Mechanisms for Information Signalling in the Universe: The Integral Connectivity of the Fabric of Reality Revealed

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Summary:

We present a comprehensive concept for the fabric of reality and the creation of life through the generation and integration of information, modelled through toroidal processing of wave energy. We submit that human consciousness cannot be understood in a reductionist context, but that it is rather an expression of a cosmic modality or a universal consciousness. We therefore introduce a mental attribute of the entire cosmos that for our world, requires a wave-like holonomic description, implying non-material physicalism in a cosmopsychism context. It is postulated that the generation of life in the cosmos requires a symmetry breaking from a 4th spatial dimension (5-D spacetime) involving a Sub-Quantum domain, that contains information conceptualized as a pro-active ontological essence. Thereby, a multi-layered fractal reality is conceived integrated by a universal toroidal/möbius-ring type of connection. This is described at the level of a sub-Planckian scale, and is instrumental in past/future transactional information processing and pilot-wave guiding. In this framework, the Zero-point Energy Field is seen as a transition zone from the Sub-Quantum domain to our quantum world. In concert they provide an all-pervading superfluid quantum field that enables soliton (electron-phonon quasi-particle)-mediated interaction with non-neural brain compartments, in which hydro-ionic (hydronium ions and Ca2+-ions) are instrumental. In this process, freely moving protons form wave-antennas in the water matrices of the brain that can receive active life-information as the building blocks for conscious moments. Toroidal geometry is also involved in the functional organisation of wave-coherence and interference in brain, to assure a personal memory. In addition, we postulate a global memory workspace, associated with, but not reducible to the brain. This field-sensitive holographic workspace, that exhibits an event horizon information projection, is seen to be involved in predictive coding and quality control of awareness and can be conceived as personal double. The imprinting of life conditions in inanimate (pre-biotic) structures in biological evolution is conceived as a toroidal processing of energy-consciousness providing a non-dual recursive creation of reality. The unfolding of pre-mordial information into the future is described in geometric terms and defined in a "Beyond Fibonacci" type of spiral mathematics that also includes an extra 4th spatial dimension. Recent studies of others indeed have shown that the creation of life can be conceived as a symmetry breaking of condensed bosons from a 5-D informational phase-space, supposedly through formation of magnetic monopoles in a Hicks setting, again using an essential toric information code. The monopoles, produced in this process, interact with DNA/RNA on the basis of the molecular entities of life such as H2O, carbon and nitrogen-bases, and this supports recent work on the role of oscillatory DNA wave resonance in cellular communication, being crucial for problem solving of life cells for survival in their environment. Boson-mediated symmetry breaking, modelled by toroidal spinor geometry was also described in a bifurcative self-interaction model that assumes supervenience of mental on physical states. It is finally concluded that scale invariant information, being expressed on the holographic event horizons of each individual cosmic entity, provides a unified connective principle that reveals an intrinsic mental aspect of the cosmos.

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1. Introduction

In this review the four authors address the question how the fabric of reality became manifest and how it may proceed in the future. We see this evolutionary process as a recurrent flux of information that obtains an everincreasing meaning within a (retro)-causally self-observant universe. We hold that this requires a guided multilayered evolution process with a fractal connectivity on the basis of a set of rules (recipe) with an intrinsic freedom rather than guided by a fixed (blue-print) design. The integral cosmic architecture, apart from its basic building blocks, requires mechanisms for bidirectional interlevel signalling, communication, holographic memory creation and retrieval, as well as self-reflection and cosmic self-learning. It is proposed that the information processing takes place through an all-pervading matrix of operators that function on the basis of self-referential toroidal geometry, that includes information integration, predictive coding and error correction. The resulting holonomic architecture is realized through a dynamic, non-material, information field that can be seen as a universal consciousness modality that is mirrored in the human brain: we are in consciousness. These elements contribute to a deep-learning cosmic neural network that displays multiple scale-invariant memory spaces reflected in the extremes of a macro-scale cosmic event horizon and the micro-scale Planckian quantum domain. A sub-Planckian homogenous superfluid quantum space, that contains mathematical and geometrical- linked wave information, is instrumental in creating as a mental attribute of reality. Through symmetry-breaking from this 4-D domain, bosons and fermions are produced that generate our material world, including life. The creation of first life and the evolution of emerging intelligent life forms provided the basis for cosmic self-observation. This process encompasses an ultimate information collection that may underly the novel rules for rebirth and becoming of a next version of our universe. In the present work Ivaldi and De Santis treat the potential connectivity of cosmic material building blocks, Faixat pictures the evolutionary aspects of information processing, Meijer projects a field-receptive brain function, operating against an electromagnetic background field, bearing a musical master code, while Klein will finally emphasize the universality of cosmic consciousness as the source of all there is.

2. Toroidal Dynamics of Energy-Consciousness in Evolution

José Diez Faixat

2.1 An Amazingly Creative Universe

Darwin's original idea that the evolutionary process happens gradually over time, driven simply by random mutations and natural selection (**Darwin, 1988**), is currently highly questioned. Chance mutations could perhaps explain the variations within a given species, but not the successive variations between them. In the words of C. H. Waddington: "*One of the fundamental problems of evolutionary theory is to understand how the very obvious discontinuities that we find between the main taxonomic groups have arisen: phylum, family, species, etc.*" (Waddington et al. 1976). In recent years, it has been seen that the gradualist conception of evolution was only responsible for a small part of evolutionary change, and that the most profound modifications in biological evolution occur at certain moments in the history of groups, in such a way very fast and giving rise to stable species that undergo very few subsequent variations.

In 1972, Gould and Eldredge published a fruitful study in which they showed that nature advances through sudden leaps and deep transformations, not through small adaptations. According to the "theory of punctuated equilibria", evolutionary leaps are relatively sudden processes that interrupt long periods of inertia without fundamental variations and in which, suddenly, a novel emergence takes place (**Eldredge and Gould**, **1972**). As Gould puts it: "*The history of any part of the Earth, like the life of a soldier, is made up of long periods of boredom and brief periods of terror*."

Until the 70s of the last century, researchers were inclined towards the conception —expressed in the most expressive way by J. Monod (Monod, 1981)— that evolution is mainly due to chance factors. But, in the 1980s, many scientists became convinced that evolution is not an accident, but necessarily occurs when certain parametric conditions are met. Laboratory experiments and quantitative formulations are confirming the non-accidental nature of evolutionary processes. It is becoming clear that the continuous unfolding of the organized complexity of the universe, its intrinsic capacity to spontaneously self-organize, constitutes a fundamental and deeply mysterious property of reality. A new and fascinating paradigm is beginning to emerge, that of the creative universe, which recognizes the surprisingly innovative and progressive character of universal dynamics.

The new sciences of evolution see a harmonious coherence and naturalness throughout the entire universal creative process, from the same original moment. They defend the non-accidental nature of evolutionary processes, and provide a multitude of evidence that all dynamic systems, at different levels of reality, spontaneously develop similar creative patterns (Laszlo, 1988). The new approaches demonstrate how any dynamic system away from equilibrium can come out of its constant state by changing some of its environmental parameters. In these situations, after a phase of indeterminacy and chaos, systems can spontaneously reach new stable states of greater complexity. The global evolutionary trajectory thus resembles a staircase, in which horizontal sections alternate, with hardly any changes, with sudden level jumps.

Both in theoretical and empirical works, in hard and soft sciences, an attempt is made to understand this innate creative tendency of nature, these surprising organizational patterns in which the game of chance is channeled. We speak of dynamic attractors (Gleick, 1988), syntropic processes (Fantappiè, 1993), morphogenetic fields (Sheldrake, 1989), archetypal channels (Waddington et al. 1976), anthropic principles (Barrow and Tipler, 1988), implicate orders (Bohm, 1988), fractal structures (Mandelbrot, 1997), stratified stabilities (Bronowski, 1970), beneficial catastrophes (Thom, 1987), dissipative structures (Prigogine and Stengers, 1990). It seems already evident that creativity cannot be reduced to a mere product of chance. Rather, the holistic intervention of unified fields that can account for both the character of totality of creative phenomena and their quality of instantaneousness is necessary. The irreducible integrity aspect of these fields would explain their ability to harmoniously organize, through a single impulse, diverse and independent elements.

2.2 Pythagorean Solution

At the beginning of the twentieth century, physicists were puzzled when they found that the energy emitted or absorbed by atoms, far from doing so in a continuous flow, did so in a quantified way and in very precise packages. For several decades they tried to explain this strange phenomenon by looking for a good mathematical theory of the atom that would generate those quantum numbers in a natural way. The solution came by proposing the similarity of the world of electrons with musical harmonics, -standing waves-, revealing a wave equation of surprising precision, that later was envisioned as a fundamental piece of the revolutionary quantum physics (Schrödinger, 1983).

The fundamental claim of Pythagoreanism was that numbers constitute the immutable principles underlying the world, the essence of reality. Upon discovering that the proportions between musical harmonics could be expressed in a simple and exact way, the Pythagoreans considered that the cosmos itself was a harmonic system of numerical ratios and that everything real could be expressed by relations between numbers. According to them, the inherent numerical order of sounds was directly related to the organization of the universe itself and, therefore, they affirmed that music was nothing but the expression of the internal relations of the cosmos, and that all material manifestations were the result of the concert of universal vibrations.

Standing waves are known to anyone who has ever played a musical instrument. The characteristic of these waves is that they divide the vibrating unit —string, tube or ring— into equal complete sections. A guitar string, for example, cannot vibrate randomly, due to the fact that it has fixed ends and therefore has to vibrate in such a way that its ends remain motionless. This is what limits its possible variations and introduces whole numbers. The string can undulate as a whole (see **Fig. 1-A**), in two parts (see **Fig. 1-B**,), in three (see **Fig. 1-C**), in four, or in some other whole number of equal parts, but it cannot vibrate, for example, in three and a half

parts or in five and a quarter. In music theory these successive standing waves are called harmonic sounds. The unlimited series of these harmonics, starting from the "fundamental sound" of the complete original unit, define very precisely the different degrees of sound vibration, that is, the entire hierarchy of levels of stability of the musical flow.



Fig. 1: Musical harmonics (standing waves): Fundamental sound (1-A). First harmonic (1-B). Second harmonic (1-C).

We see, therefore, that, both in the microscopic world of quantum physics and in the macroscopic world of our musical instruments, the energies —the vibrations— do not flow in a continuous way, but rather in a quantified way according to a hierarchy of standing waves. On any scale of reality, a vibrating unit, atom or guitar string, inherently possesses very precise potential levels at which energy flows stabilize.

Since the emergence of quantum physics and the theory of relativity, science has begun to consider the universe holistically, that is, to perceive nature as an integral whole with a global motion that is neither fragmented nor divided. As we have previously stated, the evolutionary dynamics of this unified universe unfolds its novelties in a discontinuous way, so that the most profound transformations of evolution happen, again and again, abruptly and suddenly, generating a hierarchy of levels of organization progressively complex and inclusive. Thus, we find ourselves with a vibrant unit —the evolutionary universe— that channels its energy flows into a very defined series of levels of stability. Like atoms. Like musical instruments.

Both in the world of atomic physics, and in the field of music, the secret of its sudden jumps and its sound discontinuities was revealed by means of standing waves and musical harmonics. Couldn't the same thing

happen in the field of evolution? Isn't it very coherent that this unified universe that we are beginning to discover generates similar creative patterns at its different levels of organization? Is not, then, presented as enormously suggestive the idea that the sudden evolutionary leaps that occurred in the history of the universe respond, precisely, to those same standing waves that turned out to be the explanatory key of the subatomic and musical world?

2.3 A Harmonic Hypothesis

J. Bronowski proposed in 1970 a theory about a single process that explained hierarchically ordered diversity without reductionism (**Bronowski, 1970**). This theory proposed, as a general cosmological principle, the concept of "stratified stability of potential levels" as the key to the evolution of disequilibrium systems. Basically, it proposed the existence of certain levels of stability around which energy flows would be grouped and organized, thus allowing successive and sudden ascents towards new layers of progressive complexity. The hypothesis that we are going to propose constitutes a very specific specification within this suggestive approach (**Díez Faixat, 1993, 1996, 2011**).

Taking the example of the guitar string again, let's imagine that it is tuned to the C note — the fundamental sound. If we vibrate half of its length —first harmonic— we will obtain the same original note one octave higher. If we vibrate the third part —second harmonic— we will get a different note, which in our case will be G. That is to say, with the second harmonic the sound novelty arises. Taking the new note, in turn, as a fundamental sound, we can repeat the experience as many times as we want, and thus we will obtain with each second harmonic, successive staggered sound novelties. In other words, when vibrating a third of the length, a creative jump will appear, and with the third of the third another, and with the third of the third another one, and so on.



Fig. 2: Process of deployment of the successive levels of stratified stability from the original pole -A— to the final pole $-\Omega$ —. "Exit" section (2-B). "Return" section (2-A). Integral trajectory (2-C).

This simple fact gives us the key to our hypothesis. The proposal is that simple: considering the temporal totality as a vibrant unit —see **Figs. 2**—, the successive chained second harmonics, that is, the successive thirds of the duration, will mark the emergence of evolutionary novelties. Or, put another way, the second harmonics will define those "potential levels of stratified stability" through which the creativity of nature is channeled, that is, those rungs of the evolutionary ladder through which the energy streams flow in their ascending process of creation of progressively more complex and conscious organisms.

In **Figs. 2** we can graphically observe the global process. Taking the entire temporal trajectory —from the "origin" to the "end"— as the fundamental sound, we have drawn the successive level jumps in both directions: in **Fig. 2-B**, the section from the origin to the second node "P" of exteriorization, called the "exit" or "outwards" section; and in **Fig. 2-A**, the section from that same second node until the end —the "return" or "inwards" section—. **Fig. 2-C** shows the joint trajectory, the overall ladder of evolution.

Summarizing our proposal, we can say that, just as when a certain note is emitted in a musical instrument, simultaneously, a very wide range of its harmonics sounds, in the same way, the universe as a whole possesses, from the very moment of its original vibration, a whole potential hierarchy of standing waves, through which your creative flows can ascend. The great harmony between this idea and the statement by D. Meijer and H. Geesink that life and consciousness are guided by a semi-harmonic EM background field is obvious (**Meijer and Geesink, 2017**). According to our scheme, starting from the punctual vibration of the origin, the universal process begins with a dizzying explosion of creativity and level leaps, which, gradually, slows down on the way up to a certain stratum of the spectrum —the "sound fundamental"— to, from there, begin to accelerate again, progressively, its rhythm of innovative jumps, along the uphill section that is oriented towards an unstoppable final punctual vibration of infinite creativity. Later we will analyze the deep meaning of those surprising original and final poles, because there we will find, precisely, the key to many of our questions.

2.4 Verification of the Hypothesis in the Human Phylogeny and Ontogeny

The hypothesis we propose is very simple: just as, in any musical instrument successive second harmonics (1/3 of the vibrating unit) progressively generate new sounds, these same second harmonics generate all the major evolutionary novelties in universal dynamics as a whole. That is to say, evolution, far from being a random process, runs in an orderly fashion, one after another, the successive notes of the so-called circle (or spiral) of fifths. It is really surprising that such a simple proposal has the precision and firmness that we find when comparing it with historical data.

Adjusting our evolutionary hypothesis with the dates of appearance of matter —Big Bang— and of organic life, we observe that all the moments of emergence of the successive taxonomic degrees of human phylogeny are marked with great precision: *Kingdom: animal, Phylum: chordate, Class: mammal, Order: primate, Superfamily: hominoid, Family: hominid* and *Genus: homo*. And then the same thing happens with all the maturation phases of our primitive ancestors: *h. habilis, h. erectus, archaic h. sapiens, h. sapiens* and h. *sapiens sapiens* (or modern humans). And, once again, the precision of our hypothesis is repeated with the successive transformations experienced by humanity in its most recent history: Neolithic, Ancient Ages, *Middle Ages, Modern Ages* and the emerging *Postmodern Age*. If, as we see, all these stages are clearly adjusted with the

forecasts of the "periodic table" of rhythms that we have proposed, it is more than likely that our hypothesis can also give us the key to glimpse the successive phases that will unfold, in the coming years, in a progressively accelerated process that will finally lead to an instant of infinite creativity — Omega— in a couple of centuries, around the year 2217. (See Teilhard de Chardin, 1959; Meyer, 1947; De Cayeux, 1995; Chaline et al.,1999; Russell, 1994; Coren, 1998; Modis, 2001; Snooks, 2005; Panov, 2005; Smith, 2008; Kurzweil, 2012; Nazaretyan, 2016; LePoire, 2015).

In the same way that, as we see, our musical pattern adjusts with utter precision when applied to the process of the human phylogeny, so it happens identically when it is compared with the development process of the individual human being —with our ontogeny— and it does in the same time frame, with the same pattern of unfolding and folding, and going through the same stages. Our "periodic table" of rhythms is marking, punctually, step by step, the successive phases that embryologists and developmental psychologists tell us about (Piaget, 1969; Maslow, 1972; Gebser, 2011; Graves, 2005; Beck and Cowan, 2006; Loevinger, 1976; Cook-Greuter, 1985; Kohlberg, 1981; Fowler, 1981; Kegan, 1994; Wilber, 2007), thus confirming the old theory of phylogenetic-ontogenetic parallelism, and pointing, in a way very concrete, towards an amazing fractal and holographic universe. (See Pribram, 1971; Bohm, 1988; Wilber et al., 1987; Talbot, 2007; t' Hooft, 2001).



Fig. 3: Global trajectories of human phylogeny and ontogeny, from A and to Ω : Macrocosm (3-A). Microcosm (3-B).

In **Figures 3-A and 3-B**, it can be seen how the global development patterns of the macrocosm —phylogeny and of the microcosm —ontogeny— are identical in their structures. The only difference between them lies in the level at which pole P is positioned; that is, the pole toward which the "exit" section is oriented in each one of them: in the macrocosm it is situated in the leap between "matter" and "life" —the appearance of organic macromolecules after the formation of the Earth—, and in the microcosm in the leap between "mind" and "soul" —the formation of the mature ego.

Based on these data, it seems evident that the processes studied, far from being mere products of chance and meaningless, follow a very precise harmonic rhythm of unfolding and folding between an original pole, basically of energy, and a final pole, basically of consciousness. How is this possible? What mechanism is capable of causing things to happen this way? The answer to these questions must obviously be found in the presence and joint and simultaneous action of these original and final poles from the same initial moment.

2.5 Entropic-syntropic Evolution

Along these lines, the mathematician L. Fantappiè thought that the solution to this enigma had to be found in the very structure of the equations that combine quantum mechanics and special relativity (Fantappiè, 1942 and 1993). A key equation in this field is the d'Alembert operator which, in the Klein-Gordon relativistic generalization of the Schrödinger wave equation, admits two types of solutions: divergent waves, described by the so-called "retarded potentials", that branch from the original emitting source, and convergent waves, described by the "advanced potentials", that converge at a future point that acts as an absorber or attractor. On analyzing the mathematical properties of these two solutions, Fantappiè found that, while the positive solution moves forward in time and tends towards dissipation, disorder and homogeneity, the negative solution moves backward in time and tends towards concentration, order and complexity. He thus understood that the first solution actually follows the law of *entropy* —from the Greek *en* = divergent, and *tropos* = tendency— while the second obeys a symmetric law that he called syntropy — from the Greek syn = convergent, and tropos = tendency—. Observing that the properties of the law of syntropy were exactly those characteristics of living beings, Fantappiè concluded that the increase in complexity in the evolutionary process is a consequence of the advanced —retrocausal— waves that emanate from attractors located in the future and go backwards in time. Thus, he proposed moving from a mechanistic and deterministic model of the universe to a new entropic-syntropic model, in which the expansive forces (entropy) and the cohesive forces (syntropy) worked together, so that the unfolding of the phenomena was not only a function of the initial conditions, but it also depended on a final attractor, (See Arcidiacono, 1991; Jung, 1990; Fuller, 1982; Szent-Gyorgyi, 1997; Costa de Beauregard, 1994; Di Corpo, 2011 and 2012; Vannini, 2005 and 2011).

Similarly, the physicist J. G. Cramer (Cramer, 1986 and 2016) proposed an interpretation of quantum mechanics —which he called "Transactional Interpretation" (TIQM)— which, inspired by the "absorber theory" by J. A. Wheeler and R. Feynman (Wheeler and Feynman, 1945 and 1949), describes quantum interactions in terms of a standing wave formed by interference between retarded (forward in time) and advanced (backward in time) waves. We can summarize this transactional model by saying that the emitter produces an "offer" wave that travels to the absorber, that the absorber then returns a "confirmation" wave to the emitter, and that the transaction is finally completed with a "handshake" —a standing wave— through space-time, via which a bidirectional contract is sealed between past and future. As Cramer states "This universe (...) advances in time at the quantum level through a chain of handshakes between the past and the future (...) The future goes back to make an accommodation with the past that allows a quantum event to happen, to become reality. Each quantum event emerges into reality as a result of a feedback loop between the past and the future". (See Gribbin, 1996; Davies, 2007; Goswami, 2008; Lanza and Berman, 2012; Meijer, 2012 and 2013; Kastner, 2012 and 2019).

The entropic-syntropic theory and the transactional interpretation make it clear to us that all the events of the space-time universe arise, moment after moment, via the simultaneous and coordinated action of flows from the actualized "past" and the potential "future", and, ultimately, from the original emitter and final absorber. In this way, the mechanism that gives rise to the divergent-convergent pattern revealed in our research is fully clarified: all the successive levels of the evolutionary ladder —which, as we saw in our research, unfold at the rate set by the second harmonics— are defined, like all quantum interactions, by the standing waves formed by the interference between retarded (forward in time) and advanced (backward in time) waves, that is, by the simultaneous presence and action of the initial and final poles from the same initial instant, (see **Fig. 4**).



Fig. 4: Each level of stability (standing wave) in the evolutionary process of energy-consciousness arises from the simultaneous and coordinated action of the flows from the original emitting pole (forward in time) and from the final absorbing pole (backward in time), in line with the proposals by Fantappiè and Cramer.

This approach greatly clarifies the so-called "anthropic principle", which suggests that we live in a carefully adjusted universe, i.e., in a universe that seems to have been meticulously arranged to allow the existence of life and mind, because, if any of the basic physical constants had been different, the appearance of life as we know it would not have been possible. If, as we see here, all the events of the universe arise from the interaction and consensus between the past and the future, it is completely natural that, without having to

resort to any external designer, the first events of the universal process were already fully coordinated and adjusted to future events. How could it be otherwise!

2.6 The Non-dual Key

After comparing our hypothesis of rhythms with the data obtained in the macrocosm —paleontological, anthropological and historical— and in the microcosm —embryological and psychological—, and having verified its precision, it is evident that we cannot speak of mere "coincidences". Absolutely, there is a hidden pattern in evolution. We are going to sketch below our "philosophical" proposal to understand the ultimate meaning of everything we have seen so far.

All manifested reality appears inexorably in the form of dualities. No expression is possible outside the game of opposites. You cannot find sound without silence, nor subject without object, nor inside without outside. All opposites are mutually dependent, and, therefore, we can understand them as polar manifestations of a reality that transcends them, and that is "prior" to that dualization.

In **Figs. 3-A and 3-B**, we saw how the evolutionary trajectory starts from a pole of maximum energy (and practically no consciousness at all) and ends at another pole of maximum consciousness (and practically null energy). Physicists talk about an infinite potential energy in the original quantum void, while sages talk about a clear infinite consciousness in the final mystical void. We propose that these two voids are the same and unique Void, perceived by physicists objectively and by contemplative people subjectively, which in itself, is neither objective nor subjective, but "prior" to that dual perspective. And the most fascinating thing of all is that this Void is not a distant metaphysical reality, but the simple and pure Self-evidence of each and every present moment.

As there is no separation between subject and object in this Self-evidence, it is not possible see it, because there is not "anything" that could be seen by "someone", but neither is it "nothing", because in fact all things in the universe —both objective and subjective— are mere partial and relative forms of this Self-evidence.

In order to be able to "see" Self-evidence, it needs to polarize Itself, at least apparently in subject and object, the same as 0 may become dual in +1 and -1 without changing, other than formally, its absolute value. We say this because our ultimate proposal is that, in order for Self-evidence to contemplate Itself, it apparently splits in two poles: the original (basically, energy) and the final (basically, consciousness), generating an illusory distance among them which, on vibrating —like the guitar string in our hypothesis— gives rise to a whole scale of harmonics, which are precisely the levels of stability that create the evolutionary cycles that we have discussed here which span the entire range, from the most basic —of enormous energy and little consciousness—to the highest —of little energy and enormous consciousness—, that harmoniously channel the so-called game of chance. (Note the parallelism between the hypothesis we are proposing here and "string theory", although the scope of application in our case is not simply reduced to the world of microphysics, but embraces the entire spectrum of reality).

If we see the things from this perspective, the entire avalanche of "coincidences" that we have revealed here, which are totally unacceptable for the materialistic worldview, are shown to be natural manifestations of That-Which-Is. Or the teleological character of evolution, so denigrated by official science, is understood here as the logical expression of the fundamental structure of what is Real. Or the progressive emergence of consciousness, which is often completely forgotten in many branches of sciences, is presented in our non-

dualistic approach as a simple appearance of the infinite lucidity of the ever-present Self-evidence. Is it not time already to change the paradigm?

2.7 The Toroidal Dynamics of Energy-consciousness

Everything that has been proposed up to here would have been indefensible a few years ago, but in recent decades revolutionary lines of research have begun to appear in different branches of science —physics, chemistry, biology, neurology...— that are clearly in tune with the worldview that emerges from our evolutionary research and can hence provide key data capable of explaining this unexpected universal pattern that we are revealing here.

To highlight this suggestive harmony between different avant-garde research in disparate fields of science, we are going to outline the fundamental characteristics of universal dynamics that emerge from our inquiry into the rhythm of evolution. To this end, we will start from the flat images represented in our Figures 3-A and 3-B, which, remember, summarized the global trajectories of universal evolution and individual development of the human being from the original energy pole -A- to the final consciousness pole $-\Omega-$.

On the vertical axis of these graphs, we represented the entire spectrum of energy-consciousness, from the base —with a maximum of energy and a minimum of consciousness— to the top —with a minimum of energy and a maximum of consciousness—, with all the range of possible intermediate balances between these two fundamental facets of manifested reality, known by tradition as "the great chain of Being" and which we can summarize as the series "matter-life-mind-soul-spirit." The horizontal axis of these graphs simply reflected the entire time scale, from origin A to end Ω , of both the universe and the human being.

Let us remember here that, according to our approach, to contemplate Itself, the fundamental Emptiness needs to dualize Itself, at least apparently, as an original pole of energy and a final pole of consciousness, thus generating an illusory temporal distance between the two, although, in reality, everything happens in the timeless Now of the ever-present Self-evidence. If we want to graphically reflect these two ideas in the **Figures 3-A and 3-B**, we will have to perform a couple of maneuvers on that flat surface on which we have represented both graphs (see **Fig. 5-A**).

First, having proposed that energy and consciousness are not two different realities, but rather the objective and subjective aspects of the same and ever-present Self-evidence, we should unify the horizontal lines at the bottom and the top of the graph. As we have stated, these respectively represent the levels of maximum energy and maximum consciousness that are one and the same in fundamental reality. To do so, it will suffice to fold the flat surface of the drawing in on itself, aligning the upper line with the lower one, thus obtaining a cylinder (see **Fig. 5-B**).

Then, having affirmed that the temporal distance between the original moment (A) and the final moment (Ω) is illusory —as everything happens in the timeless Now— we should also unify the vertical lines on the left and the right of the graph. As already stated, these respectively represent the original and final moments of all evolutionary and developmental processes. To do so, once again we will fold our cylinder over onto itself, until the extreme vertical lines coincide, thus obtaining a figure similar to a "doughnut" in which the central hole is reduced to a point without dimensions. It is what is called in geometry a "horn torus" (see **Fig. 5-C**).

Bearing in mind what we have just explained —taking the guidelines that have been revealed in our research to their ultimate consequences—, everything points towards a fascinating toroidal dynamic of energy-

consciousness, both instantaneous and eternal, as the key element for integral comprehension of the universe. According to this scheme, the flows start out from a Center without dimensions —in its facet A—, follow a spiral path —divergent vortex—, reach the external surface of the torus, and return to the same Center —in its facet Ω — via another spiral —convergent vortex—, to subsequently restart its endless process from there. Next, we will try to outline the fundamental aspects of this dynamic that is beginning to be glimpsed, as we are possibly on the verge of solving many of the enigmas and blind alleys in which official science and its obsolete materialistic paradigm are trapped.



Fig.5: Evolution of the energy-consciousness modelled by toroidal geometry. (5-A): Flat representation of energy-consciousness process from pole A —maximum energy— to pole Ω —maximum consciousness—. (5-B): Cylindric representation of A. (5-C): the joining of the two ends of B into a horn torus. (5-D): Scheme of nested toroidal fractal geometry.

From the outset, it is crucial to understand the ultimate meaning of the central point of the "horn torus" that we are proposing, as it is where the germ of everything else lies. As we have seen, this center is deduced, on the one hand, from the unified understanding of the infinite potential energy of the quantum vacuum and the unlimited pure consciousness of the mystical void, and, on the other, from the perception of the illusory character of time and hence of the absolute simultaneity of the original pole (A) and the final pole (Ω) of all

processes. The center of this toroidal dynamic, which manifests itself as the spatiotemporal universe as a whole and as each and every one of the structures that compose it, is hence the same and unique non-dual Self-evidence, without form, unlimited, timeless, ineffable, both empty and full, the source and goal of all worlds, absolute potentiality. Let us insist once more, this non-dual center is one and the same in everything and in all, its true nature, its ultimate identity.

Accordingly, for this faceless, pure self-evidence to contemplate itself, it needs to dualize —at least apparently— in the roles of eye and mirror, subject and object, because this allows it to update its infinite potential in the world of finite forms. In this way, as we have seen, the non-dual center, without ceasing to be so, manifests itself in polar form as the original source of energy and the final attractor of consciousness, generating an illusory temporal distance between both facets. Let us take a good look at this idea, because within it may lie the solution to many of the enigmas that science is encountering. The absolute Void, in which there is no trace of separateness, manifests itself dually in the world of forms, so that the presumed spatiotemporal distances that the "subjects" observe among the "objects" are, ultimately, purely illusory.

Previously we proposed that the vibration of the illusory "string" of energy-consciousness that is created between the A and Ω poles, generated, from the very same original moment, a particular fundamental sound and a whole range of harmonics, which constituted the entire spectrum of potential archetypal levels, which, as we have seen, are updated, step by step, throughout evolution and history. We must now apply this very same multilevel energy-consciousness scheme that we proposed in the "string" of our hypothesis to the vibrant "torus" that, as we have proposed, generates the entire universal process. We will thus have a toroidal dynamic deeply nested in a myriad of levels —like a "matryoshka" or nested dolls—, from the tiny scale of Planck to the cosmic totality, thus reflecting the radical fractal structure of the universe (see **Fig. 5-D**). The fundamental characteristic of this fascinating nested torus lies in the fact that the center is common and identical in all its levels. Thus, all the universal flows, whatever the height of the energy-consciousness spectrum through which these unfold, start out from and end in this ineffable non-dual center that unites in itself the facets of both source (A) and receptacle (Ω) of all the worlds.

This fractal, toroidal structure of reality greatly facilitates the understanding of the evolutionary process. Thus, starting out from the idea that, in the final analysis, the sole protagonist of all the processes is the same and unique Self-evidence, we will now describe how the dynamics of evolution unfolds, step by step.

We stated earlier that the non-manifest Void apparently polarizes as subject and object to perceive itself subjectively-objectively in infinite ways. Via this artifice, Self-evidence can delve into the furthest corners of its own infinity —illusively and fleetingly identifying its absolute Here-Now with any relative point-instant of pixelated space-time and, from there, contemplate itself from a certain perspective —at any level of the energy-consciousness spectrum of the nested torus—, returning instantaneously to its original fullness. Given that, as we have stated, the temporal dimension is purely imaginary, everything in fact occurs from instant to instant. This exit and return, moment-by-moment, between the non-dual foundation and its finite and fleeting manifestation in space-time allows us to update in the relative world of forms the potential levels of stability of the energy-consciousness spectrum, i.e., the entire hierarchy of "harmonics" generated at the same original moment.

This recursive dynamic between the infinite Void and all its spatiotemporal forms is intrinsically creative and is facilitated by the unified field of memory that is gestating, step by step, at a fundamental level. All the information gathered at any point-instant of the manifested world is immediately introjected into this basic

field of collective memory, whose potential is logically increased moment by moment. Thus, any entity, whatever the level of the spectrum in which it develops, has deep down in itself free access to the entirety of this unified field of memory, although it only connects with certain aspects of this field depending on its characteristics specific. The toroidal dynamic thus possesses a holographic structure, in the sense that each "part" of itself has information of the "totality", and is, in fact, a particular reflection of that totality. (See **Russell, 1927; Bentov, 2000; Young, 1976; Laszlo, 2017; Haramein, Brown and Val Baker, 2016, Hameroff and Penrose, 2014**).

From the perspective that we are proposing here, the evolutionary process can be understood as a natural expression of a toroidal, integral, non-dual, fractal and holographic dynamic of fundamental energy-consciousness. Via this recursive dynamic, the ever-present Self-evidence is focused, moment after moment, on the successive levels of the "harmonic" spectrum, beginning with the most basic ones —primarily energy—and ending at the highest levels —primarily consciousness—. On each plane, it updates the specific potential of that level, integrating it with the aspects that have already emerged in previous levels. In each turn, starting from the resources available in the unified field of memory, it is projected in each concrete situation of space-time, it perceives that determined situation according to the possibilities of its structure, and, immediately, introjects that information into the field of collective memory of the fundament. When a specific entity has unfolded the full potential of the stratum in which it basically develops and has integrated it with everything that has emerged in the preceding stages, once it has reached a specific level of complexity, it can resonate with the next "harmonic" of the energy-consciousness spectrum, and thus ascend to a new rung of the long ladder of evolution. And so on.

This toroidal, non-dual, fractal, holographic dynamic of the fundamental energy-consciousness that we are proposing has clear affinities with ancient intuitions of the wisdom traditions —the yin-yang of Taoism, the Celtic triskelion, the Egyptian seed of life, the Greek caduceus, the Hindu kundalini... even the symbol of ∞ is no other than the cross section of a horn torus, (see Lefferts, 2019). However, as we have stated, it is practically unacceptable for the materialist paradigm of classical science. In the wake of the emergence of quantum physics and relativistic theory, the landscape has changed drastically, with numerous innovative proposals emerging throughout the past century that, in these first decades of the new millennium, have begun to crystallize into a ground-breaking unified theory of fields that, in many aspects, is in tune with the toroidal evolution we are proposing here.

3. Cosmic Aspects of Bipolar Toroidal Geometry and the Evolutionary Arrow of Universal Algorithms

Franco Ivaldi and Francesco De Santis

3.1 Introduction

This section, as it regards the investigations on the mechanisms of integral connectivity, is dedicated to the same processes that can be at the basis of universal life. The latter provides a continuous evolutionary remodeling, conceived by us from the point of view of bipolar geometry, also addressing the element of meaning and role of Universal Intelligence. We believe reality has, in addition to the fourth time dimension, also a fifth non-local dimension connected with what has been defined the Akashic Library. The latter involves the universal memory of a conscious energy with infinite properties of creational organization and its own

individuality, but under the condition of free choice and dynamic constitution due to continuous feed-back from the present.

