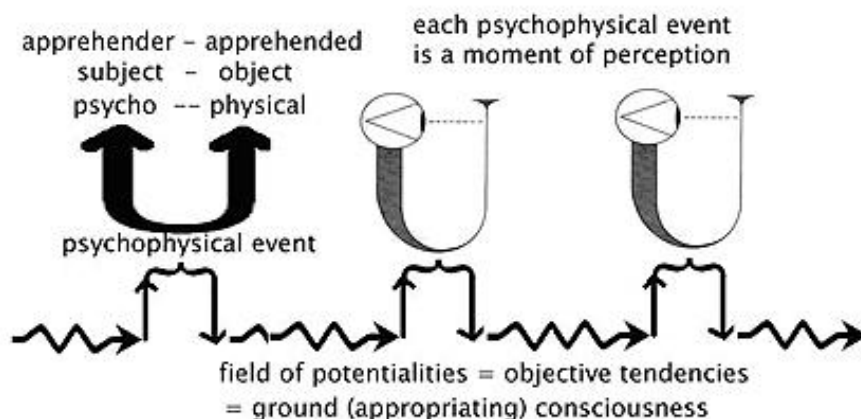


Figure 5

The process of figure 5 would be just one level in a complex ‘unfolding’ of implicate orders into the explicate realm; as Bohm indicated in his notion of a ‘super-implicate’ order standing behind the implicate order, it is necessary to conceive of a countless number of implicate orders becoming more explicate as they cascade into manifestation through increasingly explicate ‘orders’. Within this view there is the beginning of a tie up with Jung’s notion of the ‘archetypes,’ which are predisposing structures of potentiality for experience.

This emerging Quantum-Mind-Only (Quantum-Yogachara) picture of the process of reality as being an emergent experiential realm from a more fundamental field of quantum potentiality was anticipated by the Yogachara account according to which a subjective and an objective aspect of experience arise together from the ground consciousness on the basis of previous moments of similar experiences, perceptions and actions:

A seed or predisposition is activated and simultaneously produces both an object and a cognizing subject, much as in a dream.<sup>43</sup>

The result of each moment of perceptive experience, each intention, and each action is a strengthening of the latency within the ground consciousness for that event to occur again, and, when there is an activating resonance within the ground-consciousness, an interdependent subjective-objective dualistic experiential field arises into conscious awareness. And, because according to the Yogachara perspective this resonant process is amplificatory, each momentary perception reinforces, to a miniscule degree, the probability of the same perception occurring at a future moment, and upon the basis of this mechanism a coherent perceptual world emerges.

The fundamental mechanism of karma operates on many levels of mind and it is the collective level of mind which creates the physical environment which is inhabited by the countless beings whose collective karma created it. The Mind-Only perspective is quite clear that what we experience as the physical world is in fact built up through the operation of the collective karma within the fundamental consciousness which is the ground of reality:

The entire world was created through latent karmic imprints. When these imprints developed and increased, they formed the earth, the stones, the mountains, and the seas. Everything was created through the development or propagation of these latent karmic potentials.' ... 'How can all these external forms arise out of latent karmic imprints? All these mountains, oceans, the sun and moon are so solid and so vivid. How can they arise out of latent karmic imprints in the mind.' ... 'These things arise through the power and propagation of thought.'<sup>44</sup>

Karma is the non-local interconnection within consciousness which is the basis for all manifestation. Karma must be non-local because it forms the pattern for the development of the very structure of matter as it appears within consciousness. Karmic-evolutionary actions which take place in one place and time will reinforce the templates, or habits, of reality in all places and times. Such actions and perceptions, actions of body, speech and mind which have karmic, and hence evolutionary, consequences, leave very fine vibration traces within the ground consciousness which have the potential to interact constructively with other karmic traces. This provides an explanation of how a common material world emerges and is kept manifest through karmic resonance within the ground consciousness at the quantum level. It is not the power of the subjective mind of one person, or a few people, that produces the illusion of the external material world. It is the karmic resonance of unimaginably countless perceptions by incomprehensibly countless sentient beings over staggeringly vast stretches of time.