Within this dynamic universal process there is an "evolutionary arrow", for which there is still no adequate description. Thermodynamics able to explain the phenomena concerning the so-called inert matter, in which energy has a dissipative behavior, defined as entropy (measure of the disorder of the system), presenting limitations for the behavior of living systems. Living conditions do not depend only on the energy taken from the surrounding environment, but also imply the collection of significant information aimed at useful adaption and survival. Life systems therefore reorganize and continuously evolve their state of the art, among other things by solving problems and exercising error correction. (see also **section 7**).

Two "forces" are apparent in the Universe. One has a disorganizing, or entropic, character, and the other represents the world of the "phase" (an anti-entropic organizational modality). These two worlds coexist everywhere. The intrinsic intelligence form of the Universe belongs to the world of the "phase", in which the various passages of the informative forms of existence, are collected in the Akashic memory, in order to further enrich the state of harmonic being of the primordial One. In the "universal continuum", nature avoids zero; every event of an entity in nature turns out to have a positive (past) temporal component, that represents a sort of inertia, and a negative temporal component, that is the future, which reaches the present having already encountered the subsequent eras of the entity itself.

We are children of Greek thought, to which we resort with Plato on the one hand, and Democritus on the other, looking for the future truth, as the current one is full of questions, and more than truth since it includes "doubt", and in this context the Turin scientist Tullio Regge developed important concepts on the role of Geometry in the Universe (**Regge, 1961**), where an extended interpretation of Goedel's incompleteness theorem emerged. From this principle, we can deduce the reason for Regge's doubt towards the "Theory of Everything", doubting not so much the contents, but for the extent to which it was proposed as definitive. The Timaeus, a geometric vision of the Cosmos, based on the harmony of the golden ratio and on the connected Platonic solids in correspondence with air, water, earth, fire, and the ether as the "fifth essence", represented a milestone in Platonic thought.

The blind faith in the unchangeable and "real" existence of a matter, as a defined substance and subject to the "principium individuationis", disappeared with the advent of quantum physics, with two of its protagonists, Heisenberg and Schrödinger. This abjured the hegemony of Democritus and decided to follow the path of an immaterialist atomism such as that of Plato. In his memoir: "Der Teil und das Ganze", **Heisenberg W (1969)** tells of having read Plato's Timaeus in the original language for the first time, in order to practice Greek for the final exams. That meeting excited him, in particular for the thesis supported by Plato that the tiny particles making up matter correspond to mathematical figures, that in reality donot reflect matter, but geometric representations of groups of "symmetry of space". In fact, Heisenberg writes: "In the beginning there was symmetry", which is certainly a more adequate expression than that of Democritus: "In the beginning there was the particle". The problem of the ultimate consistency of reality and of the dissolution of the concept of matter was also faced by **Schrödinger E. (1944)**, who, as a physicist, compared the corpuscular interpretation of reality as opposed to the wave form. As a philosopher he mirrored this energetic vision of his "continuum of reality", in a reference to Plato and oriental philosophy.

With Heisenberg the science of quantum mechanics advocated that today's physics must basically be built on the hypothesis of symmetry, as the fundamental laws of nature. The latter are invariant with respect to the use of certain groups of symmetry, altough they are groups of symmetry, different from those of Plato. In summary, in our scientific history we have passed from the pre-modern era of "narratives", in which our feeling towards the knowledge of nature came to us from entities external to man, to the era of the "Galilean measure". However, In this, the power of "narrative" has been fatally weakened in favor of "determinism". We humans became a junction point between thought and the external world, in a perspective from which we imagine the infinite possibilities of being.

We live in a, seemingly, "Dualistic" mind/matter Universe, yet there is no separation between "Space" and "Matter", since "Space" includes the archive of all the experiences that have been, that are, and that there will be in the universe. This information is collected by transmutation of the wave fluctuations underlying every form of experience, permanently filling the archives of the supposed "Akashi memory bank". This, in fact represents modalities of conscious energy with infinite properties of creational organization and own individuality, yet under the condition of free choice and dynamic constitution by continuous feed back from the present. Within this dynamic universal process there is hidden an "evolutionary arrow", for which current science still does not have a proper description. Although Thermodynamics seems able to explain all the phenomena concerning the so-called inert matter, in which energy always has a dissipative behavior, defined as entropy (measure of the disorder of the system), the theory exhibits severe limitations when it has to predict the behavior of living systems. Life conditions not only depend on the energy taken from the surrounding environment, but also imply the collection of meaningful information in order to adapt for survival and thereby is continuously reorganizing and evolving the state of art, among others by problem solving and error correction. (see also **section 7**).

3.2. Cosmic Energy

Cosmic information can be regarded as a modality of energy and is represented as an integral matrix of geometric shapes and connective structures of the Universe. In the universe nothing is occurring by "chance", starting from the coupling of two photons that are supposed to give rise to the electron (GM effect, from **Göeppert Mayer, 1931)** to arrive, through geometric guiding, at the very structure of the atom. Here the intrinsic opposite charges have been described as the difference in pressure of two etheric flows **Izetali**, **(2019)**, in which the electron cloud has a greater etheric pressure than the nucleus. Consequently, the electronic flows towards the area associated with the center of the atom **(Orlov, (2017)**). Trough the natural phenomena of resonance, coherence and formative causation, nature expresses itself using geometric forms in which we are immersed. From the resulting integral structure, we can deduce the "evolutionary arrow" inherent in our Universe. According to the process philosophy of Whitehead. Instead of a machine, this great enigma should be conceived as an eternal unfolding process, and in order to understand it we should stop reducing it to ever smaller parts of everything, but rather try to focus more on the whole structure of "causes", within a connected holonomic flux of information.

To begin our journey towards the knowledge of these "causes", let's take into consideration the famous saying of Lao Tze, which says: "Everything is One, but it appears differentiated". The primordial One, by a combination of power and wisdom decided to kick off the "Great Carousel" of the Universe of which we are part. The first observer induced the doubling of itself, to create a new experience in evolution, in which the inevitable entropy was complemented by a reversed modality of neg-entropy. In this regard, **Cerreoni, 2020**,

revealed the "universal dualistic nature", on the basis of a four-axis system: *the tetrahedron*. In this geometric pattern the postulated positive field is the entire space that contains the tetrahedron, while the negative field is all the space that contains its dual. In fact, these spaces represent unity: only the particular phase changes from one into the other. The geometric genesis of the anti -tetrahedron does not result in the genesis of a dual tetrahedron, but rather a dynamic state of conversion. The Chinese understood this contrast with Yin and Yang, the Japanese with Ki, while Maxwell and Faraday described this phenomenon of Positive and Negative charge, as a state of tension in a calm sea called "Ether".

3.3 Bipolar Cosmic Geometry

As science and spirituality increasingly merge, a new worldview is concurrently emerging that embraces the idea that energy and consciousness (the physical and metaphysical experience of reality) are a unified whole, and that all "things" are entirely and instantly interconnected as one. Building upon the foundational research of David Bohm, Buckminster Fuller, Arthur Young, Walter Russel, Richard Merrick, Marshall Lefferts as well as Nassim Haramein, Marko Rodin, Peter Rowlands, Vanessa Hill, Elizabeth Rauscher and many other 20th century pioneers, a contemporary understanding of the fundamental patterns, structures and dynamics of the "cosmic geometry" was created. The insights of both scientific and sacred geometry that have grown over centuries of inquiry are now revealing an increasingly accepted model of a fractal and holographic universe, wherein the whole is found to be present in every "part" at every scale, from micro-atomic to macro-galactic.

The pattern that emerged, pictures the interplay of geometries at work, from the micro- to the macro-cosmos, from Quarks to Galaxies, are in a state of continuous transition or pulsation. We conceive the Quarks being represented by the faces of the "Tetrahedron" which brings stability to the manifestation of mass (**Natale**, **2016**). Therefore, as long as we have a structure in play as a single energy point, it remains in the state of *potential energy* and does not manifest itself as mass. When this energy point is somehow stimulated, it creates an energy line such as the Photon, which does not yet manifest itself as mass. Rather the appearance of mass occurs only with the insertion of the third energetic line which encompasses pulsation within a spatial arrangement, able to close the figure of the Tetrahedron. In this geometric context, the latter process generates the Proton and the Neutron in perfect balance with the resonance of the Electron. The identification of the path that nature takes to present its geometry to us would even be simpler if we would consider atoms as a construct of spherical vortices of aether with a central axis. This scientific aspect was dealt with by **Moon**, **2004**, postulating that the geometric shapes of the "Platonic Solids" can also be used to represent wave formations in three dimensions, where each vertex point touches the surface of a sphere in the area where the vibrations stop to form a knot, exactly as in a three-dimensional geometric vibration / pulsation pattern. See, The Platonic Solids, below



Figure 6: Platonic bodies

These geometric forms of "crystallized music", were supposed to be spontaneously formed in space, subsequent to a stimulation or a pulsation of any nature. We also note that when the hierarchy of "Platonic Solids" are nested into another, the inherent motion always occurs along a path in logarithmic spiral, with the ratio of " ϕ ". This finds an explanation in the assumption of an arrangement of the Platonic Solids in a pulsating spherical vortex, as can more basically be pictured as the fitting if two-dimensional shapes such as the triangle, square, pentagon and hexagon positioned in a circle.

Major questions remain: what is the cause of the motion of electrons? Is this motion regulated by some mathematical-geometric law? Why are some elements more stable than others? Some answers come from Planck's discoveries which teach us that the radiations of heat and light move in "pulsations" or "packets" of energy at a level estimated to be about 10^{-32} centimeters. Planck discovered that the relation between the oscillation speed and the size of the energy packet always remains constant regardless of its measurement. Therefore, a faster oscillation will be associated to a larger packet, and smaller oscillations to a smaller one. This constant relationship between oscillation speed and energy packet size is known as "Wien's displacement law". Planck discovered that this relationship is expressed by a single number, which is known as the "Planck constant", expressed in a simple equation, which describes how radiant matter releases energy in "packets" or "pulsations": E = hv, where E equals the energy obtained from the measurement, v is the vibration frequency of the radiation that releases the energy, and h is the "Planck constant" which regulates the flow between v and E.

Planck's constant is 6.626, and it represents a dimensionless constant. In Planck's experiments, a small cube was used to measure the energy that passed through a certain area of space, which was assigned a volume value equal to one, this for trivial simplicity. However, when Planck formulated the constant, he didn't want it to be a decimal number, so he transformed the cube's volume value into 10, which made the constant 6.626 instead of 0.6626. We can therefore note that depending on the size of the package that is released, it will be necessary to measure it with a cube of a different size, and whatever is inside the cube will always have a ratio equal to 6.626 units. At this point we should note that the value of 6.626 is very close to 6.666, which is exactly 2/3 of 10, and therefore we must ask ourselves: what is so important in atomic physics in the mathematical ratio of 2/3? Based on geometric principles, we know that when a tetrahedron is perfectly inscribed in a sphere it will fill exactly one third of its total volume.

We arrive here at the notion that the "photon" is geometrically representable by two tetrahedrals joined together for a base, as we see in the **Fig. 7** below. If this dual structure passes through a cube whose size is sufficient to measure only one tetrahedra at a time, it turns out that the total volume (energy) passing through the cube will be two thirds (6.666) of the total volume of the cube, to which Planck had assigned the value 10.

Buckminster Fuller was the first to discover that the photon was actually describable with two tetrahedral joined in this way, and announced it to the world at Planet Planning in 1969, after which it was forgotten. The small difference of 0.040 between the "theoretical" 6.666 or 2/3, and the 6.626 of the Planck constant, is due to the permittivity of the empty space, which absorbs a part of the energy involved. This "electrical permittivity of the empty space" can be precisely calculated from the Coulomb equation. This means that the etheric energy of space will absorb a small part of whatever energy passes through it.



Figure 7: Two tetrahedral joined by a common face, form a photon as seen by Planck's constant (after Moon) *B*: Pulses moving with 180 ° rotation angles on octahedral energy forms (after Moon; C: Rotating tetrahedral model of human as a being of light); D: the photon seen as an electromagnetic phenomenon; E: Light interference quantum hologram of the photon, measurement left, predicted right (after Chrapkiewics, Nature Photonics, 2016)

Space allows a little less energy to pass through than what was originally released, and so once we get into Coulomb's equation the numbers fit perfectly. Furthermore, if we measure space using tetrahedral coordinates instead of cubic, then the relevance of Planck's equation E = hv decays, since the energy is the same on both sides of the equation. The "pulsations" of energy that have been demonstrated by Planck's constant are known to quantum physicists as "photons". Normally we are thinking of photons as "transporters" of light, but in reality, this is only one of their crucial functions describing the process by which atoms absorb or release energy. The only thing we know for sure about the term "photon" is that it is an impulse traveling through space (since the photon has no mass for it, and is timeless). Yet, it does have a" geometric aspect ", and consequently, also the atoms should have a geometric component.

Bell's inequality theorem also requires geometry at the quantum level. In this context, the experiments of **Aspect, (2004),** that measured properties of photons, originating from one source, but move away from each other in opposite directions, in order to establish the correlations between physical properties such as polarization. The photons measured in Aspect's experiment revealed an "entangled" state, in which the state of the one photon allows us to predict the the state of the second photon. In fact, such a correlated state is an example of quantum-superposition. While a digital binary state of yes/no represents a bit, a quantum-bit

(qubit) information unit can exist in much more intermediate states, also with regard to the states of polarization. The qubit, therefore, is the versatile basic element of the quantum computer, offering much more choices per transition than the digital bit, largely increasing its calculation capacity. Alain Aspect's experimental results obtained on entanglement of paired wave/particles can be geometrically conceived as paired "photons" that are actually joined together by a single geometric "force" such as the tetrahedron, which continues expands to a greater magnitude as soon as the photons separate, meaning that these photons will maintain the same angular phase relative to each other as the geometry between them expands. Thus, both Geometry and Mathematics represent the tools we have at our disposal to understand the "resonance structure of nuclear space" in the quantum system which, therby is essentially a container of "Information".

3.4 Rotation Processes

The next aspect of physics we are going to consider is rotation. Physicists recognize that energy particles "spin" when they travel, for example it seems that the "electron cloud" continues to make rapid 180 ° or "half rotations" as it moves through the atom. Also, the enigma of spiral movement of torsion waves is explained by a recurrent rotational process that can be seen as pulsation. Wherever energy wave/particles are situated in the Universe, the ether will always be pulsating according to these geometric shapes, collectively forming an effective energy matrix that in current quantum physics is called superfluid quantum space also conceived as a liquid crystal. Therefore, every impulse that travels through the ether will have to follow a path through the faces of such geometric "fluid crystals" of the ether. This implies that the spiral movement of torsion waves is caused by the simple geometry through which each energy impulse must "forcibly" pass during its "movement".

Both Geometry and Mathematics can be used to represent an "information Universe " In the universe where all the information is contained within a continuous evolutionary movement, in reality nothing materially moves, we can say that matter manifests itself in areas where its energetic state finds a balance with the Space in which it is immersed. In this framework, the so-called "space-time" corresponds to an "evolving tensor network". Here the geometry of the Riemann network plays a key role in understanding of the basic properties of deep information networks or "deep learning" systems. The geometry hangs back on the square root which always gives a "dual" result. $\checkmark 1 = 1$ and / or -1; $\checkmark 4 = 2$ and / or -2; so for all numbers, which makes sense because if the numbers are quanta (with dual properties: yes and no / true and false / positive and negative / matter and antimatter), and they are arranged in space ... they do not change their position but rather their phase

3.7 Fractality of Nature

The former concept leads us to observe a "fractal organization" in the Cosmos, what also is called "selfsimilarity at all levels". This is similar to the characteristics of the hologram, in which each part represents the whole picture. Geometric patterns created by mathematical fractals can be enlarged or reduced indefinitely, but always obtain the same geometric structures. Such structures can be regarded in continuous pulsation, which was also deduced in the experiments of **Kozyrev** and his group **[see Kaivarainen A. (1991)]**, where he envisioned the concept that in the Universe generates toroid-like, spherical, formations of energy at all levels of existence. Speaking of "pulsation", for example, it has been found that the surface of the Sun actually pulsates in and out, just like a fractal attractor does when it reaches field symmetry. The Sun oscillates in constant pulsations with its surface rising and falling by about 3 kilometers, and this pulsation occurs in various harmonic intervals of basic units of time of five minutes, increasing to a maximum value of 160 minutes, suggesting that the Sun acts as a central oscillator of our solar system. Our Sun also has a less known magnetic field, the interplanetary magnetic field. Accompanying the rotation of the sun, this magnetic field rotates and forms the Parker Spiral, which has a three-dimensional structure exactly the same as the spiral arms of a galaxy.

The repetition of this pattern in all scales from micro to macro, confirms that the universe is structured in a fractal harmonic mode. Fractal patterns has been widely explored by pioneers, such as **Mandelbrot**, (1983), a French naturalized Polish mathematician, using fractality as a means to describe the repetitive patterns of plant parts, in addition to the contours of coasts and mountains, the branches of rivers, lightning, clouds, wave configurations, etc. On the same "wavelength" are the studies of **De Santis,2020** on the means that all nature uses to communicate information at speeds not comparable to those defined as maximum by the theory of relativity.



Figure 8: A: Permittivity of free space as a function of the golden ratio. **B**: DNA double helix modeled as G- ball dodecahedron resonating up around a central axis. **C:** Harmonic standing wave sharing energy inside Phi-damping that provides the very separation of notes.

De Santis **(see further)** identified the formulas that define the ways in which plants are interconnected with life in all its evolutionary states (see further). An extension of the theory is the apparent pattern of "neural activity" of the cosmos that determine the reactions of its components within the dynamics of reality. In this "fractal" model, he postulates that each portion is exactly organized according to the measurements of ϕ as defined by the Fibonacci sequence. This implies the manifestation of stationary tension waves and/or balanced etheric flow, which is repeated on all cosmic scales, such as in:

- 1. the human heart (heart rhythms);
- 2. the DNA double helix (replication frequency);
- 3. the optimal cerebral functioning (hemispheric synchronization);
- 4. the fundamental heartbeat of the planet (fundamental resonance of the Schumann cavity);
- 5. the musical geometry of creation, thereby following the golden symmetry (ϕ and Φ), among others revealed in the architecture of human bodies and the whole cosmos.

De Santis in a conference in Italy, held on January 6, 2021, by the organization "Assisi nel vento", pointed out that the theoretical divergence of plants coincides, even up to the ninth significant digit, with a harmonic fraction not of the solar or sidereal year, as one would expect, but of the anomalistic year (Interval of time between two consecutive passages of the Sun at the perigee 365.259635 days).

In summary we shall see that pulsations, distances and any other measure in nature do respect the symmetrical field line that informs and shapes it. In this process geometric relations for the field become the only way to survive and self-organize. It represents the dynamics in order to infinitely regenerate without being self-destructive. In other words, golden ratio measurements are the only way for waves to share space, and self-sustain.

3.8 Prime Numbers and Riemann Function Z

De Santis, (personal communication) also assessed that the Riemann Zeta function "counts" the prime numbers in a way that is still poorly understood by current science. The appearance of prime numbers remains mysterious, even in the hypothesis formulated by Riemann about the location of the Primes in the Argand-Gauss geometric plane. This is considered valid by the majority of mathematicians, yet there is currently no incontrovertible proof of its truthfulness, since the process of the counting of prime numbers is potentially subject to errors. In the current state of Art, this is one of the open problems of mathematics, for which a million dollars is awarded for those who can solve it. The Riemann Zeta function without yet knowing its future in the odyssey of mankind, apart from the mathematical aspects, has deep connections with our world in general, ranging from the energy states of atomic nuclei, to the security of credit card numbers and many other items in the digital world.

De Santis, (2019), with his book "*Algorithms and geometries of prime numbers*", recently, made an interesting contribution to the deepening of this knowledge on prime numbers. He also pointed out that inexact mythologies exist about the "Theory of Numbers" and related writings of the great mathematicians such as Euler, Gauss, Legendre, Goldbach and others. One of the most striking statement is Euler's phrase: "Human mind can never penetrate the secret of prime numbers". Of note, the great Swiss mathematician actually said so, immediately after he himself had found extraordinary relations in prime numbers. This, essentially, included an algorithm in which two distinct sequences can be glimpsed. In fact, his writings bear the title: "Discovery of a most extraordinary law of numbers relating to the sum of their divisors".

With regard to the formulation of Gauss's Prime Number Theorem, it seems that another false myth is widespread. This other immense genius established on a statistical basis for the relationship between the order number of the Primes and the logarithm of natural numbers, in fact according to unknown intuitions. But if the Zeta function, very well known to Gauss, is capable of counting primes with its zeros, and the extension of the Harmonic Series to the logarithm of natural numbers, what does statistics have to do with the Prime numbers? In his book De Santis sets out two methods for validating Legendre's conjectures, and one for

Goldbach's, who was not mistaken in believing that each even number is the sum of at least two prime numbers.



Figure 9: Torus geometry at various scales of the cosmos from large (left above) to very small (right below)

3.9 The Role of Geometrics of the Torus and the Evolutionary Arrow as Universal Algorithms

The geometric shape of the "torus" is present everywhere in the shapes in the Universe (see **Fig.9**). Wave frequency and resonance represent the phenomena and interconnected links between all levels of existence, and the simple concept of toroidal shapes shows us how they work **Merrick,2010**, **Lefferts, 2019**. A toroid functions as an energy coil that stabilizes an aggregation of cyclic frequencies; it begins as a simple rotating energy model in which various frequencies are introduced and incorporated, gradually making a complete, complex and integral cycle. Humans can be seen as living toroids, frequencies that circulate intact as we move through the information network contained in Space. Our basic toroidal shape emerges from what we call "soul or spirit", and we integrate it with multiple frequencies that produce to the energy patterns of the heart, the brain and in general the coherence and vitality of our body.

We hold that the process of life always and only evolves forward, driven by an algorithm represented by the term "Evolutionary Arrow", which De Santis detected as written in the spiral shapes of nature such as in flowers and plants, mathematically generated from a dimension that is hidden from us. In this theory, each event is made up of the sum of two components, one which mirrors the past and is inertial, in addition to a relatively small component of the future. The future is defined by us as characterized by a negative time, while the past time constraint is considered to be positive. Among *anomalous* forms (defined as not following the phyllotaxis based on ϕ and therefore the Fibonacci geometry) are vegetables, flowers or plants, and can be

described by formulas that provide the succession of prime numbers. We submit that these formula's, al least from a mathematical point of view, provide the basis for some physical laws, including conjectures and hypotheses which man has explored and falsified in the past four centuries. In particular, this is based on the succession of prime numbers associated with the numbers derived from their products without other numerical impurities. These features were found in a formula enunciated by Legendre after the French Revolution (1797), and represents a union of two sequences: that of prime numbers and that of their hybrids. By purifying the total succession from that of the hybrid numbers by means of the complement set operation, the net succession of the Primes is obtained.

According to De Santis, Legendre's formula is revealed with regard to the morphology of certain flowers and in particular on a palm of Madagascar with a rare triangular structure (*Dypsis decaryi* (Jum}.**Beentje & Dransfield**), in addition to the tricussate phyllotaxis of the Oleander (*Nerium oleander* L.), geometrically showing the solution of the conjecture of Goldbach. Importantly, (**De Santis, 2019 p. 20**). demonstrated how this formula is also present in the "Riemann Z Function". Evidently, there is a close link between the geometric shape of the Torus and the Evolutionary Arrow. This finding supports the generalized musical algorithm of wave frequencies, as developed by **Geesink and Meijer (2017)**.

3.10 Integral Connectivity Underlying the Intelligent Evolution Mechanism of Life.

The evolutionary mechanism of cosmic life, in a process of continuous evolutionary remodeling, work "step by step". Consequently, the living organism seems not internally aware of each next step of the evolutionary ladder. Any further step is determined by the encounter between the information defining of the step in progress, and the information of environment. This implies that the living organism must be open to the external environment, and from this concept the following questions arise:

1) How come that our biology seems to deal almost exclusively with chemicals (oxygen, carbon, hydrogen, nitrogen, calcium, magnesium, phosphorus and sulfur), that represent only 1% of a living organism and not by the complementary 99% composed of water?

2) How did living beings, for 99 % composed of water, not dissolve in sea water, but instead organized themselves in the harmonic forms that we find in nature?

The answer may be lying in the fact that in order to explain the functioning of life, the presence of an "intelligent algorithm" is required that harmoniously coordinates the birth and evolution of life in nature by means of some mechanism of integral connectivity. The self-organization of living organisms requires their ability to reduce their own entropy, transferring it to the outside as a modality of energy. In biological physics, this is seen in the context of coherent systems. This is actually realized since the molecular components apparently are not independent, but are functionally related to each other. In this perspective, as investigated by various authors (Haken,1983, Del Giudice, 2010), we see that organs, such as our brain, are centered on wave "phase", consuming about 20 watts to function. Compared to a computer centered on the force of "strength", even with information processing and related memory that is 10 times higher than our brain, it consumes about a million times more energy to function.

Also, a human, weighing about 80 kg, walking at a normal pace, but driven by the "phase" system, consumes about 80W, while the M2 robot of the MIT (40 kg), has a consumption of over 540 W. These major differences in functional energy are related to the phenomena of "Resonance" and "Coherence", by wich the human organism is centered on the spiral propagation of "phase". All this is instrumented by the generation of

wave/particles of coordinated spin and coherent vibration (neg- entropy) from which life emerges. In contrast, the wave/particles of machine systems, instrumented on "force" on the basis of de-coherent waves can only create inert matter and chaos (entropy). This type of logarithmic spiral propagation of waves in Space, is reported in the studies of the physicist in Naples: **Palmieri, (2021)**, as exemplified in his "Unigravitational Physics".

Our brain, as being "phase" instrumented, is divided into two hemispheres, connected to each other by a bundle of 200 million nerve fibers or axons featuring neurotransmission. The nerve impulse are propagated in the form of an action potentials through specialized junctions called synapses, mounting to 5,000 to 100,000 per neuron. The estimated total of one million billion nerve impulses, travel at speeds ranging from less than a few decimeters to a hundred meters per second. The two cerebral hemispheres have different specializations: roughly seen, the left elaborates the analytical-rational thought, the right elaborates the emotional components. Yet, the complexity of their interactions escape determinism: the processes of the brain are random, stochastic, predictable only roughly in probabilistic terms. The ambiguous state between "chance" and "necessity", of free choice but also emotional states, among many other factors determine our awareness and actions. Realizing this personal universe, we are faced with at least two questions:

1) How does the brain "produce" a mind?

2) How does the brain endow the mind with self- consciousness, seen as a state of mind in which there is knowledge of one's own existence, in relation to the surrounding environment?

To give an answer to these two questions, addressed in a multitude of reports, we find studies of **Meijer and Geesink**, (2019), indicating that the state of consciousness is not confined to our brain, but connected a work-space seen as a container of information. In this scientific direction, we should also consider the model developed by Hameroff and, Penrose (2014), called "ORCH-OR", who identified quantum mechanism in the neural calculations, orchestrated by the tubulin proteins in micro-tubuli of which the coherent vibrations that allows the interaction between these brain oscillations and at the Planck space by gravity-mediated wave collapse. Both concepts are based on the connection of brain processes with cosmic events such as gravity and quantum fluctuations in the superfluid quantum space or aether as treated above. They represent a transition vehicle for the transfer of information to and from space, in an "orchestrated" manner. In the brain this occurs at temperatures and macroscopic dimensions well beyond the predictions of classical quantum physics, currently coined as quantum biology. We note that this "modality in evolutionary form of guided communication was earlier identified in the theory of the implicit order by De Broglie, (1925) and Bohm, (1951).

3.11 Beyond the Realities of Fibonacci: a Model Describing Information Processing for the Fabric of Reality

In this section, we try to avoid the confusion created by the terms: Golden ratio, Golden section, Golden number, Silver number etc. as well as the different interpretations that, in Western cultures, still exist of what Euclid and Plato called: "extreme and mean ratio" (not mean and extreme ratio). We set the small $\phi = 0.61803$ and the Capital $\Phi = 1.61803$. It seems unnatural for the human mind that small ϕ is of greater value than Capital Φ . For now, we want to point out only that, according to Keppler, we can compare the Pythagorean theorem with a certain quantity of gold and consider the division of a line into extreme and mean ratio a precious gem. Kepler was the first to notice that the ratio of any number of the Fibonacci succession with the number that follows it, very rapidly in the sequence reaches the theoretical value of the small phi, which is: 0.618033989....

Pythagoras framed the particular religious secret a "gold jewel with gem". His theorem and small ϕ and capital Φ are closely associated in the right triangle with sides 1 and 2 that in the half of the diagonal have the value of the maximum of the rationality: 1.11803, to which adding or subtracting by 0.5 reveals small phi and capital Phi. This forms the basis of all the relations of the parts of the five-pointed star and the Pentagon of which Pythagoras was the Guru as his own name seems to suggest (Penta Guru).



Fig. 10: Pythagoras framed the particular religious secret a "gold jewel with gem".

We only add that the irrational quantities small ϕ and Capital Φ seem to represent the most illogical and irrational numbers in mathematics. This, almost implies a serious warning as to the rationality of man, also from the point of view of a key number of world harmony according to the Harmonic Worlds of **Keppler** (1619).

We can summarize the links between the small ϕ , and capital Φ and the Fibonacci sequence (resulting in Binet's formula) as follows:

Given the small φ:

and the Capital Φ :

$$\varphi = 0.5\sqrt{5} - 0.5;$$

 $\Phi = 0.5\sqrt{5} + 0.5;$

we have:

$$\varphi \times \Phi = 1; \Phi - \varphi = 1; \varphi + \Phi = \Phi^{-1} + \Phi = \sqrt{5}.$$

Let's see what this implies:



Figure 11: Top part: Geometrics of the small φ . and Capital Φ . Part below: the tables of the powers of small φ and Capital Φ show the links between small φ and Capital Φ in relation to the Fibonacci Sequence. Top part: the variable y approaches towards positive from zero to B, towards negative from 0 to D. Metaphorically seen: ranging towards positive values can be seen as " growth of the seed". What is the meaning of a negative growth of a seed? When the growth of the seed stops, the growth of the plant begins in the opposite direction. We can therefore give spatial meaning to the positive solution and to the negative solution, using the second degree equation in y.

$$1/y = y/(1-y); y_1 = 0,5\sqrt{5}-0,5 = \phi = +0,61803...; y_2 = -0,5\sqrt{5}-0,5 = -1,61803... = -\phi;$$

The same is true for the variable x; in the positive direction it is from 0 to D and the negative from 0 to A. The positive or outward growth is that of the plant, the negative solution refers to the growth of a seed. Applying the formulas of the proportion OD: OC = OC: CD called OC = x we have 1 + x: x = x: 1; x2 = 1 + x; x1 = +1.61803 ...; x2 = -0.61803. Down part: we note that the powers of small φ and Capital Φ both start from 1, there are two different steps starting from one, as indicated by the initial part of the Fibonacci sequence 0; 1; 1; etc.

 Φ For the Principle of Mathematical Induction, we can write for F_n as the generic term of Fibonacci succession:

$$F_{n} = \frac{\Phi^{n} - [(-1)^{n} \times \varphi^{n}]}{\Phi + \varphi} = \frac{\Phi^{n} - [(-1)^{n} \times \varphi^{n}]}{\sqrt{5}};$$
 and also:

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$$F_n = \frac{\Phi^n - [\cos(n\pi) \times \varphi^n]}{\sqrt{5}} = \frac{\Phi^n - e^{in\pi} \times \varphi^n}{\sqrt{5}};$$

Binet's formula directly provides the value F_n of the umpteenth term of the Fibonacci succession. As mentioned before, Fibonacci's numbers are found in nature and are related to the geometric arrangement in space or in parts of organisms seen in a single frame. (**Fig. 9**). In time, only one element dimensionally retraces the spatial sequence of all the parts. In order to have a continuous view, an equation in continuous variables is needed.

Transition from discrete to continuous and then beyond Fibonacci is given when we change n with the continuous variable x as follows:

$$F(x) = \frac{e^{\ln(\Phi)x} + e^{i\pi(x+1)}e^{-\ln(\Phi)x}}{\sqrt{5}}$$

that for x, belonging to the sequence of natural numbers including zero: $x = \{0; 1; 2; 3; 4; 5; 6; 7; 8; ...\}$, provides the terms of the Fibonacci sequence: $\{0; 1; 2; 3; 5; 8; 13; ...\}$; When we replace x with t (x space with t time) we notice that the progression of the event

$$F(t) = \frac{e^{\ln(\Phi)t} + e^{i\pi(t+1)}e^{-\ln(\Phi)t}}{\sqrt{5}}$$

is composed of the two terms A and B:

$$A = \frac{1}{\sqrt{5}} (e^{t \ln(\Phi)}); B = \frac{1}{\sqrt{5}} (e^{i \pi(t+1)}) e^{-t \ln(\Phi)}$$

B contains the negative value of t which, as treated before, can be interpreted as future time, whereas the past has a t which is positive. The geometric layout can be placed on a plane where the geometry of the 3-dimensional reality is assumed to be projected. If we start from a space with three dimensions besides time, we would see an additional operational dimension or a fifth dimension that, however, we are not able to graphically represent together with all the others.

From the formula $e^{i\pi x} = \cos(\pi x) + i \sin(\pi x)$ we can derive the parametric terms to obtain the graph of the Fibonacci function continuously under the assumptions adopted,

$$\frac{e^{x\ln(\Phi)} + e^{-x\ln(\Phi)}\cos[\pi(x+1)]}{\sqrt{5}}; \frac{e^{-x\ln(\Phi)}\sin[\pi(x+1)]}{\sqrt{5}}$$

now if we fix an interval of x, for example: $-12 \le x \le +14$, we derive the graph:



Reality is visible only on the x axis which is the unrolled section of the plane where the three spatial dimensions are condensed and this image is the vision of the interactions of another dimension with the three spatial dimensions condensed on the plane while the usual temporal dimension is the evolution on the plane.

Of note, the interpretation of the above needs caution, as it deals with matters not directly perceptible by our senses and beyond the boundaries that are is currently identified. With all the caution of the case, it is observed that the development in the physical reality of the entity in question manifests itself on the positive part of the axis of the abscissa. On the negative part of the axis of the abscissa there would be an anti-reality that does not appear in this simplified figure. Yet, two more illustrations (**Fig.12**) to further clarify the whole process:



Figure 12: Unrolling of Reality from the past to future. On the **left**, the horizontal plane contains all information of reality in three spatial dimensions (the height is compressed). The third dimension is now " free" and allows depiction of a fourth spatial dimension; On the **right**, by the enlarged inset,(in red), the interaction of this fifth dimension with the "unrolled" reality is shown. Moreover, the two steps on the number 1 should be seen in continuous coordinates.

Every event of the entity in question appears to have a component in positive time (past), a sort of inertia, and a component in negative time, conceived as coming from the future and thus projecting the subsequent ages of the entity itself. These two aspects are added to a third modality, which does not appear in the figures and which is represented in point 1. This occurs as a birth on the plane of reality as a whole, through the interactions of all elements of reality. These three modalities can be conceived as one relating to the acquisition of energy, one relating to the dissipation of energy and one relating to an inherent consciousness acting upon the operation of reality (**Fig. 12**).

This subject in evolution was treated as in the studies on plants made by **Mitscherlich**,(1909) and **Baule**, (1918). It is necessary to define its maximum dimension which corresponds to a cut of the evolutionary curve of the subject, at this moment of the connection between past and future and can be mathematically expressed as the return of information that harmonizes the cosmos. According to **Knerr**, (1899): "the world or universe considered as a system, is perfect in order and arrangement, as opposed to chaos ". Everything

suggests that the transmission of information that determines the relationships between the various objects of reality, is in turn influenced by the extra-dimensional connections (**Fig.12** on the left) and therefore is operating far above light speed, providing a sort of "cosmic neural connection". A sequence of small phi's and /or capital Phi's is able of transform a 3-D vision of dimension into one of multi-dimension n-1. By applying the method iteratively, it can be brought up to dimension 1 or on a line indicating the history from whuch it originated (as the scalar parameter of quaternions). It is probable that the application of quaternions and a simulation with a proper program may lead to very interesting results. Wit regard to the non-observable dimension one should realize that a growing or expanding world cannot have subtraction within it, and even more so, it cannot be a periodic without a intervention outside the circuit. Yet, the geometrics that appear from the hidden dimension clearly shows that the evolutionary dynamic system cannot be extended to infinity because otherwise the part would become the whole. The equilibrium of the whole therefore fixes the maximum dimensions of one of its parts and it is at that moment that the end relates to the beginning.

To summarize: in this model system, in addition to the plane of reality which condenses the three usual spatial dimensions, there appear the temporal evolution as a fourth spatial dimension and finally a fifth virtual non-local dimension, in which one can identify a connection with universal consciousness of the various entities. This allows, due to feedback from the future, causes of future events to be found in the present. Thus, the whole guiding is coming from a Universal Information Center, seen as sort of *Akashi library*. Such information is supposed to travel at an enormous speed compared to the speed of "c", as the Light limit of reality. The evolution of the events of reality is represented on the spiral of the plane (**Fig. 12**, left). As a convention, the speed that manages the reality cannot exceed the speed of light, and speed of photons. Yet, the rotations of the information that connects these events to the additional dimension, being one turn of the spiral, is greater than $2\pi c$ and thus is >6c.

Finally, a brief mention on the aesthetics of mathematical formulas and reasoning (see **Aigner and Ziegler**, **2010**), according to which the golden palm goes to Euler's formula $e^{i\pi} + 1 = 0$, which among other things we have resorted into our "Formulation of the Beyond Fibonacci". Without any pretense, the formulation of our "Beyond Fibonacci formula":

$$F(t) = \frac{e^{\ln(\Phi)t} + e^{i\pi(t+1)}e^{-\ln(\Phi)t}}{\Phi + \Phi^{-1}},$$

it is aesthetically pleasing and draws attention to the math we are dealing with, which in addition to the king of the irrational, also reflects the emperor of beauty and harmony.

3.12 Conclusions

The integral connectivity at the base of Universal life, in continuous evolutionary remodeling, underlies the presence of a form of "intrinsic intelligence". On this subject there have been numerous studies, for instance the mathematician **Fantappiè**, (2011), the physicist **Majorana**, (1937), who connected the concept of "symmetry" with quantum states. There are other branches of science that not only have studied self-organizing and evolutionary phenomena on the basis of intelligence **Diez Faixat**, (1996), but have successfully built and tested intelligence models. Consider in this context, for example, the neural networks of **Hopfield**, (1982), and the self-organizing and dynamic oscillatory phenomena in water, reported in the studies of **Montagnier**, (2009), **Del Giudice E. (1988)**, with suggestions of "Water memory" (see also **Montagnier (2009**), **Del Giudice (2014)**).

Classical science has identified some boundaries within certain, still unexplained, phenomena may occur. Yet, even having identified the "physical boundary" or the dimension where these phenomena are in play (Klein, 2015; 2020; Meijer et al, 2020), these hypotheses did not solve the problem of "why" they occur. Despite the thesis that the quantum boundary is sub-microscopic or even sub-Planckian, it does not provide the final means to explain the creation of life that developed in biological evolution on microscopic and macroscopic scales, (from unicellular beings to man). Interestingly, it is as if in a coordinated manner "Life" processes were self-learning if not guided, likely as a quantum phenomenon (see also section 1 and 7). Yet, we hold this firstlife process could not be predicted nor fully explained by the known quantum rules. Another example we can observe is that our planet behaves like a huge organism in continuous evolution, as clearly shown by the geological phases of growth and evolutionary modification of the conditions of our Planet, (Diez Faixat J. (1996). Evolution somehow was fine-tuned to better accommodate Life. In this context it stands to reason to consider that evolutionary mechanisms were capable of setting a goal and/or reflect a primordial recipe for the fabric of reality. To achieve such a goal, a modality of intelligent thinking did emerge, providing permanent observers, or alternatively, was able to create a virtual world with retro-causal capabilities, in this way making the future the cause of our actions. A logical interpretation of all this is that the reality we observe is an integral part of a timeless cosmic consciousness and that therefore humans are also emerged in this consciousness.

4. The Role of Guiding Harmonic EMF- frequencies in the Fabric of Reality

Dirk K.F. Meijer (including sections 5-14)

4.1 Introduction

We hold that the architecture of reality is so astoundingly complex, and at the same time seems so fine tuned in all of its physical relations that it is highly unlikely that the universe started from zero information. Although the Anthropic principle lacks explanatory power and even can be seen as some biased pre-selection of data, the very content of discrete natural constants combined with the macro-cosmic features, of the planet we happen to live on, is undeniable. We believe that often heard multiverse arguments that are used to explain the anthropic context away are speculative since this constellation is unproven and, even worse, untestable. Scientifically acceptable hypotheses that presume a potential primordial information are the earlier mentioned theories of **Steinhardt and Turok**, **2002** and, independently, that of **Penrose**, **2010**, on the circular character of our universe, framed in cosmology as the rebound Universe (see also **section 16** and **Fig.46**. In a similar vein, our present universe may be viewed upon as a previous modality of the present one, in which at least some information was preserved as a recipe for evolution. The latter can also be seen as an unfolding of information in the Bohmian context, in addition to the "it from a bit" context in the participatory universe of John Wheeler, (see **Meijer**, **2015**).

Actually, it has been proposed by several authors, such as *Ivaldi and De Santis in section 2*, that even tinier elements should be assumed to exist beyond the Planck scale in a data field containing mathematical and geometric relations and presumably complex semantic structures such as qualia (therefore by some framed as qualia or phase space). This domain is regarded by some as being 4-dimensional (4 spatial dimensions in addition to time) and would represent the earlier mentioned implicate order, according to Bohm as being related to the information holo-flux concept (see **section 2**).

Our assumption of the intrinsically created cosmic "entanglement" in the fabric of reality, clearly requires further detail and explanation. How can entanglement in physics be created anyway? If in the implicit information processing, wave propagation is the essential communication feature, it is required to define the very modes of wave form and mechanisms for their propagation (transverse or longitudinal modes or even cyclic modalities). We anyhow submit that a type of *recursive* wave trajectories, in which the wave returns to its origin should be involved (**Fig. 13**). In fact, in the transactional theories of **Wheeler**, **1945 and Cramer**, **2005**, retarded and advanced waves that probe past and future states respectively, are assumed to return to their origin (**Fig.15**). The same can be said for a bidirectional transfer of pilot wave information as proposed by **De Broglie**, **1987** and **Bohm and Peat**,**2008**, by which information flux obtains a self-referential character.



Figure 13: Representations of entangled recurrent wave function as a spherical standing wave in the structure of the electron (**A**, from **Wolf, 2016**), as waves that return to their origin after transactional fit with future and past wave information (**B**), as entangled trajectories on a torus (**C**) and as a fractal spiral construct (**D**).

Could the recurrent wave form intrinsically exhibit quantum entanglement properties? (as treated in **section 2**) The bio-physical principle found by Geesink and Meijer, was primarily revealed through meta-analysis of biomedical experimentation in animal and human studies, and was later expanded by similar analyses in inanimate systems (see **Fig. 14**). These different studies all showed numerically identical and discrete frequency patterns that exactly fitted with the fractal, octave-like musical scale. The musical aspect (see **section 12**) was supposed to be related to the physics of photon and phonon/soliton wave particles and was proposed to have a scale invariant cosmic character (**Meijer and Geesink 2017**; **Meijer et al., 2020 d**).

4.2 How Reality Is Created from Entangled Wave Harmonics

The hydrogen atom, the element that as building block comprises over 90 % of matter in the cosmos and is known as the first element formed after the supposed "Big Bang" and was therefore related to the CMB spectra reported, (**Meijer, 2021**). The underlying math was based on a a supposed *complementarity* and *symmetry* of many physical phenomena (such as action yields reaction, coherence gives decoherence etc.), a pattern also pictured in in the recurrent wave trajectories observed in toroidal and spiral geometries (see **Fig.13 and 14**).

It is of considerable interest that at the Planck scale the abovementioned wave processes can also be envisioned as a combination of three recurrent waves and that the combined processes can be pictured as interacting toroidal trajectories (see **Fig. 15**). A typical features of energy/information flux on the torus is that the spiral trajectories arise from the very center, encounter both past and future aspects, rewind to enter the center in a self-referential manner (**Fig.15**). The Torus center is known to be instrumental in the so called quaternionic torus movements that can open up to a 4-dimensional domain.



Figure 14: Toroidal entangling of wave information resuting from a set of trajectories, that provide a corresponding wave pattern of alternate coherent (green blocks) and decoherent(red) guiding waves

The latter holonomic 3-D to 4-D dimensional flux process could thereby model the interaction with the hypothesized implicate order of David Bohm. In this respect can the recurrent wave trajectories involved (see **Fig. 15**), be seen as returning back to their origin, and can be well exhibit an implicit aspect of entanglement in this type of longitudinal wave function. **Fig.15**, therefore, contains all the separate processes operating in the fabric of reality. In this scheme, the nested torus model is used in order to emphasize the fractality of wave phenomena and implying that the toroidal flux tubes of different length may introduce the harmonic frequency relations, as found both in the work of Moody as well as Geesink and Meijer (see **Brueck and Meijer, 2020, Meijer, 2021**). On the basis of the combined theories presented in **Meijer, 2021**, we conclude that the Harmonic Entangled Wave Theory and the Generalized Music Scale Theory are for a large part

compatible and in a way mutually complementary and can be conceived as spiral or toroidal movements as shown in **Fig.15**, (**Brueck and Meijer, 2020**).



Figure 15: The information waves send out to past and future blinks are recurrent and transfer the particular information into a "blinking now", also being perceived as "instant of consciousness". This information is collected in its event horizon memory (middle) and expressed as information units on the Planck scale (blue triangle). The blinking now simultaneously receives pilot information from the harmonic information field coined by David Bohm "the implicate order". An intrinsic back-reaction to this knowledge field renews overall information of this field. The collective information fluxes generate quantum entanglement of this blinking now by which the information is integrated in the collective present. The processes of information flux are postulated to have a toroidal recurrent character, both at the level of prior and subsequent blinks (bottom part) and bidirectional information transfer between the 3-D Planck scale and the sub-Planckian 4-D information field. Toroidal flux tubes of different length, in a fractal context (top part), are instrumental as wave operators and guide information with harmonic frequency relations, according to a proposed musical master code of the implicate order (from **Brueck and Meijer, 2020**).

Here we conceptualize the torus also as a *universal operator* in the dual transfer of information between the 5-D data field to the reality of the 4-D world (top of **Fig. 15**), here at the Planck scale. Yet, through its scale invariant (fractal) character, torus geometry is instrumental both on the level of our own planet and galactic system and that of the whole cosmos (see **Fig. 10**. If the entire integral process pictured in this scheme above, implying that the creation of conscious moments is by definition cosmic, it implicitly reveals the presence of a collective universal consciousness, (see **Meijer, 2019 a)**. The process of creating conscious moments (blinking now's) is implicitly related to formation of space-time. This is in line with ideas on the ongoing expansion of

spacetime as it has been ascribed to the repulsive dark energy force, representing the physical expression of the assumed cosmological constant. In addition, the cumulating information in the universe can also be conceived as the steady build-up of energy in an entangled state. The recent concept of **Verlinde, 2016**, who earlier proposed that dark energy/matter could have an informational holographic background, would be very much in line with this contention as well as the known ER=EPR conjecture of **Malcadena and Susskind, 2013**. Therefore, we argue that the basic process of wave guided blink formation and thus the creation of novel information on the Planck scale, does not only lead to the integration of the connective force of entanglement, but also to the implicit expansion of spacetime itself, as well as its informational content as registered in the zero-point energy/dark energy field, (**Fig. 15**).

We suggested earlier that the fractal brain resembles a personal universe (**Meijer, 2013; 2014**), and that consciousness in the universe is scale-invariant (**Meijer and Geesink, 2017**). This idea was confirmed by several authors showing the complexity and informational content of cosmic structure **Vazza, 2016**) and the possibility to conceive the universe as a neural network (**Vanchurin, 2020**).

4.3 Quantum States of a Monopole Embedded in a Rotating Toroidal Geometry

The hypothetical existence of a magnetic monopole would imply that electric and magnetic charge must be quantized in certain units. It is known that Bose-Einstein condensates can be used to emulate the magnetic monopole. Bose-Einstein condensate have been described by a generalized quantized coherent wavefunction, that demonstrates a toroidal geometry. It is proposed that the monopole can be used to describe many coherent excitations, embedded in asymmetric wave states that are positioned in a "quantum field". It is considered that a relation between Dirac's monopole and a rotating torus exists, and can be made visible by a Hopftransformation, that maps to each point on the ordinary 3D sphere from a unique circle of points on the 4D sphere.

The quantum theory of magnetic charge started with a paper by the physicist Paul Dirac in 1931 (**Dirac, 1931**). In this paper, Dirac showed that if any magnetic monopoles exist in the universe, then all electric charge in the universe must be quantized (Dirac quantization condition). The electric charge is, in fact, quantized, which is consistent with (but does not prove) the existence of monopoles (**Littlejohn, 2007**). The monopole potential can be the result of extending the spacetime homogeneous manifold to 5D. In electrodynamics, given in the homogeneous 4D Maxwell manifold, energy is carried by photons emitted from a charged current, which is absent in the homogeneous 5D manifold, hence although the monopole Bosons carry energy, we may describe this 5D space-time of the Universe as Dark Matter domain, a vacuum filled with the Bose-Einstein condensed Higgs' bosons (**Wong, 2020**).

Some condensed matter systems have a structure similar to a magnetic monopole, known as a flux tube. The ends of a flux tube form a magnetic dipole, but since they move independently, they can be treated as independent magnetic monopole quasiparticles (**Gibney**, **2014**). The hypothetical existence of a magnetic monopole would imply that the electric charge must be quantized in certain units; also, the existence of the electric charges implies that the magnetic charges of the hypothetical magnetic monopoles, if they exist, must be quantized in units inversely proportional to the elementary electric charge (**Gibney**, **2014**).


Figure 16: Cartoons of the magnetic monopole; A: Schematic representations of the monopole creation process and experimental apparatus. a-c, Theoretical spin orientation (red arrows) within the condensate when the magnetic field zero (black dot) is above (a), entering (b) and in the middle of (c) the condensate reference: Ray, 2013. Left: Fields due to stationary electric and magnetic monopoles. Right: In motion (velocity v), an electric charge induces a B field while a magnetic charge induces an E field. Right: Dirac's monopole exists at the end of a quantum vortex, for example electrons can exhibit terminating vortices. Of note: Dirac monopoles can also appear in Bose-Einstein condensates; **B**: Vorticity corresponding to the monopole. Vorticity Ω s is calculated and the magnitude of the vorticity is denoted by colour, and the map is linear between the minimum and maximum values. For clarity, only the relevant parts of the vector field Ω s are shown (**Pietilä, 2009**); C: condensate of cold atoms can be a model for a magnetic monopole, in which the magnetic field jots out of an isolated pole, except in one direction where there is no field. **D**: 3-D toroidal magnetic field; D: Art impression of a rotating torus, applying a Hopf-transformation, (reference P. Nylander). A 4-D to 3-D stereographic projection delivers a 3-D torus, called a Clifford Torus composed of interlinked Villarceau circles). E: Cut a magnet in half and two magnets are created, each with a north and a south pole, no matter how small the original magnet. But some theories of particle physics predict the existence of particles with a single magnetic pole. Researchers have seen analogues of such monopoles in condensed-matter systems, but they have yet to catch the actual particles and measure their mass.

There is a relation between states of Bose Einstein Condensates and the energy states of a torus geometry (Geesink and Meijer, 2020b). The modes of bright and dark solitons have been theoretically predicted in BEC's and have been observed in experiments. Regardless of the physical system in which they occur, solitons are characterized by stable, non-dispersing propagation of either bright solitons or dark solitons of the physically relevant dependent variable, e.g., particle number density in BECs. Self-interference of a single Bose–Einstein condensate and the creation of ring dark solitons has been demonstrated on a non-simply connected geometry, focussing on a toroidally trapped ring-shaped condensate (Toikka, 2014). The phase coherence of BECs leads to properties such as quantized vortices (solitons) and dark solitons. Self-interference of a BEC can appear in a ring trap and toroidal self-interference is observed, that offers a way to probe the spatial phase coherence over the extent of the condensate in the ring including ring dark solitons It has been shown that in a harmonic ring trap, the RDS (ring dark solitons) can be made stable (i.e. sufficiently long-lived), therefore, a toroidal trap makes it possible to stabilize the characteristic geometry (Morse, 1953; Toikka, 2014). Two fundamental concepts have been introduced in Dirac's original paper: (i) electromagnetism is a gauge-invariant manifestation of the nonintegrability of the phase of the wave function; (ii) nodal lines of the wave function (spacelike lines along which the wave function vanishes) are singularity lines of the electromagnetic potential and the end points of nodal lines are points of singularity of the electromagnetic field. At this singularity there is a magnetic monopole, such that the total magnetic flux through a closed surface about this singularity is different from zero (Costa de Lima, 2001).

Theoretical motivations behind the hypothetical existence of magnetic monopoles are the symmetrisation of the Maxwell's equations and/or the explanation of the charge quantisation. **Dirac (1931)** proved that magnetic monopoles could explain the discrete nature of the electric charge, leading to the Dirac Quantisation Condition (DQC) (**Mitsou, 2019**). The existence of magnetic monopoles, characterised by their isolated magnetic charges similar to electrically charged particles, has been assumed over the years in many theoretical proposals. On the other hand, dyons, carrying both magnetic and electric charge, offer a more involved solution leading to the DQC, which depends on the underlying theoretical scenario.

Dirac monopole In Dirac's formulation, magnetic monopoles are also assumed to be point-like particles with quantum mechanical conditions, establishing the discrete nature of their magnetic charge. In spite of monopoles formally symmetrising the Maxwell's equations, a numerical asymmetry emerges in the DQC (**Mitsou, 2019**). A microscopic mechanism by which trimerization leads to a modulation of magnetic exchanges, and therefore magnetic monopolar and toroidal orders emerge from the combination of 120° anti-ferromagnetism and trimerization. The experimentally observable signatures of magnetic monopolar and toroidal orders have been identified in the inelastic neutron scattering cross section, simulated from a microscopic model of LuFeO3 (**Fogetti, 2019**).

It is considered by Geesink that a relation between a rotating torus and Dirac's monopole, exists and can be made visible by applying a Hopf-transformation, that maps to each point on the ordinary 3D sphere from a unique circle of points on the 4D sphere. A 4D to 3D stereographic projection according the Hopf Fibration results in a 3D torus called a Clifford Torus composed of interlinked Villarceau circles. The circles form a fiber bundle called a Hopf Fibration and the torus embedded in R3 is an asymmetric reduced-dimension projection of the maximally symmetric Clifford torus embedded in R4 (**Borelli, 2012**) and see picture 3.



Figure 17. Art impression of a rotating torus, applying a Hopf-transformation, reference P. Nylander. The Hopf-transformation maps to each point on the ordinary 3D sphere from a unique circle of points on the 4D sphere. The rotating circles form a fiber bundle called a Hopf Fibration. A 4-D to 3-D stereographic projection delivers a3D torus, called a Clifford Torus composed of interlinked Villarceau circles).

Geesink and Meijer described the eigenvalues of a torus according to a coherent quantum wave equation (Geesink and Meijer,2014). It is proposed that a monopole can described by a quantum equation of a distribution of coherent energy (3-D semi-harmonic oscillator) as found for masses of elementary particles, EPR-experiments, Bosons, fermions and Bose Einstein condensates (Geesink and Meijer, 2020a). Probably monopoles have the same quantum behaviour as Bose Einstein condensates, but have a rotating toroidal geometry. It is considered that a relation between Dirac's monopole and a rotating torus exists, and can be made visible by a Hopf-transformation, that maps to each point on the ordinary 3D sphere from a unique circle of points on the 4D sphere. The monopole can be described by a quantum equation of a distribution of coherent energy (3D semi-harmonic oscillator).

5. The Guiding of Life Processes from a 5-D Manifold Information domain

5.1 Introduction: The Concept of Wong and Chow

A "5-D model theory of life" was recently proposed by **Wong et al, 2019, 2021,** in which the creation of life was conceived as a process of symmetry breaking from a homogeneous 5 D spacetime manifold to a inhomogeneous 4-D one, which should involve the formation of separate torus-like manifolds. These, in turn, create magnetic monopole bosons of a diagonal long-range order, thereby exhibiting a Bose Einstein condensed space. In life forms such a monopole boson field could be formed through resonances of carbon 12 nucleus hard-sphere (which is a component of all life forms) in DNA and RNA. The build-up of the genetic material is accomplished through quantum-tunneling of one hexagon onto another in an adjacent hexagon layer, creating RNA, while interaction with the pentagonal nitrogenous bases set can be seen as forming the surface of a Bucky ball, by which a standing wave of bosonic monopole is realized (see **Fig. 16 and 18).**

5.2 Symmetry breaking from "homogeneous" 5-D to "inhomogeneous" 4-D

The 4-D inhomogeneous Lorentz manifold can be obtained by a space dimension projection from a 5-D homogeneous space-time manifold (**Wong et al., 2014**). This topological projection is irreversible and is shown to be mathematically equivalent to the Perelmann-entropy Ricci-flow mappings (**Perelman, 2002;2003**) in deriving the torus-type of the spherical 4-D Lorentz mass distributions (**Kaluza, 1921**).

This extra component of the solution was originally proposed by **Maxwell,1864** and was coined as the magnetic monopole potential. It was relatively recent that we have derived its explicit form (**Wong et al., 2018**). It was then possible to derive the explicit monopole unit as +2ec and -2ec. Where they were the product from two oppositely charged, opposite momenta along the 3D spherical radius, and massless spinor solutions to the Dirac linearized 5D equation. Because of the opposite momenta of the spinor pair, this magnetic monopole magnitude must be carried by two Diagonal Long Range Ordered Bosons with opposite magnitudes. Since each charged massless spinor like a neutrino has quantized momentum and energy, these massless charge neutral Bosons also carry energy, despite being in the Bose-Einstein condensed state. It is this mathematical feature that makes them equivalent to the Higgs Bosons (**Higgs, 1964**). And they must completely fill the homogeneous 5D manifold.

5.3 Big Bang in Another Light

Recognizing that the universe is generally supposed to have started as a Big Bang with absolutely nothing, that is with no time and no space, the homogeneous 5-D universe must be given by a Higgs vacuum. From which, the creation of mass through space projections or the equivalent Perelmann mappings must be equivalent to the excitation of this Higgs vacuum. If it is in some way mathematically related and obtained by excitation giving rise to the symmetry breaking of the Higgs bosons via either the breaking of their "Diagonal Long-Range Order" (DLRO) or the explicit breaking of the charge neutrality, and therefore the Bosons itself, such that a charge density distribution term to the Gravity tensor equation can be realized and the Einstein Cosmic constant explained. And how the truncation on the bosons energy range together with choice of remaining 3D space symmetry can result in the natural forming of molecules that have natural excitation spectra, that can be divided in turns of coherent and de-coherent (**Geesink and Meijer, 2018**), a very essential philosophical point raised by Schrodinger (**Streltsov, 2017**). And lastly at the lowest frequencies how it is correlated to the life forms' DNA spectra (**Wong et al, 2014; Wong et al, 2019**).

It is these loose ends to the 5D grand unified field theory (**Wong et al. 2014**), (our intension to attempt address in this paper. We had previously proposed that the creation of the universe started with the creation of a homogeneous 5-D manifold (**Wong et al. 2014**), and obeying uncertainty principle. Such a manifold than has an enclosing 4-D homogenous Maxwell manifold boundary (**Maxwell, 1865**). Because of that, the universe started with a Big Bang, with infinite energy, carried by the Diagonal Long Range Ordered monopoles, and photons (**Wong et al., 2018**). Since the monopoles are of DLRO, they must be in the Bose-Einstein ground state (**Wong et al, 2021**). It is this phenomenon that these monopoles are in fact the Higgs Bosons (**Higgs, 1964**). But because of the simultaneous photon existence on creation, as the monopole magnitude is composed of the direct products of e and -e opposite momenta pairs of massless e-trino, and anti-e-trino, the photons that arises from the natural breaking of the charge neutrality of the monopoles, into equal numbers of massive e and -e Dirac spinor, that obeys gauge invariance.

5.4 5-Dimensional Magnetic Monopoles and the Higgs Bosons

Unlike the photon, as when its momentum is 0, so is its energy. Thus, the photon cannot exist in the Higgs vacuum, and therefore cannot exist in the homogeneous 5D manifold. In another word, inside the 5D domain, we cannot have photons. To some this can be viewed as a "black hole" region. Meaning the concept of a "black hole" as such an infinite sink of matter cannot exist in the 5-D universe, irrespective of gravity (**Liu et al., 2019**; **Abdul- Mashi et al., 2020**). Thus, this excited angular momentum must be balanced by an equal but opposite angular momentum from the rotating masses outside the 5-D domain and in the enclosing 4-D Lorentz manifold. On the other hand, Heavy hydrogen with an extra neutron is not a Boson, *E*₀ becoming the molecular binding energy cut-off, leading to the coherent and de-coherent series for molecules studied by Schrodinger, **Geesink and Meijer, 2018** and many other physicists. It is not necessary to apply the Einstein-Kaluza-Klein compacting of the proper time to unify with electromagnetic theory, as the homogeneous Maxwell 4-D is a natural boundary of the homogeneous 5-D manifold and thus will coexist with the Lorentz 4D manifold, (**Fig.18**).



Figure 18: A: Images of DNA and RNA with "base to base" separation gaps in which a monopole boson field tunnels from one layer of nitrogenous base to the next if exceeding the wavelength of the space gaps. B: fractal picture of hexagon/pentagon model of C1. C: C12 hard-sphere dense packing model; D: Cartoon of a magnetic monopole bosonic field.

5.5 Cosmology and Torus Geometry

Going down in the C cut-off value after protons, neutrons and electrons were created, stars and planets having self-rotations and a dipolar magnetic field. Finally, on the climatic surface of a planet allows further breaks of the 3-dimension space symmetry into 2D × 1D, as gravity defines the normal axis similar to the Perelmann-Ricci Flow mapping, thus favouring formation of 2D type molecules. As represented by the *toroidal topology* (**Lu et al., 2020; Geesink, 2020**), this would then make the z axis of the toroidal an entangled variable between the B, D Bosons and a quantum spectrum, with Carbon-nitrogen molecules creating the nitrogenous bases. It is the thermal averaged excitation energy from that and the allowed quantum tunnelling of the B, D DLRO bosons along an RNA or in a closed loop in a DNA. Thus, we have the B and D eigenfunctions representing the genome spectra.

Equation 1: $E = \hbar$. $\omega_{ref.} 2^{n+p} 3^m$

E_n: Coherent Energy distribution, ω_{ref}: reference frequency 1 Hz, ħ: Reduced Planck's constant,
n: Series of numbers: 0, 0.5, 2, 4, 5, 7, 8, -1, -3, -4, -6, -7; m: series of integers: 0, 1, 2, 3, 4, 5, -1, -2, -3, -4, -5;
p: series of integers: <-4, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, > +52,

To understand **Equation (1)** let us consider a semi-conductor band, with an empty CB band separated to the filled VB band by a positive band gap. An electron can be excited from the VB into the CB. As this happens, the Coulomb binding will create an exciton, which is obviously a Bose-Einstein condensed Boson, as its center of mass has no translation motion, with quantum energy orbital levels within the band gap. These orbital levels depend on the effective masses of the electron and the hole, a property due to the crystal lattice structure. Suppose, we imposed a toroidal boundary, then it is obvious that both the excited electron and the hole closed orbits must wind around the toroidal. Pictorially we can compare such an orbital to winding a rubber band around a metal wire, then band the wire into a closed toroidal, which then gives us the expression for **Equation (1)**. The more stable the *T* value as needed for the specific life form, the better would be the DNA spectra to control the reproduction of proteins and cells in the body. With this simple mathematical estimation, we show the importance of climate change on the survival of all life forms on earth.

5.6 Building-blocks of Life

As the B, D Bose-Einstein condensed state is excited by introducing Eo/kT>0, it simultaneously created a 4D non-homogeneous Lorentz manifold through a Perelmann-Ricci-flow mapping, thereby creating a toroidal structure, thus all energy eigen-solutions due to the kinematic of the masses contain within must satisfy the toroidal boundary (**Fig.19**). This condition was suggested by **Frohlich in 1968**. It is due to such imposed boundary condition, that led Geesink and Meijer to come up with **Equation (1**). Based on this formula and for a non-charged molecule, such as water, (**Geesink and Meijer, 2018**) normalized its weight of 18 atomic mass unit as 1, and considered its spinning energy spectrum which must be proportional to its weight, satisfying **Equation (1)**, they found that there exist two other atoms/molecules that will also be coherent. They were Carbon and Hydrogen molecule. The weight ratio of Carbon to water is 2/3, while Hydrogen molecule to Water is $[1/3]^2$.

It is therefore clearly verified that the fundamental set of coherent molecules obtained via the Perelmann-Ricci-flow mapping is water, carbon, and hydrogen. This essential result recognition shows the importance of these 3 elements as the key building blocks for more complex importance bio-molecules, such as sugar, proteins and fats, and must be the building blocks in all life forms. Other coherent molecules consisted of other elements obviously can exist, but are less essential as they all satisfy higher products of the Lie group generators. A detailed list of bio-molecule EMF frequencies was provided in **Geesink and Meijer**, **2018**. The coherent biomolecular spectra span from roughly 10 Hz to 500 Hz. Because of the low energies, it contains more resolvable information than the higher frequencies, and actually coincide with our modern 5G telecommunication. In fact, the same spectra cover all the life forms DNA spectra and is used in the growth mechanism. Hence, constant exposure to such external radiation source would be harmful to the proper growth of our body. Unless there is a technological way to prevent our body exposure to the 5G telecommunication sources it should not be used. On the other hand, realizing this coherence spectra can also be applied beneficially to induce our body to counter cancerous growth. One method is targeting the cancerous growth by applying a corrective radiation through the nerve system via the technique of acupuncture. Both of these topics certainly deserve further research. It was well-known that soothing music in this audible range helps our body and mind, while exposure to decoherent noise is harmful.



Figure 19: Symmetry breaking is depicted from a 5-D homogeneous manifold to a 4-D inhomogeneous Lorentz manifold with a 4-D Maxwell boundary. The 5-D manifold, also called superfluid sub-quantum information field of condensed bosons, that reflects a musical master-code seen as frequency phase-space information. In the symmetry breaking process magnetic monopoles of a diagonal long range ordered type (left) as well as

photons/phonons are formed (right). Phonon/electron interactions can create longitudinal waves called solitons. These have been shown to provide information for proper 3-D protein folding (left below) and coherent structuring of water-molecule clusters (middle, right). Magnetic monopoles are hypothesized to guide the functional formation of DNA and RNA, in the building up of coding DNA in the nucleus of the cell (midlle below).

5.7 EMF Resonance and Life Forms

Although the coherent molecules such as water, hydrogen and carbon are essential building blocks for hydrocarbon bio matters, such as proteins, fats, muscles, bio-cells, etc., we still need a mechanism over and on top of energy to make them happen and grow so that we can get life forms. It was postulated by us (**Wong et all., 2019**) that this came about because of the matching of the DNA frequency spectra which are of DLRO as they are eigen-solutions of the B, D bosons to those of the coherent molecules, such that via formation of ODLRO in the bio-systems can such ordered matching occur. In another word, it is via a superconducting transition that the coherent molecules were assembled to form the bio cells, proteins, fats, etc. and eventually the entire life form (**Fig.19**).

The superconductivity phase transition can occur if the environmental temperature *T* is below the superconducting critical Temperature Tc. As such the life form's body temperature T must remain below the Tc's for each and every bio cell, and bio-structures within its body. But since the coherent molecules building blocks are charge neutral, all bio-structures, its electronic structure can only be semi-conductor like, with a partially filled valence band and an empty conduction band separated from the valence band with a positive band gap G. Such a band structure resembles that of the known High Temperature Cuprate Superconductors, **Wong et al., 2004; 2008**). Hence, the bio-growth mechanism is the same as that in the ceramic HTC. The DNA of a life form is composed by the stacking of two linear chain of "side by side" nitrogenous bases. Within each nitrogenous base, there are three side by side carbons, and then separated with a nitrogen on both ends, before attaching to a backbone carbon twisting chain. There are in fact 3 such distinct bases that permit the B, D bosons that might exist in the, side by side, carbon nuclear time frozen 5D cores to quantum tunnel to the adjacent level base, while there is one end cap nitrogenous base, that only allows for reflection (**Fig.19 and 20**).

Hence, a closed loop of the B, D DLRO can be formed. Because the B and D are DLRO bosons, that are in fact the magnetic monopoles, their quantum flux unit is governed by a π rotation instead of 2π , the 3 adjacent carbons within each nitrogenous base then exactly satisfy this gauge requirement. It is this topological confinement and the 3D space dimension projection into $2D \times 1D$ that must happen according to the 5D symmetry breaking we are led to the formation of these 4 nitrogenous base structures. Because of such features of the 4 nitrogenous bases, there are different stacking orders possible in the formation of the DNA of a life form. It is such distinct stacking orders that give the genome. Since each specific order stacking within the DNA contains a unique DLRO spectrum, it would induce a similarly order the choice of coherent molecules via a ODLRO phase transition of the VB holes to form the specific bio cell and its Point Group structures.

Then starting with the explicit monopoles, we show its mathematical equivalence to the Higgs Bosons. Through that established a Higgs vacuum in the time irreversible ever expanding 5-D Universe. Each step of our investigation led to other branches of scientific researches. Including the ideas of Schrodinger that Life is a fully quantum phenomena. In particular in this current paper, we try and connect the Frohlich's idea of the

coherence quantum vibration sequence in biomolecules, thus justifying the **Geesink-Meijer**, **2018** formula for the coherence biomolecules (as mentioned by **Wong and Chow**, **2021**). Perhaps of most interest is, that it did lead to the identification of water, carbon and hydrogen as the essential building blocks of all bio-materials **Geesink**, **2020**. Last but not least, **Wong et al**, **2020**, **2021**, were able to connect the Einstein's Cosmo Constant in the Gravity tensor equation to that of the energy density derived from the thermal excitation of the Higgs vacuum, a result due to entropy as postulated in the Perelmann's mappings.

5.8 The Geesink/Meijer coherent molecules

It has always been the most mysterious question to us human as to how and under what necessary conditions can life forms exist on a planet. 75 years ago, Schrodinger the physicist that initiated Quantum Mechanics postulated that 'LIFE' is also a quantum-phenomena. Yet this connection remains unanswered. While it is well known that water plays a necessary and key role. And to this day, we make it our goal to find water on other planets as our condition for hope of also finding life. More recently, **Geesink and Meijer, 2018**, successfully derived a low frequency spectra formula for bio-molecules, starting with water, as represented by a toroidal structure, such that other elements essential to life, such as oxygen, carbon, nitrogen and hydrogen can all be fitted into the same formula, dividing it into coherent and de-coherent. Because their formula fit so well to our knowledge of bio-rings, it is very interesting to investigate the Geesink coherent, de-coherent spectra formulae which is based on the molecular weight, by standardizing the water molecular weight as 1:

 $E(n,m,p) = hw(ref)2^n3^m2^p. (1)$

where w(ref) is a cell specific frequency, assuming the Debye phonon spectrum dependence on the molecular weight, and p, m are + and - integers.

n=0, 0.5, 2, 4, 5. 7, 8,-1, -3,-4,-6,-7.

the 0.5 factor comes from hydrogen atomic weight which is $1/2x(1/3)^2$ as will become clearer as we discuss the essential molecules for life: water molecular weight as 1 representing the SU(3) generators Cartan identity, together with oxygen and carbon.

m=0,1,2,3,4,5,-1,-2,-3,-4,-5.

p=<-4,-4,-3,-2,-1,0,1,2,3,4,5,6>52.