The Buddhist philosopher William Waldron describes this fundamental aspect of the Yogachara account of the functioning of reality as being driven by 'self-grasping' which is the deep instinctual habit within all sentient beings to crave individuated experience. Waldron describes this as a linguistically recursive process; however the linguistic levels operative within the Yogachara account of the process of reality operate deep within the psycho-physical structure of embodiment, directly structuring and determining the potentialities for manifestation of future experience at deep psychophysical levels:

...this linguistic recursivity, which colours so much of our perceptual experience, including our innate forms of self-grasping, now operates unconsciously ... and ... these processes are karmically productive at a collective level as well as individual level – that is they create a common 'world'.<sup>45</sup>

This constitutes an unconscious 'intersubjective feedback system' and therefore:

...it is the unconscious habits of body speech and mind to which we are habituated that give rise, in the long term and in the aggregate, to the habitats we inhabit, the 'common receptacle world' we experience all around us.<sup>46</sup>

The basic function of the evolutionary mind, then, is to habituate perceptions:

The beginningless nature of the mind is empty, clear and unobstructed,  
But its nature is not recognised.  
The fundamental consciousness, stirred by mental creations produces dualistic appearances and the consciousnesses.  
Feeling develops from acceptance and rejection;  
discernment from objectification habit.

Discernment leads to mental formations which are  
mental factors; habitual adherence creates form.  
With attachment and grasping as a link the wheel of existence turns.<sup>47</sup>

Within this quote resides the pith of the entire process of creation by the fundamental consciousness, depending on the deluded activities, which is to say actions which are prompted by ignorance of the real nature of phenomena, by sentient beings.

The fundamental base consciousness is beginningless and has the nature of being 'empty', in the sense that it is the ground of phenomenon but no particular phenomenon, 'clear' because it has the clarity to cognize, and 'unobstructed', in the sense that it is formless and has the capacity to reflect all forms that appear to it without changing their nature. This base consciousness produces the world of duality because its true nature is not recognised. It now manifests on the conventional level within which the mode of perception through habituation is dominant. So for the conventional mind 'habitual adherence creates form'. The tracks of habitual modes of perception, however, are not laid down in a single lifetime. The habitual patterns of collective perception which create the 'physical world' are developed over vast stretches of time, countless lifetimes for countless sentient beings lay down the web of collective perception which makes up the continuous cycle of collective dream of the material world (figure 3).

Within this epiontic dream, which occurs within the all embracing Quantum Mind-Matrix universal wavefunction, the intentional activities of all sentient beings, both conscious and unconscious-instinctive, leave resonant traces within the *alayavijnana*, the ground consciousness, which can be identified with Bohm's 'implicate order'. These traces, or seeds, will be activated at later times through a mechanism of karmic quantum resonance when surrounding conditions are appropriate. Thus the Yogachara account gives an insight into the mechanism by which potentialities are 'enfolding' and subsequently 'unfolding,' which is the terminology adopted by Bohm. The traces laid down in one lifetime will also echo forward in order to produce a new sentient continuum in a future lifetime, although according to Buddhism this is not a reincarnation of a 'self,' all Buddhist schools deny the existence of a substantial 'self' entity. The future reincarnated continuum of consciousness is just that, a continuum of consciousness within which resonant traces from previous activities lie dormant until activation. These traces, or 'seeds,' are etched into both a global inter-subjective, or 'objective' wavefunction, and also the 'subjective' wavefunction of potentiality which makes up the mental continuum of the sentient being. The form of sentient reincarnation may change across lifetimes.

We can now propose tentative answers to the outstanding quantum issues as outlined by Erich Joos (plus an associated extra one):

☐ **The meaning of the wavefunction.** The quantum wavefunction as detected in current quantum experiments is a mathematical representation, based on the experimental evidence, which indicates the functioning of the global wavefunction of potentiality which has been built up by the perceptual and intentional activities over vast time periods by countless sentient beings. It corresponds, therefore, to the potentialities within the Yogachara *alayavijnana*, in a sense it is an objective representation of what Buddhist philosophy calls the realm of *sunyata*, or emptiness,

the ground potentiality for the experiential world. It reveals a trace of the functioning of the non-dual ground of reality.

☐ **The origin of the probabilities within wavefunctions.**

Every perception that is made by any sentient being leaves a trace which strengthens the probability of the same perception manifesting at a later point. This karmic mechanism within the fundamental ground consciousness, then, provides a coherent explanation of the nature of the wavefunction. A wavefunction contains the probabilities of perceptual possibilities built up over an extraordinary period of time by vast numbers of sentient beings; the most likely ‘collapse’ will be in the direction of the most reinforced perception. This process has been going on for eons, involving countless beings. And so, bit by bit, it provides the groundwork for the appearance of ‘it from bit’, which is one of Wheeler’s famous adages. Through this quantum epiontic perceptual process the appearance of an external ‘material’ reality manifests. The entire edifice of material reality is the result of continuous perceptual quantum-karmic reinforcement and resonance within the ground consciousness, the *alayavijnana*.