We need to start with Lie algebra and the homogenous 5-D manifold, which is given by the Fermat's sum. It is clearly proved by Perelmann that in order to obtain the 4-D inhomogeneous Lorentz manifold, where all kinematic of masses obey Special Relativity, a Ricci-Flow entropy mapping *must be enacted*, leading to the Lorentz manifold expressed in the topological shape of a toroidal. That requires the choice of an axis perpendicular to it, that can be considered as another mapping of the 4th space variable onto the time. In Lie algebra, this is the Lie Group SU(2), leaving the toroidal manifold as that of SU(3), being a conformal mapping. It is this mathematical fact that gives us the Gell-Mann standard model for all elementary particles. In terms of SU(3) generators, one then leads to the fractional Quark charges, with the hadrons governed by Lorentz Gauge invariance. In short the Cartan generators of SU(3) are given by 2/3, 2/3, -1/3 with its conjugates -2/3, -2/3 and 1/3. satisfying the Cartan sum. As suggested by **Frölich,1968** and extended by **Geesink, 2020**, all molecules with mass must also be formed then by the sum of SU(2)+SU(3) generators, and within the geometrical

toroidal. The SU(2) only gives us the leptons. As molecular weight is always positive, it must only be given in terms of the square of the Cartan generators, which itself are governed by the Cartan identity sum. Hence when **Geesink et al, 2019** selected water as the base of the identity, they in fact defined that 18 nucleon atomic weight is fixed as 1, given by: $(2/3)^2+(2/3)^2+(-1/3)^2=1$, and this is represented in the 4D Lorentz toroidal manifold.

This itself does not mean the hydrogen and oxygen in the chemical formula of water quantum state is somehow shown as a toroidal. Rather it is that if water is created out of 5-D by making a Perelmann mapping, then it is within the toroidal geometry. Following this rule, all molecules with weight expressed in terms of squares of the Cartan generators only, it's phonon spectra are considered as coherent, because they do not get out of SU(3). Should we find that we have any factor, such as $(1/2)^2$; $(1/5)^2$; $(1/7)^2$ etc, then such a molecule's phonon spectra would have to be decoherent. It is under this that we analyze the molecular weight of the nitrogenous bases in the following. Lastly, the Meijer and Geesink, 2014 phonon formula, expresses superpositions of concentric toroidals. They can be stacked or with different center void radii, one enclosing the other, etc. Such geometry are in fact common in nature as shown by galaxies, and cyclones on earth. While by investigating the phonon/photon absorption spectra of any molecule, we can also confirm whether it is coherent or decoherent and it should be able to be verified and checked by the Cartan sum rule. Asl mentioned, [SU(2)+SU(3)]xL is the only result we can get from Perelmann mapping. Then how can we have decoherent spectra? The answer is that the Perelmann mapping is an irreversible entropy mapping, thus obeys thermal conditions. As we insert this extra input, the phonon spectra for a specific molecules no longer has to be only given by SU(3), and obey the Lorentz gauge. As is obvious, if we destroy the 3D space homogeneity, into 2Dx1D, then the Lorentz gauge is replaced by the Chern-Simmons gauge, with significant eigenstates structure. See the solution in a paper in Phys. Rev. A, on the relativistic 2D hydrogen problem.

The weight of a molecule is overwhelmingly due to the constituent atomic weight, as the electrons are only of order 1/1000 of the nucleus. Thus, using the proton and neutron weight scale as 1, water has a nucleon weight of 16+2=18. Geesink proposes that water should has a topological shape of a toroidal. According to the SU(3) Cartan identity, it would be in turns of $[2/3]^2+[2/3]^2+[-1/3]^2=1$. This Cartan Sum Rule then has a geometrical structure form of a toroidal, with the tube radius represented by 1/3.

The toroidal center core radius remains arbitrary, in agreement with Geesink's topological shape. [9] We like to point out that this is in agreement with Perelmann-Ricci-flow mapping (**Perelman, 2002**), a necessary topological mapping that will create a 4D Lorentz manifold out of the 5-D homogenous manifold.

Now considering the oxygen O2 molecule, we have

[32/18]=1+7/9=1+[2/3]^2+3[1/3]^2, which is a toroidal with attachments geometry.

Hydrogen H2=2/18=[1/3]^2 is only a line geometry.

The combination water can be expressed as

 $[16/18+[1/3]^2]=[2(2/3)^2+(1/3)^2]$, which is indeed the simple SU(3) toroidal. That means it represents the realized Perelmann Ricci-flow mapping, 2Dx1D toroidal space form, we need the linear sum of the SU(3) generators.

To understand this let us investigate the Carbon 12 nucleus. On it, we have 6 protons and 6 neutrons, arranged into three hexagons and 6 equilateral triangles. According to the Gell-Mann standard model. The proton and neutron are the gauge invariant product of three quarks: namely up-up-down. and up-down-down. The up Quark has a fractional charge [2/3]e, while the down Quark is given by -[1/3]e. And 2/3, 2/3 and -1/3 forms the set of SU(3) generators. Thus, the gauge invariance restricts the linear sum of these generators to integer. Since carbon 12 nucleus is a spherical object, the gauge implied linear sum rule is applied to 3D space symmetry, and not that of the toroidal geometry (**Perelman, 2003**). None the less, on the nuclear surface, it is still a 2D, and the hexagon and triangles are and must be the mapping result similar to that suggested by **Geesink et al., 2019** for water. In fact we can go a step further, and look at the surface of the Bucky Ball. There we found on top of hexagons, we have pentagons, replacing the triangles. It is this very feature in 2D, that we find all the bio-rings are given in terms of hexagons, pentagons and triangles. There are no other geometrical shapes. Hence, the Geesink picture for water indeed should be valid.

Now consider the molecule 2[CH3], its molecular weight is

30/18= [1+(2/3)] (2), while the molecular weight of CH3 is equal to 1/2+1/3 clearly decoherent

Thus, CH3 is an essential building block of bio molecules similar to water 'plus carbon'. Of the most important and interesting bio-rings are therefore the' nitrogenous bases that makeup the RNAs and DNAs in all Life forms.

Let's look at the nitrogenous base Uracil. (see Fig. 18) for all the nitrogenous bases It contains

O2+2H2+N2+4C. Thus, its molecular weight normalized to water is

 $= \{1+(2/3)^2+3(1/3)^2\} + 2(1/3)^2 + \{1+(2/3)^2+(1/3)^2\} + 4(2/3)$

={1+2(2/3)^2+6(1/3)^2+4(2/3)}

 $=\{2+5(1/3)^2+6(2/3)^2\}=\{3+4(1/3)^2+4(2/3)^2\}=\{5+2(1/3)^2\}.$ (3)

The $2(1/3)^2$ denotes the two different attachments of either O or H to the hexagon vertices. While the 5 denotes the topological degrees of freedom from 3 vertical axis choices + 2 parities of the toroidal structure, represented by the hexagon. And a clear indication of a toroidal of tube of radius (1/3), similar to water, and is actually resulted from the covariant Carbon in the nitrogenous base. The molecular weight of carbon 2/3 can be also expressed as (2/3)^2+2(1/3)^2. Meaning it is both symmetric in structure to 3D and 2Dx1D. No other essential elements can do that. *Thus, due to this, carbon is vital to the formation of bio-rings.*

Now let us investigate the corresponding end cap nitrogenous base in the DNA, namely **Thymine**. It consists of the same hexagon ring of 4C and 2N, with the change in attachments of 2O, 2H and H3C. Comparing to Uracil, the only different is an extra H2C molecular weight.

H2C=14/18=7/9=(2/3)^2 + 3(1/3)^2. (4)

Thus the weight becomes $\{5+2(2/3)^2+(1/3)^2\}=6$ exactly. This exact factor 6 for Uracil corresponds to the 3 vertical axis, passing through the 3 adjacent Carbons in the hexagon, times the 2 up, down faces differences instead of the 2 additive parities, making it a reflecting end cap on one face, and a transmitting through the reverse side. Such a property is then vital to allow for the monopole boson fields as discussed in our recent

paper [9] to go around from one RNA side to loop around to the other RNA and thereby complete a quantum loop.

To further prove the point, let us consider another in between nitrogenous base **Cytosine**. It differs from Uracil, by missing an H, and replacing a O with NH2. Thus, we get the molecular weight as

 ${5+2(1/3)^2}-(1/3)^2/2-2(2/3)^2+2(2/3)^2={5+(3/2)(1/3)^2}={5+3(1/3)^2(1/2)}(5)$

The presents of the $(1/2)3(1/3)^2$ term shows it is a *de-coherent ring structure*, as the factor 1/2 is not a Cartan generator. While the factor 5 is the degree of freedom 3 axis and 2 parities.

Lastly let's consider the nitrogenous base **Adenine**. Compared again to cytosine, we replace O by H, and add CN2. We get

 $\{5+(1/3)(1/2)\}-2(2/3)^2+(1/3)^2(1/2)+[(2/3)+\{1+(2/3)^2+(1/3)^2\}$

={6+(1/2)(2/3)^2-(2/3)^2+(2/3)+(1/3)^2}

={6+3(1/3)^2+(2/3)^2(1/2)} (6)

The factor 6 for the toroidal degrees of freedom of Adenine as compared to the factor 5 for Uracil is the result of the single pentagon attachment, making it having the extra degree of top and bottom, while the factor $3(1/3)^2$ is the result of parity w.r.t. the 3 perpendicular axis. Again Adenine contains a *de-coherent* factor of $(2/3)^2(1/2)$ replacing the $3(1/3)^2(1/2)$ in Uracil.

In fact, the same de-coherent factor exists for the remaining nitrogenous base **Guanine**. The only difference in molecular weight is an extra O and H. Therefore, we have

 $\{6+3(1/3)^2+(2/3)^2(1/2)\}+17/18=\{6+3(1/3)^2+[5(2/3)^2+(1/3)^2](1/2)\}=\{6+3(1/3)^2+[1+3(2/3)^2](1/2)\}.$

It is vitally important to have the de-coherent factor (1/2), for the in between nitrogenous bases so that the random stacking of all the bases can change and evolve giving raise to evolution and a distinct genome spectrum for each individual life form. The de-coherent part in Guanine contains a 1, representing the present of a broken hexagon attachment to the important nitrogenous common carbon ring.

Indeed, we see that the **Geesink and Meijer**, 2019; Geesink, 2020 coherent and de coherent spectra formula appears to be valid and plays a role in the understanding of the quantum aspect of Life as suggested by Schrodinger 75 years ago Schrodinger, 1967)

The topological geometry of the nitrogenous bases does not change the quantum monopole loop spectra in the DNA, but it does provide a perturbation boundary condition effect to the DNA twisting itself, thus produces near infinite adjustment modifications possible, which in turn allows for the in coherent effect from the nitrogenous bases to induce the evolution of the life form, a very important physics that is build in for all survival of the fittest. [see chapter 12 of reference 1, for which we will not repeat here.]

5.9 Survival of Life Forms

To explain this survival of the fittest, let us consider the general structure of bio-cells. A similar creation of the bio cells structures similar to the bio-rings geometry would result is point group like structures that also obey

2Dx1D symmetry, which is similar to clay, which is mainly silicon and the High Temperature Ceramic Superconductors (**Wong and Ching, 2004**). These structures lead to Semi-conductor like band structures, with positive band gap between the VB, Valence Band and the empty CB, Conduction Band. Except that for the HTC superconductors, the VB is partially filled, due to Oxygen in the 2D ring layer structure, quite like the CuO plane in HTC ceramics, (**Ching et al., 1987**). Thus, these bio-cells are p type conductors in its normal phase, and would become superconducting at Temperature T below its superconducting transition Tc, yet still within the water phase temperature range, (**Wong and Curatolo, 2008**), As that happens, the hole state becomes Bosons with ODLRO, Off-diagonal-long-range-ordered, with specific binding gap matching to extend the DLRO of the specific eigen-energy monopole bosons within the DNA of the Life Form. This induced Long Range symmetry then provide the growth mechanism to the multiplying of the different bio-cells. The genome spectra in the DNA, thereby induces the multiplicity of the different bio-cells in the body. Similarly, the decoherent nitrogenous bases within the DNA causing the genome evolution leads to the death and rebirth with evolution of the bio-cells within the life form. Such evolution is expected to occur in all lives, from viruses to human from generation to the next, hence driving the reproduction of the life form under the survival of the fittest principle.

5.10 The RNA and DNA Spectra

As mentioned before, there are 7 independent faces from the 4 nitrogenous bases of both the RNA, and DNA from which the monopole DLRO bosons can exist linking the carbon cores within the nitrogenous 3 side by side carbon hexagon, as the back bone spirals. Because one nitrogenous base must serve as the end cap. For the RNA, this end cap serves to be the fixed boundary for the boson, while for the DNA, it serves as a reflector such that the boson wave then goes from one RNA side to the other side, making each boson wave completes a close loop. There is no requirement that the intermediate stacking of the 7 faces of the nitrogenous bases cannot be duplicated, nor can anyone be totally missing (see **Fig.18**).

10.11 Sensing and Intelligence

The monopole boson states within RNA and DNA that govern the growth and reproduction of bio cells do not provide animal life forms of its senses, intelligent and accumulation of knowledge. To realize that it is important to recognize that the DLRO monopole bosons requires the quantum tunnelling-ability from within the carbon nuclear void core to the adjacent core. But most chemical elements do not possess a void core similar to carbon 12; for example, silicon. Yet such elements, such as clay are equally created from the Perelmann Ricci-flow entropy mappings, and its molecular weight also obey the *Geesink-Jerman-Meijer* coherent and de coherent formula (**Geesink et al., 2020**). It's conducting electronic states can only be either as free electrons, such as in metals or else as insulators and semi-conductors. Only for metals in the bio-cell structures it can, in principle, be induced to form a ODLRO superconducting state. In short, there are no electron from the filled valence band into the empty conduction band of a coherent semi-conductor bio-molecule, by inducing a electric potential thus making the creation of a computer like chip circuit possible. These chips circuit existence within an animal allows the animal to build senses, that is sight, sound, smell, taste and pain, plus intelligent as well as memory. Normally this brain centre is concentrated in a enclosed bone structure called the skull.

5. 12. Conclusions this section

We briefly went through our hypothesis how Life can be created through the topological Perelmann mappings of the homogenous 5D into the non-homogenous Lorentz 4D manifold at room temperature, that is the temperature range of liquid water. And through which coherence and de-coherent molecules spectra, including the life essential elements, water, oxygen and carbon, and clays that then allows for the forming of nitrogenous bases, building up RNA and DNA, so that DLRO monopole bosons spectra can induce the ODLRO of 'p' type conducting hole states to create grow of cells and organs, while the clay structures are semiconductors, and can be organized into computer like chips, feed by conducting nerves, thus produces senses, intelligent and memory. Each segment of the DNA, appears to control the physical function properties of a spec ific body organ.

The intrinsic connection between the treated concepts of life creation are finally depicted in the comprehensive scheme below (**Fig.20**):



Figure 20: The present concept in a nutshell: The 5-D to 4-D symmetry breaking results in generation of magnetic monopoles (left above) and photons/phonons together with the essential Torus-operator for energy

guiding. Water-molecule structure exhibit torus topology and hexagonal water-clusters, containing freely moving proton atenna's are structured by interaction with discrete photo/phonon frequencies. Solitons (polarons) are longitudinal waves formed by electrons coated by phonons (quasi-particles), that promote coherent vibrations of cell components (middle right) and interact with poly-peptide chains to guide the process of 3-D folding to functional proteins (right below). In biological evolution, first life proto-cells are informed by discrete EMF waves that are generated by metal-doped phyllo-silicates (clay materials) that function as semiconducting wave transmitters and also can catalyze polymerization of nucleotides to primary RNA/DNA. DNA spatial structure with its nucleo-bases is depicted on the left below and its formation and dynamic constitution is guided by specific magnetic monopoles energies (see left part of figure). DNA exhibits a specific vibration pattern that is instrumental in cellular function and forming of a life-memory information store, that holographically steeres the holonomic cell and intercellular communication.

5. 13 "Bifurcative Self-interacting Consciousness Model".

A related consciousness model, also based on symmetry breaking, is that of **van Bovenkamp**, **2021**, called the "Bifurcative Self-interacting Consciousness Model", (**Fig.21**). He postulates that, though energy and action cannot be separated, they can be clearly distinguished. In abstract form, they constitute the very subjective faculties in a causal framework. The objective counterparts are the entropic and negentropic termini. Entropy is facilitated by the action(reduction) and advanced by energy (synthesis). Vice versa, negentropy is facilitated by energy reduction and actualized by the action (synthesis). The following text partly follows the text of the particular project as worked out on Academia.edu.

The Quantum Number_(QN) is seen as a mathematical model of consciousness. QN (1) is described by the de Broglie relation (Matter wave). QN(1..3) by the Schrödinger wave equation, and QN(1..4) by the relativistic Dirac equation. Quantum Field Theory generalizes QM with electrodynamics in the Yang Mills symmetry framework, culminating in the Higgs mechanism, giving mass to particles. If one slams all piano keys at once, it could be argued that this also includes many hidden harmonics. This is indeed what the standard Higgs mechanism is like. Likewise, it is hypothesized that a (synchronized) bifurcative self-interaction (i.e. non-linear) lies hidden in the Higgs mechanism. This not only gives mass to particles, but also facilitates quantum structure: scalar vs. vector. A scalar field is to a vector field what a high (or low) pressure area is to wind. This analogy however does not do full justice to the scalar field, because it obscures the scalar field equations as such, but from the empirical definition of the field as it acts in nature, that is, the Higgs field. The neg-entropy of the QFT is implied in the "harmonic" (or synchronous) cue, which makes the self-localizing vortex possible. More precisely, a non-trivial, hidden physical domain is created (the synchronized non-linear scalar self-interaction), in which energy is functionally cancelled out, and this makes the self-interaction effectively neg-entropic, that is, synergetic.

The question what actually brings it out is somewhat like the "Axiom of Choice" in set theory. The "selection mechanism" in this case is symmetry, and the structure created by symmetry is the Hydrogen energy levels or eigenstates, and on a more basic level the matter wave to begin with. Could quantum field bifurcation orchestrate coherence/decoherence in the brain? It is proposed that quantum field bifurcation could in fact be the principle that orchestrates "re-coherence" such as proposed by Pereira. More precisely, one would think in terms of a subtle, edge-of-equilibrium resonance between coherence and decoherence.

The realistic model of the hydro-ionic wave (**de Lima and Pereira, 2016**), shows non-trivial, stable charges in a highly complex bio-chemical environment (cortex), which tentatively could be thought of nuclei of consciousness (**Fig. 21**). Hydro-ionic waves in an excitable medium self-organize into expanding Archimedean



Figure 21: The bifurcating quantum self- interaction consciousness model of van Bovenkamp. A: shows a fourpartite relation of action at the neuronal synapse in а dynamic matrix exhibiting homeostasis/allostasis/rheostasis in the neuron-astrocyte axis, mediated by Ca2+ ions. B: Neuronal flow of energy and neuronal action project on a supposed quantum wave interference domain that provides by feed back to promote cognition. C: Bifurcation by self-interaction of waves in the manifold leads to surface resonance D: Standard de Brogly atom with coupled particle and wave aspects (left: being stabilized by action vortices).

spirals, showing properties similar to a de Broglie matter wave. The Goldstone mode, in a partially conductive medium, could together with the extra-cellular action potentials account for the actual brain waves. Hence in physics terms, the nuclei constitute least-action attractors, accounting for the non-local functionality of the network, which in turn controls the homeostasis. It forms an integral, action-centered equilibrium with (especially biologically speaking) teleonomic and symbiotic trends.

The Goldstone mode proves the symmetry breaking, or, for viable systems: the bifurcative self-interaction. In any cross-section, a spiral consists of 2 waves radiating out from the center. The latter forms a standing wave node where the phases cancel out. At the same time, cycling the center at any given radius equally constitutes a wave at the same angular rate. So, in short, bifurcation formalizes the self-referent nature of reality in the form of an integrative causal doctrine. It is hypothesized that the Golden Ratio spaced distances between the nodes forms a long-range network of non-linearly interacting standing waves - that is, each time

two waves in opposite direction. At the nodes, the phases undergo a unitary transform (Fourier) into the linear regime. This activates the spiral waves. Furthermore, integrating / averaging this pattern over its physical dimensions, generates a Goldstone mode. The reason is easily seen in the fact that the bulk of the adjacent, expanding spirals surprisingly overlap and thus annihilate simultaneously, causing a global effect. This effect is thought to be optimized by the Golden Ratio space nodal network. Bifurcative foundation of signature natural structures "the generation of feelings as an allostatic process". Yes, this properly builds the causal framework (see Fig. 21):

- Homestasis ~ Energy / also knowing principle (~Noether, Sarkar)
- Rheostasis ~ physical interactions, waves ~ entropy
- Allostasis ~ feelings, propensities ~ negentropy

H+R+A = thermodynamic cycle. ALL are controlled by the action principle (S). But only action-energy is currently employed in physics, such as E=hf. H+R+A+S = causal framework (Aristotle, Sarkar), e.g. visualized as a *tetrahedron*.

The author sees radiating as well as circular waves are *boson type phenomena*. The time- and space aspects of the self-localization are y interwoven, accounting for a complete and self-consistent phenomenal state. Starting from the formal cause, a noumenal time-like scalar bifurcates creating spin, which can be modelled as a so called "spinor" (torus isomorphic) in 3D. Thus, geometry is not generated out of dimensions, but dimensions, that is the local / global state are generated or projected out of geometry. The spiral hydro-ionic feature instead functioning as a wave guide, rather than as a wave itself, has the following advantages: purely mathematically, a log spiral r=f (e α) could excellently represent bifurcation, resp. the opposite, fusion. As there is no physical field effect such as $\alpha = e^{\omega t}$, another non-linear coupling could be in place, which is toroidal. This not only models a magnetic field, but also intrinsic spin; a hydro-ionic wave guide could process a wide spectrum of high EM frequencies such as the action potential; the magnetic moment would be robust against an external field (only not radiation such a wifi) and therefore physically viable. It could also represent a matter wave that, in principle, easily may tune in with the quantum level. A common misconception is that "quantum" is identical to "small". Yet, it is not, it means unitary, and the only quantum that exists is the quantum of action (as in the Principle of Least Action). Photons represent energy, that is not truly quantized, rather they constitute a mix of action and a continuous frequency.

"Self-localization" is no doubt a central principle in (a mathematical model of) consciousness. The term was coined in a modern setting by Kastrup, but the principle is ancient, and was also contemporarily revisited as "Cosmic Nucleus". The latter indicates that self-localization is not only a human phenomenon, but appears with every natural entity non-trivially composed of all the 5 physical elements. In an abstract approach, self-localization cannot be seen independently from a-causality and self-reference. Together they form the triplet of the integral, substantiating principle that makes a natural process self-aware. Because the term self-reference". As self-localization this process is a-causal, it means that the non-local becomes local ánd global (!) without external causes: just as for consciousness there is nothing external. In other word, self-localization is entirely autonomous, and entails the very manifestation of time-space-causality itself, from instance to instance. The specialty introduced (e.g through quantum physics) is non-locality. That is, the non-local manifesting locally is viewed as the essence of consciousness. The concept has been known in advanced

intuitional / philosophical / cultural form since ancient times. A modern day somewhat more psychological take on the same is Bernardo Kastrup's "*self-localization*". Max Velman's "reflexive monism" arguably implicates self-localization but does not actually evolve the concept. A self-referent self-localization and QFT symmetry breaking are proposed to be essentially one and the same thing.

Non-reductive physicalism is being explained as *supervenience of mental on physical states*, rather than (mere) epiphenomenalism of mental states out of physical ones. It is a way to say that mental states must be physical states, yet at the same time cannot be reduced to the latter which seems obviously somewhat inexplicable. This is easily solved if the physical state is not a physical brain in the common sense, but essentially *a non-local state*, which can be taken in the form of a local brain plus it non-trivially integrated quantum basis. In other words, *it is the quantum basis that lets the brain function as something essentially non-local, while acting locally.* If thus the physical basis of mental states is fundamentally non-local, it can safely be stated that mental states are such non-local physical states, without the need to define any distinction between them.

Bovenkamp,2020 postulates that logically, a primitive or noumenal state of consciousness must exist, because the biological organism as we know it externally, personally, and anatomically is itself an accomplishment of cognition. Without cognition, the body and any observable states, for that matter, remain potentialities. Therefore also, although consciousness is not cognition, the latter nevertheless results from an action within and out of consciousness itself. Consciousness does not do anything: Consciousness only facilitates its immanent Operative Principle. It is the latter that makes everything happen in the world of time, place and causality. "Universal Consciousness" in a scientific sense is simply the unconditional state or bearing of physical objects that are seen as fundamental. Yet, the author considers his model as far from "Idealism" and states that It's only due to the *cessation* of mind that one can perceive the notion of consciousness being fundamental. However, it is obvious that cessation of mind would immediately stop all considerations of the author.

6. The Conductive Role of Phyllosilicates and Water in the Creation of Life

6.1 The Role of Clay's in Creation of First Life

In the transition from inanimate- to animate systems in (pre)-biological evolution, clay minerals may have played a crucial role, (**Fig.22**). The current conjecture is that this was due to their structural organization leading to absorption, selection, and protection of organic biological precursor molecules, promoting the polymerization of precursor molecules to the essential macromolecules of life (**Geesink and Meijer, 2019a**). In this paper, they postulated that clay minerals may pose superconducting properties and after energization, produce discrete electromagnetic quantum oscillations that exhibit a semi-harmonic frequency pattern, and that their vibratory activity yields a guiding role in creating 3-D conformational structure of macromolecules. We hypothesize here that, through this property, clay minerals are candidate to initiate the first stages of origins of life and contain an informational quantum code. It is shown that such clay minerals are able to support quantum coherence and entanglement, as described by a proposed quantum wave equation, that was derived in our previous studies and is in line with Fröhlich's theory of long-range coherence. In our model an aspect is added, by finding an analogy between electromagnetic spectra of life molecules/cells and typical clay

materials. Each of the major classes of cellular components, such as proteins, lipids and DNA, exhibit distinct IR-spectral frequencies similar to such clay materials.

Therefore, coherent quantum wave interferences are proposed, within a frequency range from Hertz till GHz. Smectites probably act as quantum replicators and are able to copy the frequency band spectra of nucleobases, amino acids, nucleotides and biomolecules at rates of up to 80%. Consequently, such minerals can mimic the characteristic NIR, MIR and FIR wave patterns with life sustaining frequencies, including sequence information, as found earlier in cells, biomolecules and intact organisms. Minerals that show EM frequencies promoting coherence and quantum entanglement are able to mimic coherent frequency patterns of living biomolecules and cell systems at a very high rate. A future challenge lies in the further development of optimized mineral system that are able to improve the health of organisms, by stabilizing coherence of electromagnetic waves of biomolecules and cells, in condition in which they are exposed to less coherent and decoherent electromagnetic waves (**Geesink, 2007**). Considerations concerning the transition from inanimate matter to biological systems through mediation of Smectite clay minerals, indicate that this probably occurred not only through selection, protection and concentration of essential building blocks, but also via a long-distance photoactive guiding of the organization of chemical reactions of organic precursors, yielding the entangled and functional macromolecules of life that we know today.

In the latter aspect, clay related quantum processes should have played an essential role in facilitating the various steps that gave rise to first life and initiation of the first replicating cells (**Meijer et al, 2020a;b;c, 2021**). In this process, atomic resonance creates organic shapes and geometric folding of carbon containing molecules (**Geesink, 2019; Walker and Davies, 2013; Grandpierre, 2014; Tranter, 1985**).



Figure 22. Phyllosilicate clay mineral with stabilized ion/water clathrates. **A**: The metal ion-doped silicate structure exhibits platonic geometries (After G. **Sposito**). **B**: Surface structure of a clay mineral offers binding sites for negatively charged polynucleotides as assisted by positively charged metal ions. **C**: Clay a semiconductor: EMF wave function, guiding the ordering principle in life processes as an acoustic, standing wave, system, generated by transmitting exposed light to discrete EMF wave frequencies

Clays together with ordered water may have formed harmonic-like lattices resembling fluid crystals in which life can be viewed upon as a crystallized form of quantum oscillations representing the self-organized information, essential to life. Clay and water systems, assembling organic precursors, concentrating them and catalyzing their polymerization at the same time ensured the origin of organizing (active) information that we mentioned in the introduction, (**Fig.22**).

Finally, another field of research should be taken into account. As stated above, nanobacteria and similar systems, strongly resemble living organisms. Their complex multiplication indicates that they do possess the ability for processing active organized information while, at the same time, they do not possess any genetic apparatus. In spite of a low level of collective coherent frequencies; they still retain intricate organization together with a variable chemistry. This indicates that, active information essential for life, is rooted in a highly organized coherent electromagnetic pattern. Yet, it is proposed that, ab initio, typical clays like. Smectite ones, combined with organic molecules have this potential and that such conditions may even be put to experimental verification.

A second challenge is to improve superconductivity of such systems at high temperatures. Probably superconductive phenomena in superconductor materials and in life systems have common physical grounds. An earlier meta-analysis showed that the particular wave frequency patterns in superconducting materials have discrete coherent frequency bands that are very much in line with those found in biological systems. It was proposed that the spectral energy gaps of such superconducting materials can be described by an acoustic algorithm, coined the Pythagorean-biophysical principle (**Geesink and Meijer, 2019**). Known High Temperature Superconductors (HTSC's) indeed show patterns of frequencies, in which frequency ratios of 2:3 (third harmonic) are incorporated in ratios of 1:2 (fundamental frequency). In this respect, we argued that the revealed EM frequencies, either alone or in combination, may provide a means to lase superconductive materials so that they may exhibit superconductive properties at elevated critical temperature ranges.

Smectites minerals may even have a potential to pursue an effective operation at room temperature, due to the fact that energy transitions are located at 12 different frequency bands with adjacent self-similar ranges, enabling a versatile activation pattern (**Geesink, and Meijer 2019**). It would be worthwhile to focus such studies at higher Tc's positioned in THz-gaps between 4.5 and 9 meV, so that Tc in the range of 203-251 K could be realized.

Various observations highlight a potential quantum bridge between superconducting properties in physics and biological processes. A further challenge would be to design experiments that would involve interactions between clays and bioorganic molecules. For example, it might be possible to design an experimental system similar to cultivating so called nano-bacteria (bions), in which in addition to simple salts and organic substances, various typical clays could be included. This can potentially form a robust reproducing system, akin to the construction of various macro-molecules of life, that may provide a degree of complexity far greater than ordinary nano-bacteria (**Jerman, 2016**). The cell and its components are always under the influence of active wave fields of internally induced EM oscillations and are at the same time driven in concert by pilot

waves of the implicate order (the Broglie/Bohm concept). Recently, pilot-wave mechanisms were convincingly demonstrated in hydrodynamic experiments (**Bush, 2016**).

6.2 The Essential Role of Water in Life Processes

Present cosmology assumes that water was formed from hydrogen and oxygen way before the creations of solar systems and their planets. The energy that was produced in this reaction was dissipated in the abundant atmospheric dust, consisting of silicates and much of the water became associate with the dust particles to form rock-like material that later clustered to planets etc. Water, in various forms, may, therefore, played a general role as a cosmological conduit since it is present in cosmic dust in the form of metal-doped phyllosilicates that pervade the galactic spaces in the universe, and have been shown to exhibit features of electromagnetic energy transducers. In biological evolution they were potential transmitters of discrete electromagnetic frequencies that were instrumental in cosmic signalling and even in the spreading of biofriendly information. Interestingly, this cosmic communicating system can be modeled by toroidal geometry in a scale-invariant (holofractal) black hole/wormhole operator setting (Meijer and Geesink, 2017, 2018a). We may also conclude that clusters of organized water molecules in living cells provide an EMF-receptive holofractal network in which resonance patterns are evoked if exposed to experimental (external) EM-wave frequencies and vacuum fluctuations that are crucial for functional structure and ecology of living cells. Indeed, as put forward by Philip Ball (2017), water is an active matrix of life for cell and molecular biology, while Carniello et al., (2015) even considered a much wider perspective for water as the conduit of interactions for universal entanglement and excess correlations. Persinger (Persinger, 2015) reported that thixotropic effects a be shown in water in which visosity can suddenly be invreased due to frre movement of protons in the form of hydronium ions (H3O +), by which watermolecules get more intercalated and display excess correlations over very large distances. This is important aspect was confirmed in our recent studies on the importance of protons in aquous compartments in the brain that can function as receivers of quanum information (Meijer et al., 2020c; 2021, see also section 12). In this framework, we should always realize that water, also in cells, is permanently embedded in the fluctuations of the zero-point quantum vacuum field (Meijer, 2021). Our studies on the relation of the GM-biological principle on entanglement promoting EM frequencies (Geesink and Meijer, 2018b), as well as our considerations on the role of water in the creation of first life (see Fig.20) and 3-D protein folding (Meijer and Geesink, 2016, 2018b; Melkikh and Meijer, 2018; Jerman 2016, 2017), are fully in line with these concepts.

7. Quantum Aspects of Biological Evolution

7.1 3-D Protein-folding in Life Cells

According to **Wolynes (2015)**, the integral 3-D protein folding process includes random mutations, potential misfoldings/unfoldings, recombinations, and selection by successful competition with less optimal protein species, in which the protein finally obtains sufficient stability in subsequent generations of cells. As such the proteins were seen by the author as non-linear elements in cellular networks that *arise from a sort of information spaces* that, unfortunately, were not further defined. One could also question the supposed random character of this self-organizing process. In other words, how can the selection of non-functional precursors of the particular protein be envisioned? Moreover, by what physical mechanism is a specific function assigned to the particular protein? As argued by **Grandpierre (2001)**, life functions

of proteins cannot arise by chance, they can only be assigned by their host cell itself. Yet, such a cell cannot arise without these functions being already assigned and present.

7. 2 A Primordial Recipe for Life?

We propose therefore that a primordial biological principle (a register of rules) was operating, which acts as a "recipe for life" (). This type of a-priory information must have preceded the development of first life and we postulate that all known force fields, that were present from the birth of the universe, should be taken into account (see more on this aspect in **Sect. 1**). In addition, as treated before, quantum processes have probably played an essential role in facilitating the various steps that gave rise to the first life and initiation of the first replicating cells (**Meijer and Geesink, 2018b; Walker and Davies, 2013**).

According to **Melkikh et al. 2019**, the physical basis of the proposed quantum metalanguage is the collective nonlocal long-range interaction between biologically important molecules (see above). Such a collective interaction provides the evolutionary rise in information capacity of molecules, as well as that of the whole cell. The total required integral information can not only be related to overall genetic coding, the latter being orders of magnitude to low to ensure the evolutionary complexity of life. Thus, we hold that the physical basis for this is the non-local quantum field, embedding the biologically important molecules. We propose that these molecules or rather their collective wave fields are involved in the organization and work of innate life programs and that this is based on the related language programs (**Fig.23**).



Figure 23. Potential role for quantum processes in biological evolution (listed left above) and the initiation of first life, showing various essential processes. Inset on the right above depicts a Ca²⁺ channel protein with Ca²⁺- ion in a decoherence protected vibratory quantum information state. Inset right below indicate the process of parallel processing of pre-biotic life information as enabled through environmental search of various quantum

states.

The superfluid quantum/ZPE space, as treated in the present paper in **Sect. 10**, seems an excellent modality for defining the semantic basis for such an underlying metalanguage of nature. As treated above, we see the generalized process of *thinking (memorizing, memory retrieval, and perception of meaning, that determine pro-life decision making)* as essential. This seems similar to the already mentioned adjacent possible concept of **Kauffman, 2000**; **2008, 2009**, as a natural stage in the directed evolution of life. Such an evolution, in our opinion, also contains a priori *information* about the *future states of the evolving system* (see for this aspect **Sect.7**).

7.3 Genetics and Epi-genetics

At the same time, genetic and epigenetic events are, at least partly, controlled by long-range quantum forces (**Melkikh, 2017b; Melkikh and Mahecha, 2017**). We, therefore, argue that in a hidden form of force fields, this type of "thinking" existed at any stage of evolution. Such properties of living systems therefore should be implicit in describing the topological states of the universe, even before the Big Bang (in cosmology called the Big Bounce). The proposed model of the evolution of the universe **Melkikh, 2018** and the further emergence of life in it, demonstrates the great similarity of the universe with the features of an organism. Such similarity of the universe with living organisms in many respects is not accidental and suggests that the universe itself

can be considered alive.

A similar idea was previously put forward by Lovelock's Gaia concept in relation to our planet Earth. The process of bounce (scattering of the universe) seems largely deterministic (predictable). In this sense, it is in many ways similar to gene exchange between living organisms or cell division. As shown earlier. **Melkikh and Khrennikov, 2017b**, gene exchange is a largely deterministic process in which randomness plays a secondary role, and mutations seem rather controlled. The assumption that the universe was in a pure quantum state until a Big Bounce, allows us to solve the basic paradoxes of the standard cosmological model **Melkihh**, **2018**, **2020**, without any additional assumptions: the problem of the predominance of matter over antimatter (see **Sect.10**), the problem of the absence of monopoles, the problem of flatness of the universe, and the horizon problem.

7.4 Guided Structuring of Life Cells

England et al., 2008, on the basis of conventional thermodynamics, derived a mathematical formula they believe is capable to explain the capacity for creating life conditions. The formula, based on established physics (more precisely, the 2nd law of thermodynamics of entropy), indicates that when a group of atoms is driven by an external source of energy (like the sun or chemical fuel) and surrounded by a heat bath (like the ocean or atmosphere), it will often gradually restructure itself in order to dissipate increasingly more energy. This could mean that under certain conditions, matter inexorably acquires the key physical attribute associated with life. Consequently, according to this hypothesis, as particles in a system move around and interact, they will, through sheer chance, tend to adopt configurations in which the energy is spread out. Eventually, the system arrives at a state of maximum entropy called "thermodynamic equilibrium," in which energy is uniformly distributed. It is known that the phenomenon of quantum coherence, assumed to be present in prebiotic systems, may enhance photosynthesis because it

simultaneously excites two kernels in the system by the appearance of two interrelated quantum-entangled excited states [Tamulis, 2011). England et al., 2008, stated that: "Living entities are self-assembled and self-replicating wet and warm, stochasticallymoving, supramolecular systems where quantum entanglement can be continuously generated and destroyed by non-equilibrium effects in an environment where no static entanglement exists. Quantum entanglement involves the biomolecules inside one living or between other neighbouring living entities", (Fig.23).

However, a number of fundamental questions can be raised with regards to the proposed mechanism of emergence of cellular life by England et al., especially with regard to the item of self-organization:

• The present first author maintains that such an emergent process will exhibit countless potential solutions to which the evolutionary time would be insufficient to make proper choices for ones that lead to the first life (Melkikh and Meijer, 2018).

• It speaks for itself that in this manner molecules could in principle be formed that are suicidal for the overall process, as it has already been demonstrated for Eigen-quantum states would be sooner or later destroyed by parasitic autocatalytic (hyper)cycles

• The scheme of England does not take into account that a potential top-down information flux of future states can in principle operate since local quantum processes allow symmetrical time modalities (Fig.19). This item was touched upon also by Stuart Kauffman in his concept of adjacent possible concept (Kauffman, 2000).

• We postulated above that primordial information is required, and assume life to be guided by long-distance discrete EMF frequencies as a form of *partially directed* evolution (Meijer and Geesink, 2019b3, Meijer and Geesink, 2018b, Melkikh and Meijer, 2018).

8. Photon/Phonon- and Soliton-mediated Communication in Brain

8.1 The Electromagnetic Electrome of Life Structures

A few years ago (**Geesink and Meijer, 2016**) we stated: "*electro-magnetically seen, we may be living in a* "*diluted plasma*" with natural coherent quantum resonances, that can be approached by equations for standing waves". In this respect the potential role of solitons (polarons, being electrons dressed with phonons) were highlighted (**Meijer and Geesink, 2016**). Soliton waves exhibit remarkable resistance to distortions and noise interference, keeping shape and velocity even after collision with each other by which they can penetrate into materials without losing their identity. Therefore, they can function as information carriers in the entire universe, and were present at the beginning of life.

They can also be regarded as energy-informational system in whole organisms, brain and its components such as proteins, DNA and bioplasm (Adamski, 2019, Meijer and Geesink, 2018, Melkikh and Meijer, 2018). Soliton interactions with macromolecules result in self-trapping of electrons in localized soliton states. Due to these properties, they can guide protein folding and also can pass outside the brain in a sort of extra-cranial

communication (Adamski, 2019 and references therein). Phonon waves can therefore be considered as photon activity expressed as sound vibrations within a solid matrix and the physical similarity between both types of energy are described earlier (Meijer er al., 2020). Photon-like waves are permanently present in our body through resonance, since the organism is embedded in the zero-point energy field and are also generated in the brain as, so called, bio-photons.

8.2 Long range EMF guiding from ZPE

Thus, Keppler envisions discrete long-range EM frequencies, that are expressed in brain in the well-known Gamma and Theta oscillations in the brain. According to the author, such vibrations may be *related to coherent oscillations in cell water*, (see, Geesink and Meijer. 2019). These oscillations may even result in *information integration* as conceptualized by Tononi *et al*, 2008, 2015, 2016. The ZPE field (recently framed as a Superfluid Quantum Space, SFQS, Meijer et al, 2020)) is traditionally seen as the domain for quantum fluctuations of pairs of wave/particles and their antipodes (Daywitt, 2009; Setterfield, 2002). Dynamic coupling of the brain with ZPE /SFQS field modes has been proposed as a universal mechanism underlying conscious systems, (Keppler, 2016, Sbitnev, 2016), based on stable attractor dynamics by which the ZPE field/ SFQS, in fact, becomes a *substrate of consciousness* (see Fig. 24).



Figure 24: Information states, read from the Zpe field, via attractor states are reflected in Alpha, Gamma and Theta cycles of the brain EEG that are subsequently rewritten in the ZPE as memory traces (below, taken from *Keppler, 2020*).

In this framework the brain, as a resonant oscillator, extracts or rather filters a wide variety of phenomenal nuances from an all-pervasive stochastic radiation field in the form of phase-locked ZPE wave information states, that are supposedly linked with or correspond to conscious states (indicated in **Fig. 24**).

8.3 On the role of photons in cellular communication

Of note, virtual photons, that are also instrumental in the generation of van der Waals forces known from chemical binding, are produced during particle/anti-particle pair fluctuations (so-called *Dirac Sea*). Thus, photons originate from the vacuum, and are generated if dipoles in the field rotate due to interaction with moving charges in, by which a magnetic induction field is produced. In this manner, free charges perturb the vacuum by polarization. (**Daywitt, 2009**). A major problem in physics is the estimated 122 orders of magnitude difference between the energy density at the cosmological scale and that predicted by the quantum field theory at the Planck scale (the so-called" vacuum catastrophe"). Recently, **Haramein and Val Baker, (2019**), applied a generalized holographic model and found a potential solution by considering the total mass energy density in a geometry of the universe as a spherical shell. **Huang, (2013)**, approached the same item using a superfluid universe model, seen as a self- interacting complex scalar field.

Photons are intrinsically quantum objects and, by their nature, long-distance carriers of information. Annila (2016), stressed their importance in relation to consciousness. It seems clear that properties of a molecule cannot be inferred from properties of its constituent atoms alone, since they also rely on photons that couple them to their surroundings. The ultra-rapid brain responses, discussed in a previous publication (Meijer,2014), were seen as being related to photon/phonon mediated communication, in line with the findings of Bókkon, 2009, Dotta, 2013 and Persinger, 2015. Yet, in this context, the role of the earlier mentioned 4D-mental holographic domain coupled to the concept of a *universal consciousness field* (defined as the implicate order by David Bohm, 1980, 1987) should be taken into account (Meijer, 2019a). In this respect, an ZPE- stochastic electro-dynamic field as postulated by Laszlo, 2007, Keppler, 2016 and Caligiuri, 2015, should be seen as the crucial "steering" modality that mutually communicate with the *whole nervous system of the organism*, including its neuronal networks with their conscious and non-conscious aspects.

8.4 Biophotons in Brain

Neural signal communications and information processing in neural circuits play an important role in the realization of various neural functions, whereas improvement in cognitive function is driven by the need for more effective communication that requires less energy.

Combining the ultraweak biophoton imaging system with the biophoton spectral analysis device, **Wang et al., 2017 and Kumar et al., 2016,** found that glutamate-induced biophotonic activities and transmission in the brain, which has recently been demonstrated as a novel neural signal communication mechanism, present a spectral redshift from animals (in order of bullfrog, mouse, chicken, pig, and monkey, see **Fig. 25**) to humans, even up to a near-infrared wavelength (~865 nm) in the human brain. This brain property may be a key biophysical basis for explaining high intelligence in humans because biophoton spectral redshift could be a more economical and effective measure of biophotonic signal communications and information processing in the human brain



Figure 25: The theory of **Wang et al., 2017**, postulating that the measured photon energy and in particular the red-shift of glutamate induced biophotons in brain is related to species intelligence. **A**: Biophoton distribution in brain. **B**: Neuron with axon with myelin sheath consisting of white matter which shows electromagnetic vector eigenstates (after Kumar er al, 2016) **C**: Colour spectrum **D**: Photon with various energies **E**: Red shift of photon activity in various species on phylogenetic order, with humans having biophotons with the highest wavelength. Comparison of the spectral differences in wave-length in the bullfrog, mouse, chicken, pig, monkey, and human.

8.5 DNA Ocillations and Brain Function

It was previously proposed indeed that DNA itself is involved in the work of the mind directly and immediately via the network of optical fibers (**Saveley et al., 2020, Myakishev- Rempel, 2021).** The authors proposed the mechanism of signal transduction in DNA via a sequence-specific resonance between the clouds of delocalized charges in the base stack. It was computationally demonstrated that certain repetitive patterns of delocalized charge clouds were evolutionarily enriched in various genomes. Here, the authors propose that natural quantum computation in DNA in living cells is based on the tautomerization of base-pairs and involves coordinated oscillations of hydrogen-bond protons and aromatic electrons. The above mechanisms are supported by an observation that the majority of the psychoactive drugs are aromatic and the suggestion that they modify the aromaticity of DNA by binding to it, (**Fig.26**).

For genome copies to communicate via electromagnetic waves, DNA fragments should be able to resonate in a sequence-dependent manner. Although mechanical oscillations in DNA have been proposed, the authors initially reasoned that the mechanical oscillations would be damped by the viscosity of the nucleoplasm.

Instead, they propose now that there must be oscillations of delocalized charges in the nucleobase stack, which would be protected by the DNA backbone from oscillation dumping. In this model, DNA harbors vibrationally coupled oscillations of delocalized proton and electron clouds in the base stack. The fiberoptic model (**Savelyev et al. 2019;2020**) has the advantage that it minimizes data loss and crosstalk: information can be exchanged between specific locations with high specificity. These tissues involved wrap and penetrate the entire body and regulate its growth and health. It was proposed that genome copies of all cells of the body are vibrationally coupled with the signaling system of meridians in the fascia and thus are linked into a single fiberoptic network (**Savelyev et al. 2019**).

The frequencies of the waves in this network may be in the infrared and millimeter-wave range (**Savelyev et al. 2019; 2021**). Furthermore, in this model, the key oscillators serving as transmitting and receiving antennas are repetitive elements in DNA that comprise over 50% of our genome; the vibrational information is coded in positions of repetitive elements, variations within them, and in their flanking sequences; the repetitive elements work as radios by converting biomolecular information into electromagnetic wave messages and vice versa. Repetitive elements create an interference pattern of waves that is united between all cells of the organism, guides its development, and is an integral part of the work of the mind; the wave signals that are received by the DNA resonance elements are guiding the expression of genes and chromatin dynamics, (**Savelyev and Myakishev-Rempel 2019; Savelev and Myakishev-Rempel 2020**. In their paper, they further developed the aspects of this model that offer a more detailed mechanism for the link between DNA and consciousness. From the classical chemistry perspective, base-pairs oscillate between their tautomeric forms with the frequency in GHz - THz range.



Figure 26: A: Resonating base pairs of AT in the genome by quantum tunnelling; **B**: Aromtic electron rings merged in a purine stretch, a cloud of delocalized electrons is shown in yellow and proton wires in red dotted

lines; **C**: Purine and Strong codes in DNA; **D**: DNA double helix associated with a water filled groof, potentially involved in information exchange; **E**: tautomeric transition of GC 1a to GC2: Proton delocations are in blue, relocations of individual electrons are depicted in red.

From the quantum chemistry perspective, the tautomeric forms coexist in the state of quantum superposition until they are forced to make a choice in which state they exist (**Fig.26**). The choice of a tautomeric form could be forced by the background infrared irradiation, which is high in living tissues, or by an interaction with small molecules, that are in Brownian motion and constantly bump the double helix, and sometimes reach the base stack. Therefore, supercoiling of DNA may be under the control of high-frequency waves. They suggest that proton jumping coupled to the oscillation of aromaticity of purines is a natural mechanism for the ability of DNA to process information. As was illustrated in **Fig. 26**, jumping of protons causes the collapse and expansion of the wave function of the aromatic electrons of the central ring. Here, they propose that DNA, and more specifically the localization and delocalization of aromatic electrons in purines, is the mechanism for the supposed consciousness or "thinking process". Since stretches of purines are frequent in the genome, they would create antennas allowing for wireless communication between the parts of the genome and between the genome copies of all the cells in the body. Thus, the delocalized state of electrons in purine stretches would allow for organism-wide resonances and nonlocal communications that nicely produce the intuitive state of mind. Conversely, the loss of aromaticity in purine stretches would correspond to the logical way of thinking and choice making.

One peculiarity of the delocalization of charges in the base-pair shown in **Fig.26** is that it is not only electrons that are delocalized, but also protons. Quantum delocalization of protons in base-pairs is known from earlier molecular dynamic calculations Since protons are 800 times heavier than electrons, their delocalization, while less pronounced, is still real. Both protons and electrons exist in the state of delocalization, quantum superposition, and obey Heisenberg's uncertainty principle. Proton clouds are known from protein research where they are sometimes called proton wires. In this model of DNA resonance signalling, proton clouds also serve as antennas for wireless communication alongside with electron clouds. This way, there is an interplay of partially overlapping delocalized positive proton and negative electron clouds that are attracted to each other and oscillate in coordination with each other (**Savelyev and Myakishev-Rempel, 2019).** Their oscillations would only partly overlap in frequency, since protons are 800 times heavier than electrons. Consider also that oscillations of delocalized charge clouds spanning multiple base-pairs will be affected by the tautomeric transitions at each base-pair. This simplified model gives us a glimpse into the sophisticated machinery and the authors suggest that these mechanisms may underly the intuitive and logical thinking processes in our DNA and in our minds.

Another way in which aromaticity oscillations can affect biochemistry is via electromagnetic oscillations. Charge oscillations that were suggested by the author's, occur in electron and proton clouds spanning multiple bases can add together and their lower harmonics in the MHz-GHz range can induce ultrasound waves in the nucleoplasm. The frequency of 214 MHz corresponds to the sound wavelength of 7 um, the size of the nucleus. 750 GHz corresponds to the sound wavelength of 2nm, the diameter of the double helix. Since DNA comprises a large part (about 1.5% of the nucleus mass) its harmonized oscillations could create moving sound interference patterns within the nucleus. This is compatible to the ideas of cymatics, according to which moving sound patterns in tissues are responsible for structuring of the organism and driving organized motility of cellular components and proteins, reviewed in references (**Meijer and Geesink, 2016; Meijer et al. 2020 a;b;c;d**). In this way the genome could move itself using cymatic propulsion and control

the movements of proteins inside the nucleus. Thus, according to this model, DNA serves as an interface between the chemical and vibrational signalling. As they previously published, base-pairs are likely bound by delocalized proton wires composed of longitudinal hydrogen bonds (**Savelyev and Myakishev-Rempel, 2020**), which could also synchronize aromaticity.

The delocalized state of aromatic electrons and protons in biological systems is described by Schrödinger's wave function. Here, the authors proposed the same for the aromaticity in DNA. In this process, base-pairs oscillate between their aromatic and nonaromatic tautomeric forms, **Fig. 26.** According to the model, this takes place in each of the 6.4 billion purines in the cell. This number can be multiplied by 80 billion neurons in the brain or up to 30 trillion cells of our body considering that not only brain neurons are involved in the thinking process. As they proposed previously (**Savelyev et al., 2019**), the genomes of the body located in the nuclei are informationally coupled into one fiberoptic network and thus all DNA and microtubules of the body are united into one thinking network.

8.6 Decoherence and Nonlocality

Understanding of *decoherence* is one of the key developments in the quantum mechanics of recent decades (**Ball, 2018**). This concept allows modelling the biological processes in mesoscopic scale - the scale of DNA. When purines transition into their aromatic forms, their pi electrons are united into an aromatic ring and delocalize. This results in the quantum entanglement of these electrons and increases the coherence of their union. The loss of aromaticity could be caused when the base stack is bumped by the water molecules or infrared photons and is accompanied by localization (or de-delocalization) of electrons of the aromatic ring, loss of coherence and collapse of Schrödinger's wave function. Thus, purines may oscillate between two worlds - that is, between the quantum world of coherence and delocalization and the macroscopic world of decoherence and localization. The quantum delocalized coherent state occurs spontaneously whenever the electrons are left to themselves, which is possible because purines are protected from the outer nucleoplasm by the highly charged backbone of DNA. This way, oscillations of aromaticity in DNA provide an interface between the quantum world and the macroscopic world. DNA can be considered a natural quantum communication matrix.

Nonlocality, or Einstein's "spooky action at a distance", is a quantum world phenomenon arising from the entanglement of elementary particles. Entanglement and nonlocality were demonstrated in experiments with electrons and photons. Although DNA, being of mesoscopic scale, is a few orders of magnitude larger than particles for which quantum effects were demonstrated, it still retains some of the properties of the microscopic world: delocalization of electrons in aromatic rings of purines is well known and delocalization of protons in hydrogen bonds has also been shown. Another quantum property in DNA is known from the experiments on its electrical conductivity. It was experimentally shown that, in short tandem DNA repeats, electrons tunnel (same as jump or hop) through more than one base (Lewis et al., 2002). Nonlocality, or action at a distance, was also experimentally studied in biology. Sheldrake proposed that a substantial part of the human consciousness is located outside of the body in a nonlocal "morphic field (Sheldrake, 2009). To expand this, they suggest that oscillations of aromaticity in stretches of DNA could serve as an interface between the local macroscopic world and the nonlocal "morphic field" governed by the laws of quantum physics. This nonlocality would also correspond to Bohm's implicate order of the De Broglie–Bohm interpretation of quantum mechanics (Bohm, 1980). Sheldrake also convincingly argues that the work of the mind is not limited to the brain and the rest of the body is involved in the work of the mind (Sheldrake 2009).

For example, there are documented cases in which organ transplants transferred memories and character traits of transplant donors to recipients (Sheldrake, 2009; Pearsall, Schwartz, and Russek, 2002; Joshi, 2011; Liester, 2020).

8.7 The Genome Seen as a Quantum Computer

It has been previously proposed that the genome works as a quantum computer (**Richard, Miller and Webb, 1973; Gariaev et al,. 2001; Pitkänen, 2010**) and the authors adding a specific mechanism for quantum computation. The aromaticity oscillations are coordinated in stretches of DNA and are coupled to the oscillations of delocalized protons. Sequence-specificity of the patterns of the electron and proton clouds allows the DNA code to directly define the oscillations and thus serve as a program for the quantum computer.

Bidirectional communication between the brain and such an extended mental workspace was proposed to occur by toroidal integration of the above-mentioned information spectrum in both the physical and mental domains (Meijer and Geesink, 2017, see Fig. 27, below). Thus, such a mutual communication process is seen as being instrumented by magnetic flux and photon/phonon/soliton mediated wave resonance and/or phase conjugation, between the proposed mental workspace and the associated neuronal/cavity landscape of the material brain. It is of considerable interest that Alzheimer models showing memory loss in the hippocampus area, can be reactivated by photonic pulses into the corresponding cortical cells, using the technique of optogenetics. This procedure results in restoration of the retrieval of the particular lost information from the engram cells, likely due to formation of new dendritic connections and related protein synthesis, possibly via light sensitive proteins called channel rhodopsins, (Tonegawa *et al*, 2015). This technique may mimic the supposed photonic communication from the 4-D mental workspace as proposed in the present paper.

9. The Holofractal Event Horizon Brain Concept

9.1 Holographic and toroidal workspace in brain

It was postulated earlier (**Meijer and Geesink, 2017**), that consciousness in the entire universe arises through, scale invariant, nested toroidal coupling of various energy fields, that may include quantum error correction. Such a toroidal process may cause the coupling of gravitational, dark energy, and zero-point energy fields, as well as that of earth magnetic fields (**Fig.27**).

Through the supposed field-receptive workspace wave information may be transmitted into brain tissue, that thereby becomes instrumental in high-speed conscious and sub-conscious information processing. We proposed that the latter crucial process generates self-consciousness and is conceived to be operating from a 4th spatial dimension (hyper-sphere) modeled (including time) as a 5-D holographic event horizon (**Fig. 27**). As treated before, the torus is envisioned as a basic unit (operator) of energy flow in space-time, among others collecting the array of discrete GM-frequencies that in concert represent an algorithm for coherent life processes. The evolutionary essence of such a field-receptive holographic memory workspace for proper function of the chaotic brain is immediately evident if we realize that for immediate action of a life organism the brain selects those representation of related past and future events that generates a minimum of surprise in relation to survival. This implies that such representations require a permanent quality control of present state of art of the individual, that can lead to a reliable actualized reference framework as a sort of integral

personal double. The self-referential character and event horizon providing aspect of toroidal geometry offers an adequate operator for the combination of such processes, (see **Fig 45**, see later).



Figure 27. Modeling of brain/mind relation in a 5-D (4+)1-dimensional space-time framework (4+1 implies 4 spatial dimensions and one single dimension of time, on the basis of energy trajectories in a nested toroidal geometry. The opposing forces of Dark energy (diverging force) and Gravity (converging force) as well as discrete wave frequencies of electromagnetic fields, are instrumental in the generation and compression of individual life information. The human brain may receive quantum wave information directly derived from the Planck space-time level (left above) through quantum gravity mediated wave reduction, as well as through resonance with the ZPE field (right above). Our brain can perceive only 3+1 dimensions with the one-directional arrow of time. The material brain and its 4+1-D supervening field-receptive mental workspace should be seen as an integral whole, until bodily death of the organism. Only a 4th spatial dimension allows individual selfconsciousness, since an extra degree of freedom is required for self-observation and reflection, while in the 5-D mental context the time dimension is symmetrical, allowing to integrate past and future- anticipating events. The 4th spatial dimensions is also assumed to accommodate the bidirectional flow of information between the domains of self-consciousness and universal consciousness. The bottom-up information flow from the Planck scale, combined with top-down information conjugation from the ZPE field, constitutes the event horizon of the brain, also integrating gravitational and dark energy related force fields, supervening the physical brain. Event horizons of the brain and the whole body are depicted in the red ellipse and circle respectively.

Henderson, 2021, made clear that for an *action-perception loop in brain*, neurons decipher information from action potentials, within their own action frame, thereby inducing an internal change to that particular information (Buzsaki, 2019). This implies, in principle, that the action of deciphering information from neuronal

ensembles, is also the action of encoding it's own biased representation of that information. Information in the brain, thus, seems not an objective physical attribute, but rather, a construct of the brains association between developing internal states. Consequently, the mind can surmise what something is not because of what it is, and what something is because of what it is not. Since the mind will always doubt the explanation of its own programs, the mind is *computationally irreducible*, which asserts that a given program cannot be shortcut into maximally basic components. As oscillating activity between neurons increases in complexity, the brain engages in more self organized activity through internal feedback loops, and disengages more from its sensory inputs. These internal feedback loops allow the brain to "predict the consequences of its actions based on prior experiences in similar situations" (Buzsaki, 2019). When the brain disengages from inputs, it can "create an internalized virtual world" (visual-spatial map) and new knowledge through vicarious or imagined experience, tested against pre-existing and stored knowledge. We see our concept of the 5-D event horizon brain with its projected memory as a physically based modality for such a virtual personal double, by which the brain not only becomes an information handling computer but rather a creative operator that provides a high quality (helicopter) view of the personal state. In addition, the potential to communicate with the various information fields, in which all life beings are embedded (ZPE attractors, Sub-quantum field with pro-active and time-less information), this clearly opens trajectories to a spectrum of Psi-phenomena as well as to the crucial participation in a cosmic (universal) consciousness.



Figure 28: ZPE- wave activity in brain, represented as virtual particles undergoing Casimir type of squeezing in synaptic clefts and other cavities into real wave/particles that can take the form of Solitons (phonon-dressed electrons) that introduce ultra-rapid flow and/or Dark particles (either Tachyons or Majorana wave/particles) that imply time reversed information flow in a 4+1 spatial workspace, that can be modelled by toroidal geometry reflecting repulsive versus attractive energy (Dark Energy/Gravity, (see **Meijer and Geesink, 2017).**

The importance of the concept of the universe as a *cosmic hologram* has been earlier reviewed in a comprehensive study of **Currivan, 2017**, and was recently nicely reviewed by **Lefferts, 2019**. It was physically described in more detail by **St. John, 2018** and related to a fractal 5-D holo-fractal structure by **Linden, 2008**. In the brain, the proposed holographic workspace collects active information in its "brain- event horizon", thereby producing an internal and fully integral model of the self. This brain-supervening workspace is equipped to convert integrated coherent wave energies into attractor type/standing waves that guide the related cortical template to a higher coordination of reflection and action as well as promotes the network synchronicity, as required for conscious states.

In relation to its scale-invariant global character, extensive support was found for a universal (cosmic) information matrix (**Meijer**, **2019**). The presence of such a field-receptive resonant workspace may therefore provide an interpretation framework for widely reported, but poorly understood transpersonal conscious states (**Meijer and Geesink**, **2017**, see next section) and also for an algorithmic origin of life (**Meijer and Geesink**, **2018**; **Welker and Davies**, **2013**).

In the connection with the all-pervading *zero-point energy wave field (ZPE)*, real particles may be produced in the brain by a Casimir-like effect at the interspace of the neuronal synapse (cleft), acting as a cavity with proper dimension (**Fig.28**). In this process solitonic wave/particles may be formed, related to an ultra-rapid information flux related to forward time that can influence protein folding and many other macromolecular perturbations involved in short-term memory storage. Alternatively, other type of particles could be born in this quantum process such as hypothetical tachyons, that are supposed to operate in a time-reversed manner, thereby allowing retro-causation and subliminal effects of clairvoyance and other Psi phenomena. In general, the manifestation of a universal consciousness points out the deep connection of mankind with the cosmos and our major responsibility for the future of our planet.

The striking similarity with the 3-D brain as a "personal universe" (**Meijer and Korf, 2014**), implies a symmetry breaking as a dominant feature of reality. In this respect, it was put forward earlier that an anti-matter-mirror universe, associated with the universe we experience, can directly be derived from Einstein's relativity theory on the basis of a re-interpretation of the Klein-Gordon equation (**Meijer et al, 2020**), as performed by the famous Italian mathematician Fantappié (see **Galloni, 2012, Chiatti, 2007**).

10. Hydrodynamic Mechanisms from a Superfluid Quantum Space Beyond the Planck Scale

10.1 Introduction

There is recent evidence that a domain outside known space-time could be constituted by a spin-liquid network (Levin and Wen, 2004), later pictured as a homogeneous boson condensate, also coined as an amplituhedron guided force field (Arkani-Hamid et al, 2013, Merali, 2017). This underlying domain, contains information expressed in mathematical and geometric wave relations and was theoretically approached as a mathematical operation through transformation into twistor space. By some this information space is called a *frequency domain*, that may remind us of the earlier mentioned Bohmian pilot waves (Geesink and Meijer, 2018 c). Such a pilot wave- frequency domain could contain a primordial recipe for the representation of neg-

entropic information that may have led to the constitution of first life and also may act as a proper information space for the maintenance of present life.

Experimental support for a deeper information dimension beyond local space-time was found by **Megedish et al., 2013**, demonstrating that if one photon belonging to a pair of entangled photons is destroyed, entanglement between a newly created photon with similar features and the no longer existing photon can be detected, while these two photons never co-existed, indicative for an information domain beyond our local 3D- space time in which information of the destroyed photon is somehow stored. Thus, in this vision, material particles in general should be seen as excitations of an underlying non-material matrix that behave as vortices or perhaps as tori in a 4-D setting, also producing quasi-particles such as polarons/solitons (**Meijer and Geesink, 2018**). A deeper (geometric) information domain was also implied in the book on "Our Mathematical Universe" by **Tegmark, 2008** (discussed by **Butterfield, 2014**).

10.2 Zero-point Energy Field and Interactions with Life Organism and Brain

The vacuum is filled with scalar fields that serve as order parameters for superfluidity, being quantum phase coherent over macroscopic distances. Superfluid quantum space (SFQS) concepts have been developed by **Fedi, 2016**, and **Sbitnev, 2017** and recently reviewed by **Fell and Sbitnev, 2017**, in the framework of plasma physics. A hypothesis has been formulated, according to which, space is a quantum superfluid and fermions absorb space's quanta (SQ), generating an attractive force, which corresponds to gravity. According to **Fedi, 2016**, the mechanism of absorption is based on the description of fermions as vortices in a superfluid quantum space (SFQS), similarly to nano-vortices occurring in superfluid helium-4, i.e. as dynamic topological defects of SFQS. To compensate this absorption, emission of virtual photons would occur, capable of explaining the existence of charged particles (for a tentative representation see **Fig.29**)



Figure 29: Cartoons depicting features of the superfluid quantum space

Superfluid quantum space theory (**SFQS-T**), sometimes known as the BEC vacuum theory, is an approach in theoretical physics and quantum mechanics where the fundamental physical vacuum (non-removable background) is viewed as superfluid or as a Bose–Einstein condensate (BEC). An ultimate goal of this approach is to develop scientific models that unify quantum mechanics (describing three of the four known fundamental interactions) with gravity, making this theory a candidate for defining of quantum gravity and describing all known interactions in the Universe, at both microscopic and astronomic scales, as different manifestations of the same entity, superfluid vacuum.

Thus, SFQS-T has its own idea of the fundamental mass generation mechanism, elementary particles acquire mass due to the interaction with the vacuum condensate, similarly to the gap generation mechanism in superconductors or super-fluids. Consequently, the Higgs boson, would be a by-product of the fundamental mass generation phenomenon rather than its cause. In this model the physical vacuum is conjectured to be strongly-correlated quantum Bose liquid, whose ground-state wavefunction is described by the logarithmic Schrödinger equation. It was shown that the relativistic gravitational interaction arises as the small-amplitude collective excitation mode, whereas relativistic elementary particles can be described by the particle-like modes in the limit of low energies and momenta.

10.3 The Superfluid Quantum Space

In this model the physical vacuum is conjectured to be strongly-correlated quantum Bose liquid, whose ground-state wavefunction is described by the logarithmic Schrödinger equation. It was shown that the relativistic gravitational interaction arises as a small-amplitude collective excitation mode, whereas relativistic elementary particles can be described by the particle-like modes in the limit of low energies and momenta. As regards EPR-type experiments, observer and observed phenomena exist only in space which originates from a fundamental quantum vacuum, which is an immediate medium of quantum entanglement. Fedi, 2016 has developed a model of the vacuum as a shear-thickening (dilatant) fluid (the Newtonian fluid, see Fig. 29). In his model relativistic energy of the proton can be seen as accelerated proton thickens the vacuum ahead of it (Fig. 30). Important is that both models see the relativistic energy of the proton as the energy of the vacuum which is absorbed or is thickening ahead of the proton. Proton does not gain its relativistic energy because of the motion in an empty space. Proton relativistic energy is vacuum energy which is interacting with the proton due to its motion in a vacuum. Some theoretical research speculates the vacuum might be a four-dimensional reality: 'It is a general trend in modern theoretical physics to consider extended objects, like strings and membranes. Usually, one applies these ideas to hypothetical, high-dimensional completions of the four-dimensional world. However, lower-dimensional structures might also exist in four dimensions.

There is accumulating evidence obtained within the lattice QCD that there are lower dimensions objects percolating through the vacuum described in the four-dimensional Yang–Mills theories. Some other researchers predict the vacuum could be reality with a 4th spatial dimensional. If the vacuum actually is four dimensional, we cannot apply a classical understanding of vacuum density, which works only in the three-dimensional domain. The superfluid quantum vacuum model with the variable density led to the development of the electromagnetic quantum vacuum model (QED), which is one of the most successful theories. With giving electromagnetic vacuum variable density, we can describe Higgs potential and also the origin of gravity. The perspective of further research on the variable density of vacuum is to integrate QED with the Higgs mechanism model and quantum gravity model. Recent research of **Sbitnev**, **2017**, (see **section 10)**, on the hydrodynamics of the physical vacuum, opens new perspective in which elementary subatomic particles could
be seen as the vacuum vortices. In Sbitnev model the vortex is periodically exchanging energy with the vacuum via vacuum fluctuations.

According to the brain model presented in this section, a given vortex is in active relation with the vacuum. When accelerated the vortex is "dragging" with the vacuum and absorbing some of its energy which is its relativistic energy. Considering that vacuum is 4-dimensional, consequently, the proton is 4-dimensional vacuum vortex. It follows that we are limited in the proton observation with the 3-dimensional apparatuses and 3-dimensional sensorial sense (sight). Taking into account that atom is three dimensional, the subatomic world could be four and more dimensional. We have to be aware that higher dimensionality of the subatomic world may also represents the limitation of our scientific endeavour.



Figure 30. A: Steady vortex avenue confined by transfer flow with a dipole source inside and a uniform background flow outside. Yellow streamlines outside of the vortex area represent possible Bohmian trajectories B: Transformations of torus shown in (a) to the tori when the radius b tends to the radius a, or to the double surface sphere shown in (b) when the radius b tends to zero. Pilot waves of Bohm can be envisioned as motion of vortices guiding a particle along the optimal trajectory, in which the torus bears a wave pattern that accommodates all the information about the environment by reflection and therefore can fully simulate the particle until its final destination.