☐ **The exact nature of the mechanism of the collapse.**

The collapse of the wavefunction is due to resonance between the objective and subjective aspects of the universal wavefunction. This fundamental quantum mechanism results from resonances between quantum-karmic echoes or seeds from previous perceptions, these resonances, which give rise to the dualistic poles of subjective and objective experience take place at a deep implicate level of reality, and manifest through implicate quantum levels into the explicate ‘classical’ realm.

☐ **The connection between the quantum and classical realm.**

The ‘classical’ realm is an inter-subjective illusion-like creation at the intersection of the innumerable perceptions made by countless individuated consciousnesses. Zurek describes his view of quantum Darwinism:

The main idea of quantum Darwinism is that we almost never do any direct measurement on anything ... the environment acts as a witness, or as a communication channel. ... It is like a big advertising billboard, which floats multiple copies of the information about our universe all over the place.<sup>48</sup>

From this perspective it becomes apparent that the ‘information’ about the dualistic appearance of the universe ‘floats’ within the fundamental ‘epiontic’ quantum ground, which is the awareness ‘stuff’ of the process of reality (*jnana*). The subjective intentional predispositions of sentient beings, which have been built up through habituation over vast tracts of time of continuous re-embodiment of mental continuums, activate and thereby reinforce these latent modes of perception.

In the following passage, taken from the commentary to the *Diamond Sutra* by the contemporary Chinese Buddhist teacher Hsing Yun, this ‘floating’ information is compared to ‘dust’ floating within ‘clarity of perfect awareness,’ the term ‘*lakshana*’ indicates activated ‘characteristics’ or ‘signs,’ which we may interpret as activated ‘bits’ of quantum information:

Dust clouds the metaphorical pool of enlightened awareness. ... Lakshana rush into the mind and appear before it like clouds of dust-like lakshana; impure intentions are based on deluded visions of dust. Dust clouds the mind on all levels; matter is dust, illusion is dust, and thoughts and perception also are dust. Only the Tathagata sees the 'vast realm of emptiness' in which all of this floats in the clarity of perfect awareness.<sup>49</sup>

The Tathagata, or one-gone-to-thusness, is a buddha, one who has gone beyond the fetters of the 'conventional' or 'classical' realm of embodiment and has directly penetrated, through the pristine operation of the limited mind becoming Universal Mind-Matrix, into the illusory nature of the classical realm which 'floats' within the pristine ground of (quantum) non-dual awareness. As Joos has pointed out:

The disturbing dichotomy between quantum and classical notions was only a delusion.<sup>50</sup>

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<sup>1</sup> Joos, Erich (2006). 'The Emergence of Classicality from Quantum Theory' in *The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion* (Eds: Philip Clayton and Paul Davies). Oxford: Oxford University Press.

<sup>2</sup> Bohm, David (2003). *The Essential David Bohm* ed Nichol, Lee (Routledge, London) p146 (Extract from R. Weber: *Dialogues with Scientists and Sages: The Search for Unity* (1986) Routledge and Kegan Paul).

<sup>3</sup> See Hameroff's Quantum Consciousness web site: [www.quantumconsciousness.org](http://www.quantumconsciousness.org)

<sup>4</sup> Henry Stapp – The Mind is NOT What the Brain Does (2009) p6

<sup>5</sup> Barrow, John D., Davies, Paul C. W., Harper, Charles L. (eds) (2004) p577 – Wheeler, J A (1999) 'Information, physics, quantum: the search for links.' In *Feynman and Computation: Exploring the Limits of Computers*, ed A. J. G. Hey, p309 (314). Cambridge, MA: Perseus Books.

<sup>6</sup> Hopkins, Jeffrey (1996). *Meditation on Emptiness*. Wisdom Publications, U.S.A. (First published 1983) p375

<sup>7</sup> Bohm, David (2003). *The Essential David Bohm* ed Nichol, Lee (Routledge, London) p131 (Extract from Bohm: *Wholeness and the Implicate Order* (1980) Routledge).

<sup>8</sup> Piet Hut, Mark Alford, and Max Tegmark (2009): 'On Math, Matter and Mind' p6 (Foundations of Physics) p6

<sup>9</sup> Das Wesen der Materie" (The Nature of Matter), speech at Florence, Italy, 1944 (from Archiv zur Geschichte der Max-Planck-Gesellschaft, Abt. Va, Rep. 11 Planck, Nr. 1797)

<sup>10</sup> Hopkins, Jeffrey (1996). *Meditation on Emptiness*. Wisdom Publications, U.S.A. (First published 1983) (2006) p138

<sup>11</sup> Dowman, Keith (2010): *Natural Perfection: Longchenpa's Radical Dzogchen*, Wisdom, p225

<sup>12</sup> Lockwood, Michael (2005). *The Labyrinth of Time: Introducing the Universe*. Oxford University Press. (2005) p350

<sup>13</sup> Lockwood, Michael (2005). *The Labyrinth of Time: Introducing the Universe*. Oxford University Press. p353

<sup>14</sup> [www.davidsmuse.co.uk/hoffman.html](http://www.davidsmuse.co.uk/hoffman.html)

<sup>15</sup> Sarfatti, Jack 'Wheeler's World: It From Bit?' - Internet Science Education Project,

San Francisco, CA.

<sup>16</sup> Brunnhölzl, Karl (2007) *Straight from the Heart: Buddhist Pith Instructions*, Snow Lion p25

<sup>17</sup> Efstratios Manousakis : 'Founding Quantum Theory on the Basis of Consciousness' in *Foundations of Physics*, Vol. 36, No. 6, June 2006 p797

<sup>18</sup> Thrangu Rinpoche, Kenchen (2001). *Transcending Ego: Distinguishing Consciousness from Wisdom*. Namo Buddha Publication., Boulder, Colorado p19

<sup>19</sup> Thrangu Rinpoche, Kenchen (2001). *Transcending Ego: Distinguishing Consciousness from Wisdom*. Namo Buddha Publication., Boulder, Colorado

<sup>20</sup> Barrow, John D., Davies, Paul C. W., Harper, Charles L. (eds) (2004) p136 – Wojciech H. Zurek: 'Quantum Darwinism and envariance.'

<sup>21</sup> Zurek W. H. Decoherence and the Transition from Quantum to Classical – Revisited p4

<sup>22</sup> Penrose, Roger (1995). *Shadows of the Mind*. Oxford University Press:1994, Random House-Vintage:1995 p309

<sup>23</sup> Penrose, Roger (1995). *Shadows of the Mind*. Oxford University Press:1994, Random House-Vintage:1995 p330

<sup>24</sup> Zurek, Wojciech H. 'Quantum Darwinism and Envariance' in Barrow, John D., Davies, Paul C. W., Harper, Charles L. (eds) (2004). *Science and Ultimate Reality*. Cambridge University Press. p121

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- <sup>26</sup> Zurek, Wojciech H. 'Quantum Darwinism and Envariance' in Barrow, John D., Davies, Paul C. W., Harper, Charles L. (eds) (2004). *Science and Ultimate Reality*. Cambridge University Press.
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- <sup>28</sup> Stapp, Henry (2004). *Mind, Matter and Quantum Mechanics*. Springer-Verlag Berlin Heidelberg p268
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- <sup>30</sup> Schmidt, Marcia Binder (Editor) (2002). *The Dzogchen Primer*. Shambhala, p29
- <sup>31</sup> Thrangu Rinpoche, Kenchen (2001). *Transcending Ego: Distinguishing Consciousness from Wisdom*. Namo Buddha Publication., Boulder, Colorado p43
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- <sup>34</sup> Longchenpa – trans: Guenther, Herbert V. (1975) *Kindly Bent to Ease Us, Part One: Mind*, Dharma Press p189-190
- <sup>35</sup> Dharma Fellowship ([www.dharmafellowship.org/library/essays/yogacara-part2.htm](http://www.dharmafellowship.org/library/essays/yogacara-part2.htm)).
- <sup>36</sup> Davies, Paul – see <http://www.counterbalance.org/ctns-vo/davie-body.html>
- <sup>37</sup> Longchenpa – trans: Guenther, Herbert V. (1975) *Kindly Bent to Ease Us, Part One: Mind*, Dharma Press p55
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- <sup>39</sup> Waldron, William S. (2003): 'Common Ground, Common Cause: Buddhism and Science on the Afflictions of Identity' in Wallace, B. Alan (2003). *Buddhism and Science: Breaking new Ground*. Columbia University Press. p153
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- <sup>41</sup> Brunnhölzl, Karl (2007) *In Praise of Dharmadhatu*. Ithaca: Snow Lion Publications. (2007) p85
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- <sup>44</sup> Thrangu Rinpoche, Kenchen (2001). *Transcending Ego: Distinguishing Consciousness from Wisdom*. Namo Buddha Publication., Boulder, Colorado p28-29
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- <sup>47</sup> Jamgon Kongtrul & Kalu Rinpoche Translation Group (1995)
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