The exchange of SQ occurring between two adjacent vortices would, moreover, justifies the strong interaction leading to the complete unification of the four fundamental forces. The reasons for considering fermions and other particles as superfluid vortices of SQ are several. One could, for instance, explain the appearance of particle-antiparticle pairs from quantum vacuum as a perturbative phenomenon analogous to that described in a so-called Kármán vortex street, where pairs formed by a right- and a left-handed vortex occur due to a perturbation of the flow. In our case the flow may be represented by the gravitational field and the disturbance by other particles or stochastic perturbations of SFQS. The trigger to the formation of vortex-antivortex pairs in the fluid quantum space, corresponding to matter and antimatter within our analogy, might be a phase transition similar to the fluid vortices providing a new basis to describe the wave equations of fundamental fermions. In this direction, Sbitnev (Sbitnev, 2012-2017) considers quantum vacuum as a superfluid and applies quantum considerations to Navier-Stokes equations.

Sbitnev describes vortex objects (vortex balls) that, unlike Hill's spherical vortices, show intersected streamlines (Fig. 30) and satisfactorily reproduce fermions' spin by varying their orientation at each revolution. When a photon is described as a phonon in SFQS, the energy it carries would be justified within the quantum phenomenon of second sound, occurring in this case in SFQS.

Conclusion: the physical definition of SFQS and ZPE field are closely related, yet it should be realized that the ZPE concept mainly reflects the frequency of quantum fluctuations of the field, while the superfluid quantum space defines the total overall dynamic field structure that may underlie the fabric of reality in which also our world in embedded.

11. Does the Brain Exhibits Two Different Mechanisms for Information Transfer?

11.1 Introduction

In the following section we will pay attention to question how our brain may communicate with cosmic fields such Zero-point energy/ Superfluid quantum space, as previously treated in **section 7.1.** We argue that consciousness is partly *received* from quantum wave information derived from these fields in a bi-directional interaction with our organism and here we address the potential physical mechanisms involved. This implies that we should identify the potential field receptive medium in and around brain tissue, according to quantum mechanical principles. This serves two major problems in current understanding in neurology and brain physiology: the origin of so-called qualia and the supposed broadcasting functions of neural networks that may explain the binding of distant brain nuclei (**Baars et al., 2013**). The assumed broadcasting mechanism should afford an instantaneous integration of the various sensory input that underlies our integral observation of the world around us. However, the physiological or biophysical process responsible for such broadcasting has not been identified until now, although a field type of mechanism seems plausible.

11.2 Optical Communication Through Photons in Brain

In recent studies experiments were focused on the question whether biophotons could serve as a supplementary information carrier in the brain in addition to the well-established electro-chemical signals. Biophotons are the quanta of light spanning the near-UV to near-IR frequency range. They are produced mostly by electronically excited molecular species in a variety of oxidative metabolic processes in cells. They may also play a role in cell- to- cell communication, **Fells**, **2009**, and have been observed in many organisms, including humans, and in different parts of the body, including the brain (**Tang and Dai**, **2014**). Photons in the brain could serve as ideal candidates for information transfer. They travel tens of millions of times faster than a typical electrical neural signal and are not prone to thermal noise at body temperature owing to their relatively high energies. It is conceivable that evolution might have found a way to utilize these precious high-energy resources for information transfer, even if they were just the by–products of metabolism to begin with. Most of the required molecular machinery seems to exist in living cells such as neurons. Mitochondrial respiration or lipid oxidation could serve as sources, and centrosomes or chromophores in the mitochondria could serve as detectors.

However, one crucial element for optical communication is not well established, namely the existence of physical links to connect all of these spatially separated agents in a selective way. The only viable way to achieve targeted optical communication in the dense and (seemingly) disordered brain environment is for the photons to travel in waveguides. Mitochondria and microtubules in neurons have been hypothesized to serve as waveguides (Thar et al, 2004; Rahnama et al., 2011; Scholkman, 2016.) However, these structures are too small and inhomogeneous to guide light efficiently over significant distances. Therefore, several authors propose myelinated axons as potential biophoton waveguides in the brain, (see later). The potential role of quantum effects in biological systems is currently being investigated in several areas, including

olfaction Turin, 1996; Franco et al., 2011, avian magnetoreception Ritz et al., 2000; Hiscock et al., 2016, and photosynthesis Engel et al, 2007; Romero et al., 2014.

There is also growing speculation about the role of fundamental quantum features such as superposition and entanglement in certain higher- level brain functions (Wang et al., 2016; Hameroff and Penrose, 2014; Fisher, 2015). Of particular relevance is the "binding problem" of consciousness, which questions how a single integrated experience arises from the activities of individual molecules in billions of neurons. The answer to this question might be provided by quantum entanglement, where the whole is more than the sum of its parts in a well-defined physical and mathematical sense. The main challenge in envisioning a "quantum brain" is environmental decoherence, which destroys quantum effects very rapidly at room temperature for most physical degrees of freedom (Tegmark, 2000). However, nuclear spins can have coherence times of tens of milliseconds in the brain (Warren et al., 1998), and much longer times are imaginable (Fisher, 2015). Long-lived nuclear spin entanglement has also been demonstrated in other condensed-matter systems at room temperature. A recent proposal on "quantum information, which is very slow. In contrast, photons are well suited for transmitting quantum information over long distances, which is why currently envisioned man-made quantum networks rely on optical communication channels (typically optical fibers) between spins.

If photons are to serve as quantum communication links between nuclear spins, one also needs to explain how the photons and spins would interface with each other. Researchers in spin chemistry have discovered various ways in which electron and even nuclear spins can influence chemical reactions, which can also involve photons. A well-known biological example is provided by cryptochrome proteins, which can be activated by light to produce a pair of radicals with correlated electronic spins, which are suspected to be involved in bird magneto-reception (the ability to perceive magnetic fields (**Niessner et al., 2017**) Recent theoretical work suggests that interactions between electron and nuclear spins in cryptochromes are important for explaining the precision of the magnetoreception. Cryptochromes are found in the eyes of mammals too (including humans), and they are also magneto-sensitive at the molecular level (**Foley et al.,2011**). Similar proteins, if present in the inner brain regions, might act as an interface between biophotons and nuclear spins. In order to connect individual quantum communication links to form a larger quantum network (allowing for the creation of entanglement between many distant spins), the nuclear spins interfacing with different axons would have to interact coherently, which might require close contact, (**Fisher, 2015**, see also **Fig. 37**).

The existence of synaptic junctions between individual axons is particularly interesting in this context. Concerning the potential relevance of (classical or quantum) optical communication between neurons for consciousness and the binding problem, an interesting anatomical question would be whether brain regions that have been implicated in consciousness (Koch et al.,2016), such as the claustrum Koubeissi et a., 2014, the thalamus, hypothalamus and amygdale (Loewenstein, 2013), or a recently identified "hot zone" in the posterior cerebral cortex, have myelinated axons with sufficient diameter to allow light guidance. From a medical perspective, an active role of the myelin sheath as an optical waveguide, in addition to the conventional role as an insulating layer, might also enable us to understand the causes of the diseases associated with it (e.g. multiple sclerosis), better and help conceive and design subsequent treatments. Given the potential advantages of optical communication, one might wonder why evolution did not shift exclusively to this modality. Did evolution reach a local optimum of some kind? If optical communication along

myelinated axons is indeed a reality, this would reveal a whole new aspect of the brain, with potential impacts on many fundamental questions in neuroscience.

11.3 Role of Myelin and White Matter as Photon Lightguides in Brain

Efficient light guidance seems necessary for both classical and quantum optical networks in the brain. Is this possible in myelinated axons with all their "imperfections from a waveguide perspective? Axons are tightly wrapped by a lamellar structure called the myelin sheath, which has a higher refractive index than both the inside of the axon and the interstitial fluid outside. This compact sheath could therefore also serve as a waveguide, in addition to increasing the propagation speed of an action potential (via saltatory conduction) based on its insulating property. There is some indirect experimental evidence for light conduction by axons **(Tang and Dai, 2014; Sun et al., 2010)**, including the observation of increased transmission along the axes of the white matter tracts, which consist of myelinated axons. Myelin is formed inthe central nervous system (CNS) by a kind of glia cell called oligodendrocyte. Interestingly, certain glia cells, known as Müller cells, have been shown to guide light in mammalian eyes. An interesting feature of photonic communication channels is that they can transmit quantum information as well.

Kumar et al., 2016, have developed a detailed theoretical model of light guidance in axons, although the source of photons remained controversial These authors have shown that light conduction in a myelinated axon is possible even with realistic imperfections Several other studies with regard to the possible role of photons in neural communication provided evidence of the transfer of photons through myelinated axons. Neural communication represents one of the most complex functions of biological systems.

The presence of photons during neural activity was experimentally demonstrated by optical detection and more recently by a technique of in situ biophoton autography, based on the principle that ionic Ag+ in solution precipitates as insoluble Ag granules when exposed to light (**Sun et al.,2010**). Recent studies have put forward possible explanations of such experimental evidence. **Liu et al.,2019**, **also** reported myelin sheath as a way for dramatic speed enhancement of signal propagation in nerves in the THz-infrared range. **Xu et al., 2018**, mimicked the myelin sheath structure in myelinated axons. They showed a clear confinement effect for the energy flux of transmitting electromagnetic waves inside a dielectric tube, strongly supporting the model of soft material waveguide. **Xiang, et al.,2020**, reported a primary model of THz and far-infrared signal generation and conduction in neuron systems. **Song et al., 2020**, reported relatively strong coupling of the mid-infrared photon with the vibrons of phospholipid tails in the myelin. They proposed that cell vibron polariton in myelin sheaths may provide a promising way for superefficient consumption of extra-weak bioenergy and even directly serve for quantum information.

However, the question of the *source of the radiation* arose. Recently the group of **Zangari et al., 2018**, described a model in which electromagnetic waves, in the infrared and optical wavelength range, would be generated at the node of Ranvier, where the sodium currents would behave as an array of emitting nanoantennas. Aim of this study was to investigate the possibility that light-induced reduction of silver occurs in the node of Ranvier, during electrical stimulation of a peripheral nerve. In this study, indeed, photons in the node of Ranvier were experimentally detected by Ag+ photoreduction measurement These results indicated that in association to the action potential a photonic radiation takes place in the node.

11.4 Other Mechanisms for Non-synaptic Neuron Signalling

Non-synaptic long-range physical signaling in neurosystems* Direct signal connections between brain cells via gap junctions Extra-synaptic chemical volume signal transmission Neurons form structural, long range connected neuronal networks Non-neuronal cells (glial cells) are involved in Ca2+- flux signaling Brain exhibits dynamic criticality induced phase transitions Direct information processing by axons and dendrites Signaling via membrane nanotubes and extracellular vesicles Internal generation of EM fields and/or reception of external EMF signals EMF facilitated ephaptic coupling between brain cells Braincells have resonant properties with freq.-dependent excitability Membrane potential resonance by stochastic resonance and noise level Endogenous EMF produce feedback loops with bidirectional causality Electromagnetic fields form global, spatiotemporal, interference patterns EMF mediated effect on synaptic transmission via QM-tunneling Electromagnetic fields modulate the protein-ligand recognition EMF solitons modulate 3-D protein folding and memory storage Magnetite (Fe3O4) particles mediate EM signaling in the brain EM wave coherence yields wave collapse in microtubuli / mitochondria Harmonic EM resonance induces patterns of EEG rythm * Scholkmann, Journal of Integrative Neuroscience · May 2015

Table 1: Potential mechanisms for non-synaptic long-range physical signalling in brain

Signalling between cells and organs, either by proximity or across a distance, is essentially accomplished through a multitude of biochemical mechanisms. Although such communication mechanisms are ubiquitous in cellular systems, including nervous system, what trivially characterizes nervous cell is that its function is communication itself. Key features of neurotransmission are speed, synchrony and the amount of information transfer. An explanation of such properties may require a form of energy transfer emerging from, but not limited to, molecular contact and interaction. The fundamental theory formulated by Hodgkin and Huxley explained the basic mechanism of neurotransmission by a sequential activation of local ionic currents. Since electrophysiological phenomena are ultimately electromagnetic, the classical theory may not be the sole mechanism and it is tempting to suggest that we should take into account more comprehensive electromagnetic approaches.

In the last decades research gradually began to deal with the implications of electromagnetic fields generated by brain activity, (McFadden, 2007; John, 2001; and Pockett, 2012), both as a whole and at the level of individual cells. In particular, electromagnetic waves in the optic and infrared range, have been attracting growing attention for their possible role in neural communication, (Tang and Dai, 2014; Trail, 1988; Persinger et al., 2013). This aspect raises the general question what mechanisms can be anticipated in cells for long-range signalling. Scholkman, 2015, in a vey relevant review, discussed a great number of potential signalling mechanisms (see Table 1), indicating that nervous tissue exhibits a versatile combination for long distance electromagnetic signalling other than classical and synaptic neurotransmission. As mentioned above, In this network various cell-types and connective tissues may be involved. The information

transfer may also include known features of quantum mechanics such as tunnelling, spin-mediated processes and quantum wave collapse in specific cell organelles.

Conclusion of this section:

As treated above, we hypothesize the permanent involvement of photon- and phonon-dressed fermions such as electrons and protons (the quasi-particle soliton is one example). We hold that these are crucial in the function of our entire organism, with special reference to our brain (**Meijer and Geesink, 2016; 2017; 2019b**). The need for such a special mechanism has various backgrounds: a) to be able to deal with the ultra-rapid brain responses that are not compatible with the relatively slow synaptic process of neurotransmission (**Cacha and Poznanski, 2015**), b) in order to explain the binding and synchronicity phenomena in brain function c) to understand the unexpected cognition capabilities of patients with severe brain damage and d) to address the presently unexplained subjective experiences in the category of Psi phenomena (**Brueck and Meijer, 2020**, **Meijer et al, 2021.** Anyway, all of the phenomena, treated in this section, point to some kind of *ultra-rapid communication at a distance* in brain tissue and/or between different individuals. This may also be related to a non-local connection of humans to some kind of information domain that may explain phenomena such as precognition and near-death experiences.

12. Role of Hydro-ionic Entities as Wave Antenna's in Brain

12.1 ZPE- Wave Activity and Guiding Waves in Brain

Our hypothesis on the role of quantum processes in brain does not invalidate current models of neuronal transmission: it is rather meant as a complementary but essential aspect. Alternatively, the structures that underlie neuronal function may be involved in brain function in another manner than the classical neural mechanisms generally assume., **Georgiev and Glazebrook, 2018** presented an intriguing model of synaptic communication, in which quantum tunnelling on the basis of solitonic interactions with SNARE protein complexes at synaptic vesicles is essential. The latter seems a modern version of the earlier presented model of **Beck and Eccles, 1998.** We hold that biological evolution may have selected all available biophysical processes for intra- and inter-cellular communication. In this respect, a "Two-Brain hypothesis" was postulated earlier by **Goodman et al, 2015**: postulating one electro-ionic modality related to the well-known neuro-humoral transmission and another that may be rather electromagnetic field- based. Also, it remains in principle possible that the quantum field type of transmission uses material elements that are also instrumental in classical circuitry. For example, it has been proposed that connective tissue/water assemblies may afford superconductive properties (**Ho, 2012**) and that myelin-based white matter in brain may function as optical wave guide (**Kumar et al, 2016**).

As soon as the 'Orch OR' consciousness model of **Hameroff and Penrose, 2014** was published, it was severely criticized by **Tegmark**, (**2000**), whose primary remarks concerned the following serious discrepancies: (a) the collapse of the wave function is much shorter than that of relevant dynamic timescales of neuron firings; and (b) wet warm brain, working at room temperature, cannot provide supporting quantum computations. Thermal noise of the brain would, in his opinion, completely exclude such delicate computations. This criticism, however, was later extensively and quite satisfactory addressed (Hagen et al, 2002).



Figure 31: Model for wave-coherence-mediated conscious states: The brain water compartment functions as a receiver and conduit for discrete quantum wave frequencies via (i) excitation of hydronium ions in brain fluids that promote coherent domains in structured water (inset middle right) and other interacting cavity modalities or (ii) through cyclotron EM wave activity resulting in perturbation of delocalized ions such as Ca²⁺ in dedicated channel proteins, that through vibratory states can become quantum entangled. Both these events are leading to syntropic flow of information and increased functional binding and synchronization of neuronal centers that are known to promote conscious states. Information is, apart from the known senses, obtained by quantum resonance with the vacuum (zero-point energy field) and in the non-linear organized brain produced attractors that are the building blocks of conscious states (see **Fig 31**, left).

In any event, we should also take into account that the study of mental aspects of brain function and consciousness may require quantum aspects of entanglement, non-locality and wave coherence, not offered by classical physics. Of note, such phenomena are experimentally demonstrated now in various cellular processes in Quantum Biology, and thus open the potential for top-down and retro-causal elements, as well as wave mediated action at a distance. They also invite a less reductionistic and more holistic top-down approach in the study of life in a cosmic context (**Schwarz, 2019**). One example is the peculiar notion that consciousness and reality have a "mobius ring/strange loop type of relation: consciousness may itself be instrumental in quantum wave collapse producing the material world, versus the view that such a wave collapse, may only occur through gravitational (orchestrated} reduction of wave information at the Planck Scale, thereby *producing* conscious moments as proposed by **Penrose, 2014**.

It is important to note that the microtubule hypothesis in brain function of Hameroff and Penrose, 2011; 2014a, was experimentally supported by the innovative studies in Anirban Bandyopadhyay's group (see

Agrawal et al., 2017, 2018; Sahu et al., 2013, 2015). In the latter studies it was shown in life visualizations that self-assembly of tubular proteins can be obtained under the influence of discrete EMF frequencies in the kHz, MHz and GHz ranges and that many of the registered resonance peaks of tubulins seem compatible with the earlier treated fractal GM-scale revealed by us (Meijer and Geesink, 2019b). It is of interest that Anirban Bandyopadhyay's group found clear evidence for a fractal information theory-derived geometric musical language, that may guide brain-inspired hypercomputing as a basic phenomenon underlying consciousness, a concept that is very much in line with the concepts in of the present paper.

Taking into account the earlier mentioned criticisms, let us look at the Hameroff-Penrose theory from another side: the side mentioned by **Tuszynski**, (2014). By inspecting the Hameroff-Penrose solution on the central role of oscillating microtubular proteins, an enormous matrix of oscillating tubular elements is occupying the whole brain, especially if other organelles such as mitochondria and nuclear DNA are involved at the same time This entire vibratory machinery is embedded everywhere in the brain in the intracellular water, (Fig.31).

12.2 The Role of Cerebral Fluids

The present study, emphasizes the importance of cerebral and interstitial fluids, that in concert with coherent water domains in the cells, could be involved in the guiding of consciousness originating from realms outside the brain. Interestingly, micro-tubuli in this context are not only 'scaffolding' instruments of cells but may also serve as warehouse for memory and memristors (**Chua, 1971 and 2011**), as instrumented by heavy ions, such as *calcium ions*. In the past, (**see Meijer and Raggett, 2015**), but also more recently, a number of attractive quantum brain models, have been proposed, that are at least partially compatible with the present "event horizon model" (see **Fig. 27**).

To emphasize the place of proton in brain consciousness functions, we show a rough diagram of brain organization, shown in **Fig.31 and 32**. A conditional diagram of brain organization consists of three levels (**Tarlaci, 2010**): (a) a 'water basin' containing all the other levels; (b) a level consisting of many neurons and glial cells, which organize the electrical activity of the nervous cells against a background of the neurochemical medium prepared by special nuclei and cells; and (c) a level expressing higher cognitive functions, which provide adequate behaviour of a living organism in the social environment (**Allakhverdov**, **2000**).

It is noticed earlier, that the thermal action parameter $k_{\rm B}T\delta\tau$ and the Planck constant are almost equal each other. Here $k_{\rm B}$ and $T\approx 310$ K are the Boltzmann constant and temperature of human body, and $\delta\tau \approx 2 \cdot 10^{-13}$ s is the average lifetime of proton mobility in water (**Bell, 1959, 1973**). The above equality means, that exchange of the hydrogen ion energy with the vacuum zero-point energy can be available as well. It should be noted in this regard, that the quantum mechanical zero-point energy is mentioned also by **Beck and Eccles 1992**, in article entitled "quantum aspects of brain activity and the role of consciousness".

The mass of the quasi-particle, which they adopt in this article, is the mass of the hydrogen atom. The vacuum zero-point energy fluctuations happen on surface of a vast ocean of energy called by the dark energy, or more specifically the "superfluid quantum space", the name proposed by the earlier mentioned **Fedi, 2016.** It contains virtual particle-antiparticle pairs, which are created and annihilated again and again by staying in a continuous vortex dance. The pairs possess integer spin and therefore form the Bose-Einstein condensate covering the entire Universe **(Albareti, et al., 2014, Das and Bhaduri, 2015)**. Thus, the hydrogen ion (proton) has the possibility of tunnelling through the space on huge distances. Let us look at the proton migration

mechanism from the perspective of the de Broglie-Bohm theory (**de Broglie**, **1987**, **Bohm**, **1952**). In this case, the 'water wires' look like the Bohmian trajectories forming every time the need arises. But first we shall show the hydrodynamical equations describing motion of hydrogen ions in the water medium. Factually, the balance equation for electrical processes occurring in a nervous tissue (**Dudkin and Sbitnev**, **1998**), is written down initially, that leads further to the Navier-Stokes equation and the continuity equation.

12.3 Water Configurations as Quantum Wave antenna's: the Role of Protons in Hydronium Ions

Living brain is a biological organ which operates in a slightly salty liquid environment at room temperature. Most widespread chemical substance in the living body is liquid water (**Chaplin, 2016, Geesink Jerman and Meijer, 2019b**). Water is the main liquid medium in the brain, where important events, related to consciousness occur.

Although dendrites and axon terminals of neurons of the brain penetrate through all brain space densely, there are spaces relatively free of the nervous filaments. These spaces are ventricles of the brain filled by the cerebral liquid. In medical practice, there is a peculiar case in which a 44-year-old patient with postnatal hydrocephalus of an unknown cause (Feuillet et al, 2007). Magnetic resonance imaging (MRI) showed that his brain had hypertrophied brain ventricles. The deficit of the filamentous organization demonstrates massive enlargement of the lateral, third, and fourth ventricles, with a very thin cortical mantle and a posterior fossa cyst. Surprisingly, however, this patient possesses quite normal social functions, and exhibited an intelligence quotient (IQ) of around 75. This example provides an indirect hint that the cerebral liquid, a slightly brackish water, may have a direct relationship to cognitive functions of the brain.



Figure 32: A: Cerebrospinal fluid compartments within and surrounding brain. **B**. Enlarged ventricle compresses brain tissue. **C**: Circulation of cerebrospinal fluid and contact with interstitial fluid. **D**: Massive ventricular enlargement, in a patient with normal social functioning: **(A)**, **(B)**, **(C)** MRI with gadolinium contrast at different cross-sections; **(D)** T2-weighted MRI. LV=lateral ventricle. III=third ventricle. IV=fourth ventricle. Arrow points to Magendie foramen. The posterior fossa cyst is outlined in (**D**). The figure is taken from **Feuillet et al**, **(2007)**.

We assume that the proton plays an important role in the transport of subcritical information through the brain liquid. At room temperature, the liquid water consists of many fluctuating hydrogen-bonded clusters **(Chaplin, 2016, Fig.31).** The hydrogen bond is strong enough to maintain the coupling of atoms during some time under thermal fluctuations. As treated above, water can be depicted as consisting primarily of a mixture of clusters of water molecules with different degrees of hydrogen bonding in an equilibrium. Under thermal fluctuations, some hydrogen couplings are broken but other arise (**Geesink and Meijer, 2020, Massori, 2019, Meessen, 2020).**

On average, the equilibrium distribution of different cluster sizes is maintained. **Fig.33**, illustrates the hydrogen-bonded chain mechanism (**DeCoursey**, **2003**), called the Grotthuss mechanism, by means of which protons tunnel from one water molecule to the next via hydrogen bonding (**Chaplin**, **2016**; **Hassanali et al**, **2013**). Consciousness may arise through information transfer to this water from the ZPE-field.

It can be shown that the thermal action parameter of a proton

$$b=k_{\rm B}T\delta\tau$$
, (1)

in which k_B = Boltzmann constant=1.38E-23 J/K, T = the room temperature=298 K, $\delta \tau$ = lifetime of a Hydronium ion = 2E-13 s, and we get b=8.2 E-34 J·s. One can see that h = Planck constant =6.6 E-34 J·s, is in the same order of magnitude as the thermal action parameter, b. (Sbitnev 2016).

In the fluid medium, as a basic speed of matter transfer, we choose the speed of sound rather than the speed of light proposed by **Brady and Anderson (2014)**. In a saline water solution at room temperature, T = 298 K, the speed is equal to $c_s = 1508$ m/s. The speed is taken from the formula of **Wilson (1960)**. Observe that

$$m_* = \frac{k_B T}{c_s^2} \approx 1.81 \square 0^{-27} \text{ kg}$$
 (2)

is slightly larger than the proton bare mass m = $1.6726 \cdot 10^{-27}$ kg.

This means, that the hydrogen ion may behave itself as a particle exchanging its energy permanently with the vacuum zero-point energy and not only with water. In other words, the hydrogen ion can act as an intermediary between the physical vacuum (i.e., the superfluid quantum space) and the water environment of the brain (Sbitnev 2016). The quantum mechanical zero-point energy is also mentioned by Beck and Eccles, in their article (Beck and Eccles, 1992) entitled "Quantum aspects of brain activity and the role of consciousness".

The mobility of the hydrogen ion in water leads to an average lifetime of 2·10-13 s (**Bell, 1959, 1973**). Hydrogen ion, that is proton, is considered here as a bit of information transmitting across the cerebral liquid of brain by the Grotthuss mechanism (**Chaplin, 2016**), (see **Fig. 33 and 34**).

The mass of the quasi-particle, which they assumed in their article, was in the range of the mass of the hydrogen atom. Besides, Beck and Eccles (**1992**) noted that the thermal energy $k_B \cdot T$ of external environment (T = 298 K) expressed in units of the electron-volt

$$E_e = k_{\rm B} T / e \approx 26 \text{ mV}. \tag{3}$$

lies in the range of voltages where neurons operate. It means that thermal noise may have an impact on the electric activity of nerve cells. It is instructive, to draw attention in this article, to the time of the metastable instability of electronic transition, τ , evaluated by the authors to be about $10^{-13} - 10^{-14}$ s. Their estimation shows a relatively good agreement with the average lifetime of the hydrogen ion, $\delta \tau = 2 \times 10^{-13}$ s



Figure 33: Diagram illustrating the hydrogen-bonded chain mechanism for proton migration (Grotthuss mechanism **De Coursey, 2003**): a proton enters the chain from the left side and then, as a result of the series of proton hops indicated by the arrows, a proton exits the chain on the right side. This chain represents a hydrogen-bonded 'water wire' (Chaplin, 2016).

In the transport of protons, the so-called exclusion zone (EZ) phase of water could play a significant role, **Fig. 33**. This special "fourth phase" of water arises near hydrophilic surfaces that abound in living tissues. Water molecules are ordered into hexagonal lattice, (**Fig. 34**), and the exclusion zone (EZ) water (**Pollack, 2013**) expels any foreign inclusions so that EZ water molecules are more constrained. An assembly of EZ water molecules is more stable. EZ has negative charge, which is friendly to the resting membrane potential of neural cells. EZ absorbs light at the wavelength around 270 nm. These unique properties make the water a perfect conductor of the hydrogen ions through itself by the Grotthuss mechanism (**Agnom, 1995**, see **Fig. 33**); (**Peng et al, 2015**, see **Fig. 35a**).

Here we will try to understand what pathways are available for the moving protons. As was noted above, a main mechanism is the Grotthuss one that can be effective when water is in the" fourth phase" as expected to exist near the countless subcellular structures and the cellular membrane of neurons as well as in the brain fluid molecular material. In that case, water molecules are predominantly arranged according to the hexagonal symmetry, (see **Fig.33 and 34)**. As shown in **Fig. 35(a)** the hexagonal symmetry can provide an eightfold path for the hydrogen ion entering on a hexagon assembled from water molecules. At the beginning, the hydrogen ion enters the right hexagon at the node *a* and hops along it around central point *A* clockwise. Then, upon reaching node *a*, the hydrogen ion begins to hop along the left hexagon around center point *B* in a counterclockwise manner. Upon reaching node *b*, the hydrogen ion re-enters the right hexagon, and so forth.

Each eightfold path, corresponds to two oppositely oriented vorticities $\vec{\omega}$ that change the orientation after the completion of each cycle, see **Fig.35(b)**. This illustration shows the following sequence of changing the vorticity sign. Initially, the hydrogen ion hops along the left hexagon in a clockwise manner. The vorticity $\vec{\omega}$ is represented by the blue arrow. At the transition to the left hexagon at the node *a*, the hydrogen ion begins to hop in the counterclock-wise way. The vorticity $\vec{\omega}$ corresponding to this motion gets the opposite orientation (the same blue arrow oriented in the opposite direction). After completing the motion along the left hexagon, the hydrogen ion in node *b* enters again the right hexagon and begins to hop along it. The vorticity orientation remains (red arrow). After completing the motion on the right hexagon, the hydrogen ion, in node *a*, again



passes to the left hexagon. The orientation of the vorticity changes sign to the opposite direction (the same red arrow oriented in the opposite direction).



Figure 34. From *Pollack, 2013*. The hexagonal water lattice can work as an interferometric device acting as a receiving and transmitting antenna.

As a result, we have the following pattern: (a) the eightfold path along EZ water molecules consist of oscillating dipoles in time due to the change of vorticity. (b) We note that arrows drawn on tips of the green dotted lines in **Fig. 35(b)** point to flow of time. (c) The dipoles exchange the orientations in the tact with oscillations that fluctuate in time. (d) If the EZ water contains many such eightfold paths working synchronously, then this EZ water plate can work as a multi-slot emitter-receiver of the electromagnetic field (multi-slot interferometer).

The hydronium ion can obtain a *soliton character*, since when moving along some surface it scrolls a mass of matter composed of a substrate along with it during this moving. In other words, the soliton can obtain a torque mode. If its core carries a charge, for example, positive charge of the hydrogen ion, then due to the torque it is covered by a coat of negative charges. In particular, due to this coat, the soliton lives longer than that with a naked charge. Surprisingly, excess protons can create their own pathways, 'water wires', before protons can migrate along (Peng et al, 2015).

Grotthuss shuttling of an excess proton charge defect through hydrogen bonded water networks, shows the interesting avalanche-like mechanism of the hydrogen ion transport through it. It turns, there is a related process in which water molecules move ("shuttle") through a hydrated excess proton charge defect in order to wet the path ahead for subsequent proton charge migration. Surprisingly, before the proton enters the nanotube, it starts "shooting" water molecules into the otherwise dry space via Grotthuss shuttling, effectively creating its own water wire where none existed before. As the dry nanotube gradually becomes wet when the proton charge defect enters it, the free energy barrier of proton permeation through the tube via Grotthuss

shuttling drops significantly. This finding suggests that an important wetting mechanism may influence proton translocation in biological systems, i.e., one in which protons "create" their own water.



Figure 35: Hydrogen ion hopping along two EZ water hexagonal structures: (a) a general organization of EZ water consisting of two hexagons; (b) dynamics of the hydrogen ion hopping along two hexagons. Hydrogen ion hopping along two EZ water hexagonal structures: (a) a general organization of EZ water consisting of two hexagons; (b) dynamics of the hydrogen ion hopping along two hexagons. According to the righthand law, currents about the closed circuits induce magnetic fields, oriented perpendicular to these circuits - along either red arrow or blue arrow depending on orientation of the current in the circuit - either counterclockwise or clockwise. Such currents synergistically flowing along the water hexagons on the hexagonal lattice (see Fig. 17) lead to cumulative effect either of radiating information to subtle worlds or of receiving information from these worlds.

13. The Potential Role of Ca2+- ions in Quantum Consciousness

13.1 Introduction

It has been shown that Ca2+ ions are also hydrated, and, in principle, their behaviour can be described by similar hydrodynamics and path integral approaches, as described in the previous for hydronium ions. Thus, just as there is a wide variety of intercellular Ca2+ waves in different cell types such as astrocyre (**Fig.36**), so there is a corresponding variety in their mechanism of extra-cellular propagation.

Nevertheless, two basic mechanisms are predominant: propagation by the diffusion of an extracellular messenger and propagation by the diffusion of an intracellular messenger through gap junctions. Sometimes both mechanisms operate in combination to drive an intercellular wave. Of note, Ca2+ waves can exhibit spiral patterns (**Meijer et al., 2021**) and are also influenced by external cyclotron EMF resonances (**Meijer and Geesink 2015**), both supporting our concept of toroidal flux mediation in the brain. The Ca2+ messenger function may be influenced by Schumann and cyclotron resonances by far-infrared (FIR) radiation resonance as well as Zero-point energy (ZPE).



Figure 36: Schematic of astrocyte – neuron interactions and the role of α 1-NAR signaling. (A) NA is released from LC varicosities into the extracellular space. (B) Activation of α 1-NAR on astrocytes elicits $[Ca^{2+}]_i$ transients. (C) GABAergic interneurons also express α 1-NAR. (D) Astrocytes appear capable of integrating information across signalling modalities: α 1-NAR signalling 'primes' astrocytes to local glutamatergic synapse activity. (E) Astrocytes also integrate activity at GABAergic synapses, through co-activation of neuropeptide receptors (NPR) and GABA_B receptors. (F) One consequence of astrocyte stimulation is modulation of synaptic activity (G) Astrocytes can downregulate GABA_A currents by releasing ATP which acts on neuronal P2X receptors. (H) Astrocytes can transform inhibitory activity at a GABAergic synapse into excitatory signalling at a glutamatergic synapse. (I) Functionally coupled astrocytes can act as bridges, allowing communication between distant synapses. One mechanism used is direct transfer of the $[Ca^{2+}]_i$ signal (or metabolites) through gap-junctions. (J) Integrating synaptic activity with α 1-NAR signalling allows astrocytes to participate in the "Glutamate Amplifies Noradrenergic Effects" mechanism, in which astrocytes act in a positive feedback loop releasing glutamate. (K) A similar mechanism may also act at GABA-ergic synapses, with astrocytes transforming GABA-ergic activity into glutamate release.

The resulting phonon and photon scalar waves in the brain are integrated and protected against decoherence through toroidal processing. Topological integration on the brain macro-scale is realized by torus nesting and self-similar fractal representation. This integral process may contribute to the creation of awareness and conscious perception in relation to the external world. Fractal patterns of re-entrant calcium waves have been used in order to map brain attractors that could even represent a bridge between the realm of physical laws and a timeless platonic realm (phase space) of mathematical objects.

Interestingly, calcium may also play an unexpected role in nuclear quantum spin-mediated brain communication in the brain. **Fisher, 2015** identified the so-called "Posner molecule", Ca9(PO4)6, as a unique molecule that through shielding the phosphate group (**Fig.37**e) can protect the spin-mediated neural qubits for very long times and thereby may serve as a (working) *quantum-memory*



Figure 37: The potential role of quantum-entangled Ca-phosphates (**a**) in brain (**b**), that protect spin-entangled neural Qbits and after endocytosis of Posner molecules in neurons, release Ca2+- ions that influence neuronal glutamate release (**d**) and thereby induce post-synaptic firing in spin-entangled neurons (**e**) throughout the brain.

A central requirement for quantum-processing is *quantum entanglement across the brain*. It was argued that the phosphatase enzyme that breaks a pyrophosphate ion into two phosphate ions can form quantumentangled pairs of qubits (**Fig. 37 c**). A mechanism for transporting Posner molecules into presynaptic neurons during vesicle endocytosis was than proposed. This endocytic process is supposedly coupled to a glutamate transporter in the plasma membrane and in intracellular vesicles. Quantum measurements throughout the brain, due to the generated spin-entangled state of multiple neurons, can then occur. When a pair of Posner molecules, engulfed into the neurons fall apart it releases a burst of intracellular calcium ions, that then can trigger further neurotransmitter release and enhance the probability of post-synaptic neuron firing of the quantum spin-entangled neurons (**Fig.37 d**). This is one example of a well thought out multi-step quantum brain mechanism. Yet it remains to be experimentally demonstrated at any of the abovementioned step.

13.2 Final Conclusions on the Treated Modalities of Consciousness

- We submit that consciousness states are, at least partly, received from the superfluid quantum space/zero-point energy field and the information flux is likely bidirectional (back reaction). Consequently, a field-type of

cosmic connectivity is attained, necessary for global synchronization in the brain and of the brain with the cosmos.

- The fractal water compartments in the brain function as superconductive antennae for the ZPE/ superfluid quantum space wave information (see **Geesink and Meijer, 2019a**). This aspect extends to interstitial spaces and non-neuronal cell types, in which spiral Ca2+ wave fluxes, that mediate multiple bio-information mechanisms in the brain, play a crucial role.

- For wave-information transfer in brain, one needs two separate mechanisms operating in brain water: the intermolecular jump of hydrated protons (Grotthuss mechanism) for superconductive states as well as a different mechanism of wave/particle diffusion. The latter propagation process in the whole brain is facilitated by quasi-particle formation of solitons (rotating electrons or protons that become dressed with phonons/photons). Hydrated protons have been shown to be quasi particles with solitonic solutions.

- It could be shown that mass-energy and dynamics of movements of protons exhibit a quantum wave character that obey the non-linear Schrödinger wave equation. Since the Klein-Gordon mass-energy equation, as a starting point has a dual solution including negative mass/energy, by which anti-particles may travel from future to past, allowing reversed flow of time and retro-causality.

- The solitonic solutions implicitly introduces the aspect of vortex-like rotation and toroidal geometry of energy trajectories (**Fig.9**). Rotatory mediated toroidal flux is likely important for information integration and error correction of various forms of wave energies.

- Holographic memory storage and retrieval can be understood from a 4-D situated event horizon workspace that is associated with the brain but not reducible to it, (**Fig.27**). The cerebrospinal and interstitial water compartments are equipped with, and sensitive to internally generated and also external resonating solitonic excitations. In conscious states in brain and the entire cosmos, resonating wave activities can function as the communication conduit between zero-point superfluid space and modalities of life organisms.

- Current observations on relative intelligence of hydrocephalic patients, life panorama aspects of NDE experiences, and pre-cognition PSI phenomena can be better understood through the present superfluid and superconduction model.

14. Zero-point Energy Field: The Physical Basis of an Implicate Order?

14.1 Introduction

The concept of a *Universal Knowledge Field* was previously also framed as *Universal Consciousness, Cosmic Consciousness, Universal Mind, Universal Memory, Universal Intelligence, Holographic Memory, Collective Consciousness, Implicate order and the Plenum,* among many other terms. The concept that information can take a universal character and that all information is present in a general knowledge field can be treated from a number of backgrounds and perspectives.

In principle, this item can only be approached through a general treatment of the evolution of intelligence and therefore, for us, is intrinsically based on human knowledge and its scientific concepts: natural laws, evolutionary theories, historical analyses and philosophy. This seems evident, since clearly everything we discuss and project and all we can say on the observed nature entails the product of human deliberation. In other words, one could say that basic information implicit in nature can only be revealed and faithfully registered through human observation that, coupled to our intelligence and metaphoric representation transforms experience in significance (**Meijer, 2012; 2018**). Yet, if we assume a collective storage of all *information* that is present and/or evolves in our Universe and that humans and other intelligent species in the cosmos interact with such a knowledge field, it intrinsically implies that it cannot be solely treated as a by-product of human brain and intelligence in general. At first sight, this idea seems to conflict with current mainstream science and conventional pictures of reality.

However, recent developments in current physics show that in fact there is solid ground and even overwhelming evidence for the hypothesis/concept of a *universal knowledge field*. These considerations are based on the current descriptions of nature on the micro-level (spacetime building blocks such as string and spin theories), quantum mechanical concepts (such as entanglement, non-locality and resonance), cosmological models on energy (zero point and negative energy) as well as holographic concepts of reality and other space/time modalities. The present review is partly based on texts and figures out of a set of earlier publications of the author on information science, studies on brain function and consciousness as well as science philosophy (**Meijer et al., 2012-2018).** In addition to these research fields, universal consciousness can be approached from transcendental human experience, including transpersonal and PSI phenomena and should be discussed against a meta-physical as well as informational backgrounds, also in relation to self-consciousness.

14.2 Pilot-wave Theory, Implicate Order and ZPE- field Mediated Consciousness

Quantum mechanics predicts the existence of what are usually called "zero-point" energies for the strong, the weak and the electromagnetic interactions, where "zero-point" refers to the energy of the system at temperature T=0, or the lowest quantized energy level of a quantum mechanical system. Zero-point energy is the energy that remains when all other energy is removed from a system. A harmonic oscillator is a useful conceptual tool in picturing this process. Classically, a harmonic oscillator, such as a mass on a spring, can always be brought to rest. However, a quantum harmonic oscillator does not permit this. A residual motion will always remain due to the requirements of the Heisenberg uncertainty principle, resulting in a zero-point energy, equal to 1/2 hf, where f is the oscillation frequency. Zero-point energy was experimentally demonstrated with the so-called Casimir Effect, a unique attractive quantum force between closely-spaced metal plates. The Casimir effect or force was shown to be due to radiation pressure from the background electromagnetic zero-point energy which has become unbalanced due to the presence of the plates, and which results in the plates being pushed together.

Electromagnetic radiation can be pictured as waves flowing through space at the speed of light. The waves are not waves of anything substantive, but are ripples in a state of a theoretically defined field. However, these waves do carry energy (and momentum), and each wave has a specific direction, frequency and polarization state. Each wave represents a "propagating mode of the electromagnetic field." Each mode is equivalent to a harmonic oscillator and is thus subject to the Heisenberg uncertainty principle. From this line of reasoning, quantum physics predicts that all of space must be filled with electromagnetic zero-point fluctuations (also called the zero-point field) creating a universal sea of zero-point energy. The density of this energy depends critically on where in frequency the zero-point fluctuations reach its limits (**Beck and Mackey,2007**). Energy has a clear relation with information and together with the third building block of the universe, matter it provides a tri-angular relation with mutual transitions (**Meijer, 2012**).

14.3 How Does ZPF Affects Matter?

As explicated in the preceding section, SED regards matter as immersed in an all-pervasive stochastic background field with which it interacts permanently and unavoidably, thus acquiring a stochastic motion. This motion can be studied for various systems. As an example, we take a closer look at the hydrogen atom, which is composed of a proton and an electron. In classical physics this system is unstable and collapses within a tiny fraction of a second due to the fact that the orbiting electron emits radiation and loses energy. However, within SED the situation changes significantly since the electron is no longer surrounded by a void. Rather, the electron is now able to perform a dynamic interaction with the background field, which results in an exchange of energy between the material system and the ZPF, (**Fig.38**).

Indeed, it can be shown analytically and numerically (**Cole and Zou 2003, 2004a, 2004b; De la Peña and Cetto 2006; Cavalleri et al. 2010,**) that there are certain dynamic situations in which the average power absorbed by the atomic electron compensates its average radiated power. These situations are characterized by quantization conditions and correspond exactly to the stationary states predicted by quantum theory, i.e., the stability of matter goes necessarily hand in hand with the quantum behavior of matter and both are a consequence of the interaction with the ZPF.



Figure 38: How brain reads and rewrites quantum vibrations from the zero-pont enegy field in the form of attractor modalities

A closer look behind the scenes of matter from an SED point of view reveals that not only the stability of matter but also its spatial structure and three-dimensional conformation are governed by the ZPF. Hence, SED is able to provide a clearer and more intuitive understanding of structure formation, in such a way that a quantum mechanical orbital, which reflects the probability density of finding an electron in a specific region around the nucleus, is associated with a stable attractor of the stochastic interaction process between the electron and the ZPF (**Rodriguez, 2012**). In other words, every stationary state of matter is characterized by an individual dance pattern that comes into being under direction of the ZPF. External stimuli, such as the presence of a magnetic field, can cause transitions between different attractors, i.e., an external stimulus or a perturbation can prompt the system to follow a new dance pattern. In this respect several authors have pointed out that each pilot wave steering elements in the explicate order as defined by David Bohm exerts a backreaction to the implicate order, rendering this domain permanently dynamic. This implies that the Bohm mechanism can never be fully deterministic since each pilot wave is operating from a different background field, (see **Sutherland,2006; Sarfatti, 2011; and Holland, 2020**).

14.4 How Matter Affects ZPF and the Relation with Brain Function

So far, we have dealt with the impacts of the ZPF on matter. In the second step, we now have a look at the impacts of matter on the ZPF. This is very important because it must be considered that matter and ZPF as mentioned above, exert a mutual influence, i.e., not only the ZPF affects the dynamics of matter, but the latter also affects the dynamics of the ZPF. From the study of simple nonlinear systems (**De la Peña and Cetto 2001**; **2006**) one can learn that the ZPF is modified as soon as the system reaches a stable attractor. The free field with the initially random phase adapts itself to the new situation in such a way that the relevant frequency components involved in the maintenance of the equilibrium become highly correlated (**De la Peña and Cetto 2001**). In other words, the formation of a stable attractor results in a de-randomization of the local ZPF. This amounts to imprinting an information state on the ZPF (**Fig.38**). Different attractors are associated with different ZPF configurations and, hence, different information states (**Keppler,2012**; **2013**; **2016**, as partly cited in the following:)

First of all, one can observe long-range coherence in the brain, which means that the activity of distant brain regions is highly correlated. Particularly, synchronized activity in the gamma frequency band, ranging from 25 to 100 Hz, is strongly associated with perceptual awareness and consciousness (**Crick and Koch 1990; Engel et al. 1999; Engel and Singer 2001; Melloni et al. 2007**). It was found that gamma synchrony shows up not only during attention to an external stimulus, but also during meditation (**Lutz et al. 2004**) and REM sleep (Montgomery et al. 2008). In order to understand gamma synchrony, deterministic neural network models have been studied, which generate auto-coherent gamma oscillations as an emergent network property. However, such models can be ruled out because the analysis of real data reveals that the brain behaves like a resonant stochastic oscillator (**Burns et al. 2010, Meijer and Geesink, 2018**).

This means that the brain activity cannot be understood on the basis of a deterministic model. Rather, any realistic model must incorporate a stochastic driving force. For a physicist all these pieces of evidence clearly suggest that the brain behaves like a macroscopic quantum system. This view is also taken by Freeman and Vitiello who interpret the nonlinear brain dynamics as a macroscopic manifestation of underlying many-body field dynamics (**Freeman and Vitiello, 2006**). They argue that the patterns detected in the brain resemble those of quantum many-body systems, so that many-body quantum field theory is the appropriate tool to study brain dynamics and the only way to understand patter formation and phase transitions in the brain.

From this perspective, the brain is a complex system that operate near a critical point of a phase transition. In the unordered phase the brain displays irregular dynamics. However, an external stimulus above a certain threshold can vary the system parameters appropriately and induce a spontaneous transition to the ordered phase that is characterized by scale-free activity patterns, long-range correlations, particularly gamma synchrony, and spatiotemporal attractor (see for an adequate set of reviews **Keppler, 2012, 2013, 2016**)

Nevertheless, from the existing quantum field theoretical models one can draw the conclusion that the whole process is initiated and stabilized by the electromagnetic vacuum fluctuations. This seems equivalent to saying that the process is driven by the ZPF. In the following, the cornerstones of a conceptual framework for consciousness is presented. As noted in the preceding **section**, this conceptual framework is designed to be in accordance with all the scientific findings of physics and neurophysiology. The framework is formulated in terms of three main principles:

Principle 1: Consciousness is a fundamental property of the universe.

According to Eastern philosophy, mind and matter are composed of the same primordial energy, i.e., there is an implicit unity of primordial energy and primordial consciousness. Hence, consciousness is not produced by matter. Rather, matter and consciousness have a common basis.

Principle 2: The ZPF is the substrate of consciousness.

According to SED, primordial energy is represented by the ZPF. All phenomena spring forth from this field through selective restriction and a dynamic flow of interactions. Since, as laid down in hypothesis 1, primordial energy and primordial consciousness are based on the same substrate, the ZPF is an appropriate candidate for the substrate of consciousness.

Principle 3: Our individual consciousness is the result of a dynamic interaction process that causes the realization of information states in the ZPF.

The neural activity of the brain modifies the ZPF, which is the substrate of consciousness. Whenever the activity of the brain falls into a stable attractor, there is an information state in the ZPF that is associated with a conscious state. The modified ZPF, i.e., our consciousness, also influences the brain, so that there is a permanent information transfer between the brain and the ZPF. These interrelationships are depicted in Fig. 21 shows that the physical and phenomenal properties turn out to be two different aspects of a single world. This is in line with the double-aspect principle of information (Chalmers, 1995; 1996, Keppler, 2012, 2013, 2016).

In the context of the SED-based approach presented here, this means that particular information states in the ZPF, if not all, are associated with a physical realization and a conscious experience (**Fig.38**). In other words, the internal aspects of such ZPF information states are phenomenal, i.e., a conscious moment is a ZPF information state experienced from inside. The external aspects of such information states are physical and manifest themselves as the neural correlates of consciousness (NCC). Hence, a key characteristic and important quality of this conceptual framework is the notion of a *information state in the ZPF*, also called *ZPF information state*, which is the central link between a physical manifestation in the outer world and a psychological state in our inner world. The relationship between information states in the ZPF and NCC is completely determined by the laws of physics, while the connection.

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Hence, a key characteristic and important quality of this conceptual framework is the notion of an *information state in the ZPF*, also called *ZPF information state*, which is the central link between a physical manifestation in the outer world and a psychological state in our inner world. The relationship between information states in the ZPF and NCC is completely determined by the laws of physics, while the connection. between information states in the ZPF and our spectrum of qualia is specified by psycho-physical laws (**Meijer and Geesink, 2017, Keppler, 2012, 2013**)

However, these psychophysical laws have nothing to do with extensions to the existing laws of physics. Rather, they can be regarded as mapping rules between ZPF information states and qualia, describing where a given information state in the ZPF is located in qualia space. Looking at higher levels of complexity, it is quite obvious that the universal mechanism of structure formation must apply also to living matter, indicating that biological systems can be fully understood only on the basis of the electromagnetic vacuum fields, as addressed by SED and described by the formalism of quantum electrodynamics.

A key motivation for **Bohm**, **1980**, **1993**, in proposing a new notion of order was the well-known incompatibility of quantum theory with relativity theory. The *Pilot Wave theory* is one of several interpretations of quantum mechanics. It uses the same mathematics as other interpretations of quantum mechanics; consequently, it is also supported by the current experimental evidence to the same extent as the other interpretations. The Pilot Wave theory is in fact a hidden variable theory. The positions and momenta of the particles are considered to be the hidden variables. However, the observer not only does not know the precise value of these variables, but more importantly, cannot know them precisely because any measurement disturbs them – as stipulated by the Heisenberg uncertainty principle. A collection of particles has an associated matter wave, which evolves according to the Schrödinger Equation. Each particle follows a deterministic trajectory, which is guided by the wave function; collectively, the density of the particles conforms to the magnitude of the wave function. The theory brings to light non-locality that is implicit in the non-relativistic formulation of quantum mechanics and uses it to satisfy Bell's theorem. Interestingly, these nonlocal effects are compatible with no-communication theorem, which prevents us from using them for faster-than-light communication.

Implicate order and explicate order are concepts coined by David Bohm to describe two different frameworks for understanding the same phenomenon or aspect of reality. The implicate order, also referred to as the "enfolded" order, is seen as a deeper and more fundamental order of reality. In contrast, the explicate or "unfolded" order include the abstractions that humans normally perceive. (**Bohm, 1980**). In analogy to Whitehead's notion of *actual occasions,* Bohm considered the notion of *moment*—a moment being a not entirely localizable event, with events being allowed to overlap and being connected in an over-all implicate order: Bohm proposed that each moment of time is a projection from the total implicate order. Central to

Bohm's scheme are correlations between observables of entities which seem separated by great distances in the explicate order, but are manifestations of the implicate order. Within quantum theory there is entanglement of such objects.

The implicate order represents the proposal of a general metaphysical concept in terms of which it is claimed that matter and consciousness might both be understood, in the sense that it is proposed that both matter and consciousness: (i) enfold the structure of the whole within each region, and (ii) involve continuous processes of enfoldment and unfoldment. For example, in the case of matter, entities such as atoms may represent continuous enfoldment and unfoldment which manifests as a relatively stable and autonomous entity that can be observed to follow a relatively well-defined path in space-time. In the case of consciousness, Bohm pointed toward evidence presented by Karl Pribram that memories may be enfolded within every region of the brain rather than being localized (for example in particular regions of the brain, cells, or atoms). Bohm also used the term *unfoldment* to characterize processes in which the explicate order becomes relevant (or "relevated"). Bohm likens unfoldment also to the decoding of a television signal to produce a sensible image on a screen. The signal, screen, and television electronics in this analogy represent the implicate order whilst the image produced represents the explicate order. As an analogy, Bohm considered a pattern produced by making small cuts in a folded piece of paper and then, literally, unfolding it. Widely separated elements of the pattern are, in actuality, produced by the same original cut in the folded piece of paper. Here the cuts in the folded paper represent the implicate order and the unfolded pattern represents the explicate order.

14.5 The Holographic Consciousness Model

Bohm employed the *hologram* as a means of characterizing implicate order, noting that each subdivided region of the hologram, intrinsically contains the information for the whole three-dimensional image, which can be viewed from a range of perspectives. That is, each region contains a whole and undivided image. According to Bohm, a vivid image of the whole is afforded by vortex structures in a flowing stream. Thus, according to Bohm's view, the whole is in continuous flux, and hence is referred to as the holomovement (movement of the whole). According to Bohm, the implicate order represents the universal, holographic subtext of reality, which unfolds in every moment to produce the explicate order that we all observe. From a human perspective **Germinario**, (2004) has equated the implicate order with the unconscious process, and the explicate order with conscious process. The principle of synchronicity, the instantaneous connection of people and events beyond the senses, has been equated with the quantum-physical principle of non-locality (**Combs and Holland**, 1990) that has been proposed to be the fundamental mechanism of any conscious process (see **Germine**, 1991). Several authors have completed the pilot-wave theory by including a so called back-reaction, meaning that the guided structures in the explicate order transfer the particular information involved back to the knowledge domain (Holland, 1996, Sutherland, 2006, Sarfatti, 2015). This may imply that the pilot wave domain is dynamic and ever changing and, thereby, the guiding process is never fully deterministic.

The holonomic brain theory (**see Wikipedia** for introduction) has been put forward by **Pribram**, **1971;2014**, proposing that localized neural holograms are formed by diffraction patterns of oscillating electric polarization waves in the cortex. (**Fig.39**). This "patch holography" is called holonomy or windowed Fourier transformation. This process is suggested to be directly related to the phenomenon of consciousness, as arising from such microprocesses in the synapto-dendritic network. This produces multiple waves that give rise to distinct

interference patterns that provide holographic and thus non-local storage of memory and through synchronization produce spatio-temporal binding, across the brain, leading to integral to conscious moments.



Figure 39: Holographic representations of various aspects of reality: **A:** Human embedded in multi-nested toroidal fields **B:** 3-D nested torus projected in 2D as a spiral network; **C**: 3-D to 2D holographic representation of planet earth; **D**: Memory generated in brain by interference of electromagnetic fields in the branched dendritic neural netwotk; **E:** Fourier transform of sub-Q frequencies into spacetime form information. **F:** consciousness as arising from a conversion of non-local implicate order frequency domain into a local explicate order in our space-time domain, representing a Fourier transform- mediated unfolding of active information (modified from Joye); **G:** Cosmic scaling of explicate to implicate order transfer at the level of the Planck scale.

This aspect was further worked out by **Di Biase and Amoroso**, **2007** and, more recently, elegantly elaborated by **Joye**, **2016** a;b and **2020**, (Fig.39). She stipulated that this holonomic mechanism is not restricted to our brain but is a scale-invariant cosmic field-like process in which information is accumulated. In these field interactions, each new field configuration is used to compute the next iteration of the overall knowledge domain from which information can be broadcasted as guiding pilot waves to living beings in a Bohmian context. As mentioned above, the latter information flux is bidirectional rendering the knowledge field permanently updated and dynamic. This also allows the important feature of retrocausality (Sutherland, 2006;2016), that in turn guarantees the crucial aspect of human free will (Aharonov et al., 2014, Hameroff, 2012).

The present first author, in collaboration with the mineral nano-technologist Ir. Hans Geesink, found consistent evidence for a semi-harmonic background field in our world, revealing a set of EM field frequency bands, coined the GM-biophysical scale principle. This phenomenon was detected in both animate and inanimate systems, and may reflect part of the electrodynamics of Bohm's implicate order and/ or zero-point

energy quantum fluctuations, (reviewed in Meijer, 2021; Meijer and Geesink, 2019, Geesink and Meijer 2018, a, b, and c.), The history of the discovery of the generalized music (GM)-scale was highlighted in relation to the areas of bio-field research (Geesink, 2020) and quantum biology (Meijer and Geesink, 2018 b). The central message is that nature may be guided by a discrete pattern of electromagnetic frequencies, as expressed in photon/electron (polariton) and phonon/electron (polaron or soliton) activities. This guiding seems to be based upon a physical coherence principle that is coupled to entanglement (Geesink and Meijer 2018a). It acts in a local and non-local way, and is embedded in a toroidal geometry. Among others, the authors performed meta-analysis studies on various biomedical items, cancer (Meijer and Geesink, 2017b), and neurological literature (Meijer and Geesink, 2018b), revealing the discrete EMF frequency pattern in a consistent manner.

The novel biophysical principle exhibits a mathematical background (Geesink and Meijer, 2018a), and was also applied to brain function and consciousness research, (Meijer and Geesink 2017a; Meijer 2020 a;b;c)) and also to 3-dimensional protein folding in integrate cells (Meijer and Geesink, 2018b). A very similar pattern of such as energy/frequency distributions were detected in water (Geesink et al., 2019), entanglement (EPR) experiments (Geesink and Meijer, 2018a). In addition, frequencies of the currently known elementary particles in the standard model as well as in frequency patterns of spectral energy gaps that promote superconductive properties were revealed (reviewed in Meijer and Geesink, 2018a; 2019). The latter aspect provided an interesting bridge between life systems and pure physical phenomena. It is of interest that recently GM-scale compatible spatio-spectral eigenmodes were detected in brain that can take either a coherent or decoherent frequency pattern. They fit with normally detected EEG gamma to delta brain states, and may be indicative for healthy and diseased brain conditions as studied in modern psychiatry (Geesink, 2012). It follows that some o these neural conditions can be treated by external EMF-exposure (Hamblin, 2017), who reported frequencies fully compatible with the GM-scale (Meijer and Geesink, 2019).

15. Sub-Quantum Inspired Universal Connectivity and Signaling Model, in Relation to Human Consciousness

Adrian Klein

15.1 Introduction

At the beginning, we address some of these conceptual tendencies, as seen from our possibly different perspectives. Further on, I'll try to discuss a few specific conjectures regarding life and its informational signalization systems, which ensure its interconnectivity in our sentient universe. The special function of toroidal attractors in matter and consciousness set-ups will be treated as supported both by supersensitive observations and recent experimental findings (Boyd and Klein,2007). Next, a theoretical attempt to extend the Stapp formalism for consciousness, based on Sub-Quantum (SQ) tenets), will be introduced, supporting a novel perspective on the brain's perception and action mechanisms. Finally, the presentation will give a diagrammatic representation of the SQ holism as a general expression of quantum sentience.

To put it clearly from the start, according to the SQ concept, that the author together with his long-term collaborator and quantum physicist Dr. R. N. Boyd, PhD, worked out during more than a couple of decades. We envisioned that *Information is no way originating in energy but the other way around*. (Klein & Boyd, 2007) The kind of Information, obviously addressed in the proposals of our highly educated colleagues in the present paper, is rather the kind of binary concepts describing artificial intelligence, where the object of analysis is a by-product of energetical systems. Yet, at a theoretical level, any mathematic/geometric approach to pure Information, as the mere component of intelligent and self-conscious systems, is non-sensitive to mathematics in its essence as an ontological prime, though its manifestations in the realm of matter/energy are. We consider that our current instrumentation is barely sensitive to only quantifiable forms of such manifestations through expressing them in various mathematical and geometric forms (toroidal geometry included).

Of course, we observe and think only in terms of physical reality which, until recently, was considered to be «all that is». Our joint challenge is to replace this philosophy by a new paradigmatic, post-materialistic worldview. This implies recognizing the hyper-dimensional sentient reality we live in, and the primacy of Information as a pro-active, naturally occurring and guiding agent in all our well-studied physical laws and their manifestations. This fundamental change of perspective is the prerequisite of further progress in sciences, philosophy and faith systems.

Actually, Meijer's, GM- scale content (Meijer, 2021), can be seen as a math operator, whose function of information selection from the ZPE superfluid quantum space wouldn't be possible without resonant frequencies that concur both from the SQ-driven subtle energy domains and the sub--Planckian quantum potential. We submit that information is selectively transferred across the ZPE barrier according to these resonances, that is under a higher degree of information operator control, acting on both of sides of the field.

-The universal connectivity code, thus, is *informatic resonance*, which is at the background of any energetic resonant systems, both in pre- and post-Planckian scales. Thus, the tenet of "resonating sets of Quantum vacuum" is perfectly accurate, provided they are *informatically* resonant.

-Consciousness, defined as the highest degree of information complexity known, is not scale-invariant by itself, but rather the tendency of increase in the informational content complexity is.

- We hold that, consciousness oscillates in a spectrum of relative nonlocality, as described by Prof. V. Neppe in his paper *Relative non-locality: Theoretical implications in Consciousness research.* (Neppe, 2014).

-The total entropy conservation law applied on pure negentropic structures, makes it even possible that the ultimate all-preserving interdimensional information balance between local and non-locality domains, can extend into post-mortal regimes.

The essence of Information and its related laws are to be addressed in their scale-invariant form and holographic projection across dimensions. The 5th dimensional phase-space, obviously accommodates Information in its endless degrees of complexity, but we realize that our analytic resolution works only in the referential framework of 4D manifestation domain. Beyond the latter, progressively refined taxonomic resolution modalities may well extend into far more epistemological dimension levels, corresponding to the Information variants of structural complexity. Obviously, self-reference, as an essential part of consciousness,

corresponds to the highest complexity level of organized Information, that just as its less complex variants, penetrates all the 4D conformations.

Life, in its biological meaning, is the expression of such a specific complexity domain, while biological evolution, representing Information bands of a higher super-implicated level, drives the sequential biomanifesting forms. This process corresponds to the particular Information complexity they have to express (Klein & Boyd, 2008). Biology follows a scalar complexity increase in the corresponding Information dynamics at its background and not the other way around. Dr. José Diez Faixat's (see section 3), toroidal evolution scheme, perfectly applies to our concept, that is, if reversed. Energy reflects the coupling aspect of initially undifferentiated proto-information fields with physical matter by interdimensional vectors. Its known (or still to be known) variants are limited by the 4D constraints themselves, being different from the practically infinite combinatorial potentials operating in the SQ, trans-Planckian domains.

Toroidal geometry is indeed a very attractive concept in our modelling attempts, as it may reflect some basic algorithms by which nature operates, especially in the way SQ flux variants flow into, form and guide their 4D manifested configurations. The way toroidal cyclic/spiral oscillations are invoked as a pertinent model of matter/energy-Information balance, is appropriate for the sake of clarity by simplicity. A cyclic/spiral trajectory in 3-D, can only be described in reference to our entropic linear time-flow. From higher dimensional perspectives however, we really see a non-linear conversion of Information into energy. This is controlled by a chain of sequentially higher implication fields of deterministic instances, according to "future" actualization matrices. Obviously, this multi- dimensional process is at the background of its concrete actualization forms in 4-D, conceived as retro-causation effects (Cramer's transactional interpretation of QM (**Cramer, 1986**).

Our basic understanding identifies the quantum potential as a superluminal SQ Information-carrying background field, able to interact with matter and physical forces at well-defined space-time positions, injecting their information content into our world of observables by modulating the event potential. This interaction is possible realizing that matter/waves exhibit a n-degree entanglement state of SQ complexity. This absolute void contains Information in its nascent, non-aggregative form if observed from our space-time perspective. The structure shows implicated layers of increasingly subtle pre-quantum domains, where each manifestation range may be organized in the form of coherent worlds such as our own, reflecting the transition state, at its own absolute void limit, to the next implication level of reality. This proposal has a strong outreach into anomalous, non-conventional exploration fields, (**Radin, 2006; Beauregard,2018, Hardy, 2017**), that clearly showed statistically significant results, and integrated into epistemologically sustainable blueprints. Our analyses address a pre-temporal range, in which an endless time-vector allows inherent resonance links in any SQ subtlety domain leading to sequential entelechial self-contented worlds. We hold that these primeval harmonic SQ resonances are the very pattern of our overarching cosmic harmony, the source of all conceivable manifestation and interconnectedness.

Any discussion addressing "signal mechanisms" and "connectivity", therefore, relates fundamentally to Information physics. Signalization, in order to be efficient, implies the alignment of two sets of Informational structures: an emitting and a receiving one. They can be of a similar complexity range, or may differ in complexity degrees. Overall, the outcome of such a signalization process implies a further increase in complexity, as often found in self-referent Information processing configurations.

15.2 Universal Informatively Interconnected Signals of Life

Recent views in biological evolution try to establish the minimum requirements for a bio-system to respond adequately to internal and external changes. These include various regulatory mechanisms which are subordinated to a spectrum of feedback-triggers. Such requirements imply that a successful alignment must arise, between at least two sets of Information, with each Information set active in different implication layers. Furthermore, this mutation/adaptation ability requests a higher order of Information control, according to higher attractor blueprints. Such a self-perpetuating open system of interlinked organic reactions, must be produced within the open system itself, both through self-organisation and guiding by a overarching final constitution.

As we know, RNA has the dual capability of both coding Information, and also acting to catalyse biological reactions. Replicase RNA, functions both as an Information code, and as catalyst, providing the template on which actual genetic replications are performed. The right self-replicating conditions, for activated mono-RNA nucleotide sequences into longer chains, imply that an original non-random frequency selection must exist, gradually evolving in increased catalytic speeds, finally leading to what was framed as Hordijk's "collective autocatalytic sets" (Hordijk, 2013). Such conformal conditions require coherent behaviour that can only be supplied by "teleological attractors", which can only operate along retro-causational vectors (future bio-system informational "blueprints), that eventually are physically expressed.

A special attention, in this respect, deserve bio-photonic regulatory pathways, vastly superior in their velocity and efficiency compared to the relatively slow signal mechanisms of neurochemical transmission. The superiority of bio-photonic regulations, has been proved in A.B. Burlakov's experiments, where bio-photonic activities, in the absence of any action by chemical/genomic activities, did produce obvious changes at the level of the life processes at stake, (**Belousov et al., 2002**).

Similar experimental results, leading to far-reaching conclusions are reported by P.P. Gariaev (Gariaev et al., 1990) concerning the ways chromosomal DNA control is implemented. He showed that the available coding by DNA matrices are, apart from the known transcription modes, are also supplied by DNA oscillation patterns in which the wave-functions provide a holographic system-memory. As Popp has pointed out, in order to implement efficient intra- and intercellular electromagnetic couplings, cellular photon emissions must have the qualities of multimodal and multifrequency oscillations, as have been used in Gariaev's experiments (see Popp et al., 2002). This implies high coherence of wave domains combined with harmony requirements, as shown in the increasing photon counts at increasing cell densities. This points to the essential roles that Informational control and guidance have, at the multiple scales of life phenomena. This results in groups of ontologically collective behaviour, at various integration levels. We hold that the conventional bottom-up and chemically-based biogenesis theories at the cellular and whole-organism level should be supplemented and/or replaced by more adequate top-down Informational tenets. In general, this type of regulation applies to all scales of physical manifestation since they are instrumented by Information that is provided from outside the given system.

Therefore, a new approach is required for an accurate understanding of the essence of life in relation to the organization of energy, shifting the pivotal attention to quantum Information fields in relation to the origination and patterning of life forms. As treated in the following, several scientific advancements paved the

way for our concept of a "Subquantum domain", providing a model with high explanatory potential in the framework of this novel paradigmatic trend.

15.3 Toroidal structuring of matter, the Compton Radius Vortex

Intuitively described for the first time by theosophy teachers, struggling to define structures at this subatomic level, the Anu (or UPA = "Ultimate Physical Atom") was envisioned as a heart-shaped particle present in positive and negative chiral variants, exhibiting radiating and vibrating shades. The structure was pictured as a polarized vortex of force lines in a spiral and self-referential pattern, that allows a recurrent super-physical flux of energy through it. This flux was seen as entering the core of the Anu at its top and leaving it at its bottom, thus binding groups of Anu in structures of increasingly high complexity. The low frequency of the non-physical force traversing the Anu corresponds to structures considered to be at 6 levels below the physical atom. Any increase of this frequency results in an increment in the spacing between these elementary entities, with tendency to link end-to-end forming quantum rope-like chain structures (**Fig. 40**).

Beyond the Anu concept, some scholars suppose a so-called "space between space", where the fabric of the origins is made of 12 levels of structure, distributed in dimensions, and subdimensions, (the features of Anu are suggestive for the symmetric operations of a 3-D vacuum wave physics). Thus, the integral whole can be envisioned as the universal background of life, from micro-scale photons to cosmic megastructures of our physical universe. **Sarkar's (1991)** "Microvitum" concept (**section 5.8**) extended the functional spectrum of Anu beyond its quantizing ability to a rather qualifying one for the internal coherence of all life processes. Sarkar's spiralling mode of Anu is strongly resembling a toroidal primary charge topology, suggesting an internal space of the symmetric operations, able to transform into physical space contending matter/energy dynamics. Toroidal charge topology is the substrate of intricate electro-hydrodynamics at the interface of two different media coexisting in an equilibrium state (**Smith, 2000,** see also **section 12**).



Figure 40. Intermingling of the ether diffusive flux vortices of individual nucleons. Source: LaViolette, P.A., The Cosmic Ether, 2011, p. 17

15.4 Novel Experimental Confirmation of Toroidal Attractors in Consciousness Studies

Brilliant experimental work done in clinical settings, that aimed at proving the hyper-dimensional function of the consciousness supporting brain, has been accomplished by Peter **Walling and Hicks (2009, Fig.41)**. It brought undeniable evidence for the contention that the percept (or qualia) is a multidimensional construct in projective space. The availability of powerful computers for data analysis resulted in an approach in the field of nonlinear dynamics.



Figure 41. Walling-Hicks EEG Attractors: The sequential increase of the dimensional correlates corresponding to specific attractors, associated with progressive recovery from deep anesthesia, plotted by Delay Co-ordinate Embedding: showing 1.5 D (point) to 1.5 D (periodic) to 2,5 D (torus) to 3D (Chaotic) attractors, as estimated by "correlation dimension" method, are shown as progressing from unconscious to totally conscious state. Upper field of indicated broken line: attractors, Lower field: corresponding EEG patterns, both in frontal and lateral views.

The signals were analysed according to non-linear dynamics and showed distinct patterns with attractor dimensions that invariably went from point, periodic and toroidal patterns before the chaotic brain pattern emerged. As seen in the observed sequential EEG attractors of Walling-Hicks, during recovery from deep anaesthesia and thus total absence of consciousness to full conscious state, torus attractors, marking the recoupling process of active mental processing to its neural EEG background, preceded the chaotic one, which is the signature of pure hyper-dimensional information dynamics in conscious awareness bands (**see Fig.40**). From this, we may understand that the torus geometry corresponds to the interdimensional link between any

informational structures and the matter/energy domain and not only to their self-referent state that is a marker of consciousness (Fig.41).

Brain dynamics were shown to progress from periodic to toroidal to chaotic attractors in a nonlinear fashion, where with each jump to a new kind of attractor, the attractor dimension increases and at the time of return of consciousness the appearance of 3D attractors is evident.

Observing the emergence of conscious awareness from a deep anaesthetic state, we see that hyper dimensional integration gradients into SQ-mediated Information fields are dependent upon the quantum states of brain. The **Walling-Hicks (2009)** research results, therefore, are of a paramount importance for an accurate understanding of the individual self-conscious structure of the brain (as the interaction tool of the Self, with relation to an energy-defined ambient reality).

Meijer et al, 2020, also discussed the Walling theory: "The smallest attractors registered (1.3–2.0 dimensions) are also demonstrable in subjects that are meditating or at prayer. Under these conditions, the conscious mind is closed to the senses while the subject concentrates on the prayer or meditates. In contrast, the highest number of dimensions was detected at multitasking. The team has also shown evidence of nonlinear dynamic activity in the brains of animals, activity that seems to increase in complexity among various species in a logical progression. To look for signs of nonlinear dynamics, the team again manipulated data from electroencephalographs of 11 different fauna: anemone, starfish, earthworm, moth larva, crayfish, minnow, perch, catfish, frog, dog, and human. This was done in order to see whether an increase in mathematical sophistication across species correlated with preconceived notions regarding evolutionary ranking in the central nervous systems of the animals. The electroencephalograph correlation dimensions from the 6 animals were plotted against their age as estimated from the fossil record: anemone, 700 million years; crayfish, 650 million years; bony fish, 490 million years (mean of perch, catfish, and minnow, D2 = 2.65); frog, 245 million years; dog, 65 million years; and human, estimated at 30 million years. They showed that the greatest attractor dimensions for these species increased steadily during the period of animal evolution. The shape of the curve took the form of a logarithmic spiral, obviously being self-similar. The authors noted that such typical pattern may be seen throughout nature, from the arms of spiral galaxies to the arcing shape of the shell of the chambered nautilus. Thus, the more variables there are in a nonlinear system, the more dimensions are needed to accommodate them".

Thus, hyper-dimensional integration gradients into Sub-Q-mediated Information fields are locally dependent upon the deterministic quantum states of Brain, which are in turn, hampered during anaesthetic impairments of the supposed regulating London force effects associated with hydrophobic pockets in functional proteins, and thus at the level of nanoscale biomolecular events. This explains why lower subsets of organism integrations, governing vital functions, which are able to disconnect biological ground processes from their projective space consciousness correlates, are preserved during anaesthetic depth values, As an unavoidable, absolutely compelling consequence, conscious processing of environmental events may freely evolve during this disconnected state, leading to SQ memory patterns which are being dynamically stored in their phase space-time, and subsequently re-supplied to the individual, for post-anaesthetic recollections. Such recollection instances are abundantly described in the literature as "Psi- events" of the OBE and NDE kind. Just as at biological resolution level, chemical energy patterns have Information propagating efficiency. Unimpaired conformal functioning of collective neural assemblies are required for up-scaled integrations of Qualia, in order to provide meaning into the Self during the coupled modus operandi to Brain. Anaesthetic impairment at low integration levels propagates in cascade-like dysfunctional arrays across the higher integration structures of Brain. This results in Brain's transient functional dissociation from the self-conscious entity. The duration of such instances may vary from consciously unperceived micro-blackouts in the stream of consciousness, for example through short-term CNS hypoxic effects, controlled efficiency windows of anaesthesia, to long-term, so-called, "vegetative" preservation of vital functions. Beyond this reversible connectedness threshold, experimental and experiential evidence strongly supports the presence of unimpaired cognitive functions, operating on their own. They likely represent separate, SQ integration domains, which apparently are able to overcome the general anaesthetic state. This phenomenon can be perceived as a lowering of entropic states, which of course can occur in both biological and non-biological systems.

15.5 Toward a Sub-Quantum-extended Stapp Formalism in Information Signalling and Cognitive Functions

For those readers, sufficiently familiar with Stapps' leading theory regarding consciousness and free will, it may be realized that it leaves open the question how the Self selects the content of its query and how "Nature" selects its choice. These are indeed the elusive, yet most fundamental, components of the Stapp model, which still need to be solved (**Stapp, 2017**). In his current formalism, Stapp clearly leaves open the question of nonphysical origination, as potentially situated in a domain of causally effective hidden variables, and in particular, the free will, or better the free choice. Moreover, Stapp ascribes the "Dirac choice" to a very fuzzy and poorly defined "nature's response". Thus, in Stapp's description, the boundaries of the von Neumann chain are ontologically indefinite, leaving the already well described probability aspects of quantum processes the only explanatory component obeying the so-called uncertainty principle in Quantum laws.

Our Sub-Q approach claims to supply a first acceptable extension of these poorly defined details of Stapp's theory concerning of the von Neumann Quantum chain. This idea entails an accurate deterministic defining of the very sources both of the Heisenberg and Dirac choice events. Amazingly enough, both interpretations not only turn out to be of a similar Information consistency, but at the same time represent the terms of a coordinated global meta-process by their inherent causal link. Further on, we may suggest a similarity between Stapp's "action potential" and a certain *"reception potential"* ascribed to the primary processing of parallel sensory multimodal inputs. We emphasize that our considerations rely upon the fundamental difference between the high-velocity Sub-Q-Informational propagation domain versus the Quantum-limited velocity of neural processes that runs as a correlate under its control. The Stapp Quantum mechanism for the setup of the readiness potential in prefrontal cortical areas actually runs in Quantum domain.

In order to complete our understanding about the parallel processes running in the Sub-Q range, which allow for the alternative setup of the Stapp chain, we suggest a careful consideration of the chart below in **Fig 42**. The readiness potential (in red) is the Quantum observable process displayed in classical electro-neurological terms. It runs in both [+T] and [-T] quadrants of the Quantum domain. Of note, its true origination can be described only by considering parallel Sub-Q processes, *extending in both Time directions* (**Fig.42**.



Figure 42. Objective Q versus Subjective SQ regimes in time symmetry: A 4-quadrantic representation of a time symmetric information loop in Quantum/Sub-quantum range: **In red**: Readiness potential running in both T+/T-time quadrants of the Quantum domain. **OEv**: Objective Quantum event in future (Stapp's "absorber agent"). **SqE** : Corresponding Sub-Q representation of OEv contending both yes/no actualization variants.

SqE is projected by a SQ operator into a time-symmetric, virtual, subjective, subconscious "commitment".

"Commitment" (assisted by an objective event potential) exerts a trigger effect in negative time (-0.35 sec) for initiating a serial bundle of readiness potential. At it's peak value (To) the "commitment" places the request for possible validation (Heisenberg request), which is a time-symmetric counterpart of the preselected confirmation in actualization range. Further details in text.

An objective Quantum event, predetermined by super implicated orders of reality and actualized in the future, X+, (corresponding to Stapp's "absorber" agent) has a Sub-Q structure, hereby represented by a projection into Sub-Q domains in both its possible actualization variants (+/- stands for yes/no). This Sub-Q structure is projected by a Sub-Q operator as a Po projection into a time-symmetric virtual subjective potential "*commitment*", postulated to arise from a conscious self. This projection runs at superluminal velocity (not prohibited in the Sub-Q regime).

The subjective, virtual "commitment" structure (y+/y-), assisted by the objective event potential Qe, exerts a trigger effect in negative time (~ -0.35 sec) for initiating a serial bundle of readiness potential action waves in the prefrontal cortex. At the peak value of the thus initiated RP, (To), the virtual potential structure y+/y-places the request for possible validation of the initial Po-transferred options. This request is the very time-

reversed counterpart of the preselected confirmation in actualization range +T1, completing the causal loop in the time symmetric frame of reference.

Of course, the evolution of the readiness potential obeys the low-velocity constraints in physical energetic range, while the Information operators (at this stage P1a) may virtually act in quasi-null time. The "conscious query" corresponds to the (To) Quantum peak activity of the Readiness Potential: [+P1b]. The actualized event's quantum blueprint, projects at this stage a second "confirmatory" signal in reversed time vector, signal that acts upon the still evolving Readiness Potential (RP). As a consequence of this impact on the RP, the Sub-Q conscious structure y+/y- reacts to P1b by radiating a rapid string of projection operators P2 which stabilizes the P12b Dirac response by the so called "Zeno Quantum effect, ZQE", leading to the collapse of the Schrodinger quantum function, resulting into physical action that corresponds to the double "confirmed" informational pathway. Of course, for the virtual negative probability variant [P1b-] of the Dirac choice to the Query, no P2 Zeno stabilizing effect is issued.

Please note that all the processes running in negative time domain, as defined by the conscious participant instance in both directions of time, evolve in the *self-aware entity's unconscious range*, while the intent-related component (or "will effort"), evolves in positive time. This controlling effector neural pathways, is needed for the physical integration of the Self into its energetic environment.

15.6 "Sub-Q holism as a General Expression of Quantum Sentience

The self-directed neuroplasticity reveals that direct mental effort affects cerebral functions systematically and predictably by a clearly obvious causal function, which is, after all, the basic principle in whole physics. The influence of mental choice data with the quantum status of a system (brain or other life systems), at any given point (plane) of time, may be expressed in basic mathematical formalisms, similar to the one describing intraatomic phenomena. This is so because at Quantum level Sub-Q background processes work as hidden variables following their own dynamic laws.

In Brain, the ion-conductance channels and trans-synaptic chemical dynamics obviously obey classical Quantum formalisms. The origins of conscious effort are, in principle, not untraceable (as suggested by **Stapp**, **2017).** They are associated with the conscious entity's Sub-Q Information structure, working as an effector component of the non-local hidden-time Sub-Q loop, as described by **Cramer's**, **1986** transactional interpretation of QM.

In our extended model, "Nature's Dirac response" is the informational origination trigger that acts in timereversed vector *for setting up the particular Query,* according to presets, determined by higher implication orders of Information content. This is the mechanism at the background of the emotion related resonant reframing and re-contextualizing in the prefrontal cortical range. The latter by the original query that triggers the selective redirection of neuro-energetic response from lower limbic system. Brain's only task is performed by von Neumann's Process 2. This is the Quantum activity binding both information-controlled domains, described in Process 1 and 3. The readiness potential (in red) is the Quantum observable process displayed in classical electro- neurological terms. It runs in both [+T] and [-T] Quadrants of the Quantum domain. Nevertheless, we hold that its true origination can be described only by considering parallel Sub-Q processes extending also in both Time directions, (**Fig. 43**).



Figure 43: Sub-Q Brain-mediated perception mechanism: A 4--quadrantic representation of the timesymmetric, Q/SQ Information perception loop. **qE**: Objective quantum event. **sqE**: SQ spectrum of qE, retroprojected in time into a "fuzzy precognition" in Self (FPr). **FPr** in brain initiates a multimodal coherence map by perceptive neural synchrony informatically resonant with incoming external signals. A brain-originating decoherence operator impacts the coherence map, producing the alpha-quantum delay of actual perception data, reprojected into Self in a re-averaging Q/SQ perception loop.

Therefore, we cannot fully agree with Stapp's contention that the intentional action depends partly on the state of the quantum system acted upon, as included in Heisenberg's "space of action". We see in the effect of Process 1 the consequence of the preliminary signalling, emitted from the future space-time configuration by a hidden reversed time propagation. The latter is able to render the intermediary Quantum chain responsive, and thus aligned to the phase 3 Dirac choice, in tis way tuning the Brain's Quantum reactivity to the outcome state of the system already present in the intentional effort. Cancelling this loop (by cancelling the ZQE) is a correction option for inaccuracies in the retro-causal output at the query level of the mental agent. In other terms, the accuracy of the Sub-Q-mediated Process 1&3 loop is validated by the ZQE

At classical physical levels Process 2 runs through nerve terminals and synaptic ion-channeling mechanisms, leading to the coherent state of specific whole-brain firing map required by the primary predetermined outcome. which is collapsed from the cloud of Quantum potentials associated with the Ca2+ ion's behavior. In our view, Brain's action template originated in mental action, the von Neumann Process 1 is a really "free choice" only from the agent's perspective alone. From the Sub-Q loop's perspective, it is a controlled input variable, aiming to complete the loop.

Further on, Pashler's parallel sensory processing that runs under micro-modulators is NOT an instant effect (neural ionic processes involved), but its *output* for further "post-perceptual" processing (by von Neumann Process 1) is received as a unitary structure that, once integrated into the global conscious Self, "selects" the corresponding initiatory effect of Process 1. This is a complementary spectral array of Sub-Q vectors acting upon the Brain's Quantum state sequentially. This in order to fit Brain's temporal low-velocity processing needs, (**Fig.42**).

The high-deterministic future preset condition is a multipotential probabilistic state, sent backwards in time as a Sub-Q substrate. The latter is able to be acted upon by the resonant components of the Self, provided that a readiness potential is in place. A bi-level Sub-Q implication is at work, comprising both a super-implicated origination of the primary Heisenberg choice and the implicated morphogenetic potential that by the R.P, makes a confirmatory response possible in Brain-mediated modus operandi of the Self. As in Quantum terms projection operators obey the P=PP rule, the Sub-Q input represents a double (multiple) projection operator, initiating both the cortical brain subspace (readiness potential) and the Heisenberg choice's content related to its instantiation. These both are neural correlates of the conscious process evolving in the physical energetic realm of manifestation.

The Sub-Q model allows both for the von Neumann/Stapp ZQE and the causality violation at the level of Schrodinger probability collapse (Process 3). Conscious choice enters as an irreplaceable free input variable in the Sub-Q retro-causality projection system. Moreover, the Sub-Q superluminal impact variant, ensures applying strong and super-fast coherent pulses via ZQE, which decouple the system from its decoherent environment. Our conceptual frame describes both the Heisenberg choice and the Dirac response as Informational in nature, shifting away from Stapp's rather "materialistic" implication of "Nature" in the process 3. This approach allows in Sub-Q regime the controlled resonant time-symmetric interplay between the "query" and "natures" response. In conclusion: the readiness potential originates in the informational value of "nature's YES response, which thus is correlated both to advanced "commitment" status of the Self and the "Question" at its peak value.

Thus, the high-deterministic, future-preset condition is a multipotential probabilistic state sent backwards in time as a Sub-Q substrate, and able to be acted upon by the resonant components of the Self, provided a readiness potential is in place. A bi-level SQ implication is at work, comprising both a super-implicated origination of the primary Heisenberg choice and the implicated morphogenetic potential that makes (by the R.P.), a confirmatory response possible in Brain-mediated modus operandi of the Self.

Objective Event (E) energetic structure spectrally decomposed in Sub-Q Informational units and combinatorials are retro-projected in time (Po) and perceived as unconscious time-symmetric representation in T- by the Self. Consequently, the Self initiates an attractive coherence map of integrated multimodal perception/processing areas by global activation mechanisms on the Brain (supported by recent studies about Brain's structural asymmetry) - P1. The resulting global brain-filtering apparatus reacts selectively to the external (sensory) input data by an attractor/resonant effect.

The neural network's *coherence* itself can be best explained by the Sub-Q spectral decomposition of each component into a sum of Information-driven flux vectors (see **Fig. 43**), which align in a resonant outcome according to the main Information vector that has to impact the Quantum process in a pre-determined way.

This resulting Informational complexity vector is able to recruit morphologically highly-distributed neural areas into a shared collective action. The latter is required by the particular task in the given circumstance and specific position on the bidirectional timeline involved. The result of this resonance is projected sub-quantally into the Self as the accurate version of the originally fuzzy representation in precognitive range - P2. This occurs at a delay corresponding to the slow neural processing (alpha). The "alpha" segment represents the Brain as statistical operator (reduced density matrix - S (t) - under decoherence effects, by preselected reaveraging of all non-brain degrees of freedom (**Fig. 43**).

15.7 Sub-Q Holism: Interdimensional Holographic Concept

For a synoptic perspective on the universal holographic interconnectedness and its corresponding signalling pathways, as seen in the sub-quantum interdimensional concept, let's try to represent it diagrammatically by an analogue approach as to the creation process of a hologram (**Fig. 44**).



Figure 44. Sub-quantum-Holism diagram: Metaphorical analogy between Sub-Q holism and classical holographic process. Observer as percipient of Informational structure both by direct Sub-Q impact from the Quantum Potential and its time-encoded reflection from the 4-D Quantum reality. The global overarching cosmic harmony (ultimate source), is channeled at infinite velocity through the Sub-Q plenum into the Quantum Potential. By drop of velocity, the quantum potential gets diffracted into a D-4-sensitive vector and one that is directly impacting (by ES ways) the observer. The assumed Observer has feed-back ability for the D-4-reflected vector, and thus is actively participating in the set-up of reality.
Here Observer stands for the nonphysical self as an active contributor to the setup of "Reality", without being itself embedded in it. This is realized by a double emission/reception act of the same information that is projected and stored in the 4-dimensional physical Reality (Brain) by time-symmetric EM/gravity-related photonic mediators. The time-encoding of the information, implying the Observer, is performed in hidden variables of time acting as described in Cramer's transactional interpretation of the QM.

The diagram also displays the subluminal velocity regime of neural conduction responsible for informational input and transmission in neural networks, reached by the drop of velocity from close-to-infinite values in Sub-Q-flux domain. Moreover, it illustrates the transition process from the Sub-Q Plenum as a total intent expression in infinite velocity. The omni-directional propagation variants to Quantum-potential sensitive values, are detectable by energetic sensors in Brain's Quantum activity.

16. Final Remarks and General Discussion

16.1 General Features of Consciousness

From the foregoing sections, it may be clear to the reader that the item of super-dimensional communication through resonance with a sub-Planckian information domain is central in our considerations on information signalling in the Universe. In relation to (self)-consciousness, this was envisioned as a mental workspace operating in 5D context assuming one extra spatial dimension in addition to the three spatial dimensions and one time dimension as known from our experienced world, (Fig.45). The latter opens up the crucial question on the role of the observer in the perception of realty. With regard to our view on consciousness it should be stressed that there are major, but sometimes also quite subtle, differences in terms when we try to comprehend consciousness. We certainly should discern conscious states, to have consciousness, to be or to have conscious, to perceive self-consciousness or to be in consciousness. Apart from the subjective and strict individual aspects of consciousness, related to our intrinsic knowledge of intrinsic qualia, the central question is whether all life forms operate from a collective context and thereby participate in what is called a universal consciousness (Meijer, 2019). Clearly, the roles of observer and participant come together in a cosmic context, in the above-mentioned frame of being in consciousness. We submit that consciousness is an ubiquitous cosmological principle of the universe that pervades atoms and molecules and that should be conceived as an prime attribute of reality and organizing power, with the properties of light (Meijer, 2012). It should be emphasized that the feeling of belonging to a greater whole can have major impact on the way we see and experience our fellowman and nature in general. One aim of the present study is to clarify how fundamental connective principles can determine the fabric of reality and consequently our own existence in the realm that surrounds us.

The first effect of peace, according to Whitehead, is a surpassing of personality and the removal of the stress of acquisitive feelings arising from the soul's preoccupation with itself. Thus, peace is self-control at its widest, "at the width where the 'self' has been lost, and interest has been transferred to coordinations wider than personality" (Whitehead 1967). Capra and Luisi (2014), call this new science "the systems view of life" because it is grounded in "systems thinking," or systemic thinking — thinking in terms of relationships, patterns, and context). Through the exchange of ideas in their interdisciplinary networks the scientists realized that living systems, in contrast to mechanical constructions, are integrated wholes characterized by their

relations, their properties being different from those of the smaller parts. Consequently, systems theory involves a shift of perspective from the parts to the whole. The essential properties of a living system thus arise from the dynamic connections among the parts. The interconnectedness between organisms and their natural and societal environment has several consequences. The systems view of life shows us that all living systems share a set of common properties and principles of organization: the systemic principles of life. Throughout the living world, we find multileveled structures of systems nested within systems. Each individual system is an integrated whole and, at the same time, part of larger systems.



Figure 45: Double rotational holo-flux of information in a toroidal geometric model showing two intermingling wave trajectories with each having diverging and converging energy modalities that reflect the generation and compression of information as being related to Dark Energy and Gravity forces respectively. They can also be envisioned as entropic and negentropic energy forces. Each wave arrives at an intrinsic boundary (blue arrow, middle) and subsequently returns to its origin in the Torus core that, via quaternionic (inside to outside) transition allows opening to a 5-D domain. The latter dimension is by some regarded as a superfluid quantum space representing a sub-Planckian (primordial) domain in which the zero-point energy (ZPE) field is a transition zone to the 4-D world we know. The 5-D domain bears discrete sets of harmonic EMF frequencies (musical master-code) that are supposed to act as pilot-waves guiding particles in the fabric of reality. Note that, from the perspective of the supposed 5-D superfluid sub-quantum space (to be regarded as a homogenous manifold, see **section 5**), the torus operator is created in the process of symmetry breaking from the 5-D phase-space, mentioned above, to our 4-D reality, (see middle blue arrow).

Another important property of living systems is their resilience. They are able to absorb disturbances, reorganize, and retain their effective functioning. This resilience is closely connected with the system's diversity. A diverse ecosystem, for example, will be resilient, because it contains many species with overlapping ecological functions that can partially replace one another. Ethics is usually associated with philosophy or religion, but it can also be considered from a scientific, or perhaps, from a scientific and spiritual perspective. When we study the long history of the evolution of life on Earth, we come to realize that nature sustains life by creating and nurturing communities. Cooperation, based on dynamic dialogue, allows more integrated solutions than the mechanisms of an atomistic and competitive economy. Equality and mutuality among the involved actors are necessary conditions for constructive cooperation. Also, the crucial aspect of organic interconnectedness and meaning-based causation brings value and quality into science and the central role of information should be seen as not simply descriptive but rather prescriptive (**Meijer, 2018**). It is not only syntax but also semantics and any moral system is based on information preservation and maximization in which information is a difference in form that makes a difference in content (**Meijer, 2013**). In this context, meaning represents the activity of information and both principles can now be extended to physical laws and been applied to all matter.

It has been rightfully concluded by **Schmitz et al., 2011** that the current view on the human condition is a result of consequential historic process implying a reductionist objectivation of lived experience culminating in the invention of the "mind" or "soul" as a private inner realm, thereby intrinsically reducing lived experience to a value-neutral objective reality as presented to us through the sense organs. Instead, the authors propose a holistic exchange of corporeal dynamics and *a vibrant attunement to meaningfull surroundings*. This is related to affective involvement as an immediate, pre-reflective, not yet articulated, self-consciousness. This implies a consciousness without identification but fusing the dimensions of here, now, being, this and I. Self-consciousness, therefore, is always *self-ascription* in an attempt to giving an account to oneself. Yet, in turn, self-ascription can only be based on self-consciousness without identification with the environment

It is of interest, in this respect, that the complexity of the human brain has been compared with the informational structure of black holes as a toroidal information processing structure, (see **Fig. 45**). The black hole exhibits an intrinsic singularity that, if modelled as a Clifford torus, opens to a 4th spatial dimension (**Fig.45**). The processed information, at least according to quantum physics, cannot be lost: it is both mirrored via the singularity in a sub-Planckian quantum domain and holographically projected onto a surrounding screen with Planckian type of information: *the event horizon*. The latter represents a scale invariant modality for any information containing object, and consequently was also postulated to be associated with the brain structure (**Meijer and Geesink, 2017**). From this horizon register, information can be returned to the universe as a remembered source of information that, as one element, may provide the total information for the potential rebirth of our universe in a conformal cyclic cosmology context (**Penrose, 2012**, see **Fig. 46**). The particular micro- to macro information "data bank" is in fact a self-similar (fractal) constituent of cosmic reality (**Fig. 39**), bearing a holographic character that we regard as the prime candidate for universal connectivity and collective signalling.

Another linking pin in connectivity is obviously gravity and its counter force dark energy. With regard to these basic forces, the holographic principle was also applied by **Malcadena and Susskind**, **2013**, showing that there is a correspondence between physics theories including gravity in d dimensions and theories without gravity in d-1 dimensions. It should be realized here that holograms are 2-D projections of 3-D structures in which each

part of the hologram can represent the entire picture, an aspect that is also seen in fractal representations. If string theory will ultimately evolve in a theory of everything, it is noteworthy that string theory with gravity in a 5-D AdS space is related to to a supersymmetric 4-D quantum field without gravity, again pointing at a holographic relation, (**Fig. 46**).



Figure 46: Holographic model of the Universe on the basis of a 5-dimensional Anti-de Sitter spacetime with a spherical event horizon showing Black Hole and elementary particles projected on a 4-D flat hologram

It is clear therefore that the 5-D Sub-Q domain, as proposed in the present study, may represent the deep connection between an underlying information field (Bohm's implicate order), consisting of basic frequencies from which all forms of reality are unfolded. This process is reflected in the bidirectional mathematical process of Fourier transformation (see the reviews of Shelli, R **Joye, 2016, 2020,** see also **Fig.39**). The hypothesis of Bohm regards consciousness as a cybernetic process, picturing a holo-flux transforming two different expressions of information between two orders of being: a spectral Sub-Q implicate order frequency domain as a non-local holo-sphere and a frequency spacetime domain. This undivided holo-flux of energy resonates with electromagnetic energy in spacetime and since signals are more readily superpositioned and manipulated within a frequency domain than in a time domain, the well- known Fourier-transform equations, became an important mathematical tool to express transmitting signals between such domains. Interestingly, the same mathematics was earlier used by **Pribram,1971** for the holographic description of memory building and storage by dendritic wave interference in the human brain. The abovementioned collective studies again point at the possibility that the observed connective micro-brain organization and cosmic macro-structures exibit similar features of quantum neural networks (**Vanchurin, 2020**).

Fig. 47, lists the current models that are proposed to describe the self-learning, self-observing, and potential self-explanatory and/or cyclic Universe in physical terms. This in comparison with the

supposed layered organization of the mental attribute of our existence (see inset of **Fig.47** above) that culminates in our "higher self" in a transcendental relation to the universal self. This integral process is shown to occur via informed matter, aspects of feeling, mind and self, and in particular on the basis of typical human intuition and free will. In earlier work (**Meijer, 2012;2015, Meijer et al., 2020 a b c**), the becoming of the universe was described likewise as a participatory process in which the universe creates intelligent life in order to enable its self-observation, information integration and guided cosmic evolution. These integral processes, ultimately may be instrumental in healing the broken relation between mind and matter (**Meijer, 2012**, see **Fig.47**, **inset** for further explanation)



Figure 47: Current models proposed for the Universe (modified from Paul Davies). A more extensive review on this topic can be found in *Ramzan, 2018.*

16.2 An Integral Concept of the Fabric of Reality.

As we have shown in this review, there is mounting evidence that mind can act outside of space and time, and that the brain perse may not be required for the existence of mind and consciousness. The evidence presented, including studies of Psi phenomena (**Meijer 2018**, **Meijer et al.,2020**, **Klein, 2020**), suggests that the impact of the mind is not confined to space and time, nor closely restricted to the brain and body, since mental intentions can influence at a distance the activity of physical and biological systems screened from all conventional physical influence. The present authors in their various contributions to the present paper clearly agree on a number of central principles:

- The fabric of reality requires a mental attribute in order to understand its creation, becoming and final fate

- Reality is partly hidden from human observers due to an essential 4th spatial dimension for describing physics of the universe in a quantum physics context
- A Sub-Planckian domain, also seen as a homogeneous wave manifold, bears the mathematical and geometric relations as a boson condensate, for building the animate and non-animate worlds by symmetry breaking from the 4-D to 3-D worlds
- Toroidal geometry is conceived as a likely operator to integrate trajectories of energy and action that describe the processes of life and evolution
- Brain function in general and consciousness on particular require a field-receptive holographic workspace that bidirectionally communicates with the neural system and functions as a time reversed double for individual information storage being necessary for supervenience of the brain processes and error correction
- We submit that in the information integrating and information processing brain two different communication mechanisms are instrumental: the known neurotransmitter neuronal pathway and a much more rapid photonic signalling that also includes quasi-particle electron forms guided by light and sound such as solitons(polarons) and polaritons
- This event horizon information workspace is associated but not reducible to the brain structure and may represent a permanent individual information matrix that in principle is immortal and may explain BDE and reincarnation phenomena (Meijer, 2018; Klein, 2020)
- Consciousness is a human but also a non-human faculty, and can only be understood if the brain acts as a receiver of (primordial) information in a quantum mechanical context, implying non-local communication, entanglement as well as interacting electromagnetic and ZPE fields
- Among the many models for the cosmos the authors favour a non-material modality that assumes that all life and intelligent beings are part of an all-pervading universal consciousness: *our universal self is in consciousness* (Fig. 39)
- The presence of a cosmic consciousness with its universal connective aspect is regarded as the foremost crucial element of our world, the survival of our planet and a further evolution of our cyclic operating universe
- Within the material Universe, a spectrum of signalling processes guarantees the connectivity of the whole cosmos, including electromagnetic fields that provide a series of semi-harmonic "musical" waves, zeropoint energy field, quantum entanglement, non-locality and tunnelling, in addition to conductive elements in cosmic dust metal-doped and H2O containing phyllosilicates as well as recently detected gravity waves.
- The universe should be seen as intrinsically self-observant, among others by its intelligent species, building up its own memory and holographic information space, exhibiting a multi-layered (fractal) structure from black holes down to the micro-conditions of the Planck scale, also fed by primordial information.

16.3 Sub-Quantum Field as a Holistic Brain/Mind Interface

This preference of the present authors is reversal of the common bottum-up information algorithm, into a top/down approach, while keeping of course in mind that both are complementary and interwoven aspects of the same *"Whole Reality"* we try to understand. This leads us to have a world-view starting from Information structures imprinting corresponding modulation patterns into the Quantum formalism. With regard to brain function, such a starting point supports the assumption that subjective, non-local space/time configurations are pro-active domains, instead of emergent modalities of neural systems. This working hypothesis may have serious bearings upon the orders of reality we have to consider, with possible ground-shaking consequences in the more philosophical context.

In this view, mental/brain causal mechanisms are not "random" but purposefully deterministic. Poorly explained non-linearities, randomness, apparently chaotic settings or outcomes observed at the local level of quantum processes in very short time resolution frames are often misleading. Such processes should be treated in the broader perspective of integration into higher levels of congruences and their low-entropic macroscopic results in observable manifestation, by some erroneously featured as their emergent properties. Instead, the microscopic to cosmic order, arising from quantum chaotic events, points to a reversed entropic vector not merely counteracting the physical one, but portraying it as "matter-of-fact universal attractors".

Consequently, *reality* is a whole, and not a random product of "probability variants" that never ever are, or were meant to be implemented. A time-symmetric causality (running in "hidden-time" as hyper-dimensional loops) is determinant for the actual Schrodinger wave collapse, producing sequences at specific spots in well-orchestrated landscapes. This cosmic architecture runs under higher orders of implication Informational guiding processes. Classical QM models amenable to mathematical treatment, miss the fundamental non-quantifiable guiding Information essence and therefore disqualify as pertinent analytical tools for scaled processes, running beyond usually invoked effectors and modulators, since they are at work in their hyperdimensional background. This implies that the hitherto quite elusive, brain/mind relationship might be closer to a holistic solution than before. This leap has been made possible by some quite recent developments in QM concepts, which are compatible with our Sub-Quantum tenets and related fundaments in Information physics. Consciousness and cognitive functions may relate to brain's quantum sufficiency, in a way that is compelling, if an effective dimensional interface is positioned between the Self and its ambient ecosystem.

The earlier shown interference hologram model of brain, assumes that Information's ontological distinctiveness is a prerequisite for its ability to generate and participate in holographic matrix configurations. The best way for modeling Information is emphasizing its hyperdimensional coupling modalities into energetic infinitesimals (as proposed by sub-quantum models). This view has an enormous explanatory potential in fundamental QM events too, such as in the quantum tunneling. The latter implies a particle's re-forming around its own Informational matrix (assumed to be actually traversing the energetic barrier unimpeded). Interestingly enough, this description also applies to cosmic scales, where "black hole"-like singularity positions that can be transcended by a hyper-condensed essence of information, originating in extinguishing "past" universes creating new ones (see the opposite world-cones convergence points described by **Hardy, 2017**. At such singularities, no space or time exist. They represent the pure information bridge between two sequential universal space-time reference frames, in a pulsating no-beginning-no-end pluriverse scheme.



Figure 48: Three levels of consciousness derived from primal universal or cosmic consciousness, the fractal (inside/outside flux). Note that Sub-Planckian and Cosmic Event horizon domains are mutually coupled (see arrow).

At neurophysiological scale (**Fig.48**), the relatively high-speed Information transference that is associated with short response times in the functional domain that contrast the slow-propagation mechanisms observed in the neurotransmitter one. This may well relate to heightened information flow rates in non-local media vs. the local space-time signature as imposed by classic relativistic and quantum laws. A quantum-diffraction process into constituent Sub-Q spectra may be at work, resulting in information storage/carrier systems with widely more efficient trigger and integration efficiencies. Fractional charge and spin values are probably also involved. Protein conformation perturbation effects associated with ultra-fast action potentials inside the cell, can be conceived now as running in projective Hilbert space rather than the conventional 3-/4- Dimensional one. A still higher velocity informing mechanism, that can affect protein configuration be conjectured due to retrocausal propagation vectors.

How all this relates to the "Individual Universe" of Self, its data-processing abilities and Information storage in non-local memory banks? How can Sub-Q physics extend, complete or improve current QM views? Experiments of trapping single atoms and even electrons by fine-tuned laser beams, proved that electrons may be locked between a couple of different energetic orbitals, thus confirming the further divisibility of quanta, as proposed by the Quantum Hall Effect. This has been correlated with the atom's apparent fluorescing behavior that stops at the instance of the particle's decaying out its locked energy position (**Minney et al., 2009).** At a closer scrutiny, a quantum jump becomes experimentally predictable, pointing to a deterministic mechanism at work rather than a fundamental randomness (please note that we use here the term "deterministic" in the sense of sensitivity to Informational control, not in its classical meaning). Such "determinism" is ultimately

implemented in the form of coupling information resonance effects between potential and actual quantum superposition states.

To begin with, conventional thermodynamics addresses matter-related energy up till the entropy barrier of the ZPE field where the quantum void is described in the context of systems boundary. This near-zero energy boundary is supposed to show wide fluctuations inside the pre-quantum regimes that can be envisioned as the gateway to the terrain of "dark energy". Also at a biological level, the omnipresent ZPE is proposed to be used by biological units (cells) for interconversion of information states available to it. Mukhopadhyay's "triple transcendence" scheme is in this respect a useful metaphorical description of the hyper-dimensional interactions that we support in the present paper (Mukhopadhyay, 2020). In cell biology, macromolecular conformational changes can't be fully accounted for without postulating a direct access of such molecular configurations to the "dark energy" domain at the ZPE interdimensional barrier. Seen at its own resolution level, Information may be treated as factorizable into content, intent and a third fraction that reduces uncertainty in physical systems. This spectral analysis holds true for sequentially increased combinatorial forms of Information, as well as in the ceaselessly ongoing symmetry-breaking and symmetry-making processes in life systems that, trough morphic resonance are recorded and stored as cellular information and integrated to collective life experience. This chain of increasing complexity in Informational configurations is reflected at biochemical level by the transitional chain of "signal" polypeptides, into quaternary proteins with conformational symmetry, to spherical highly complex protein forms.

If it comes to genetic regulation basics, our contention is that genes do not only express information but also the other way around. Through resonance with information in the ZPE field and hyperdimensional sub-Q domain, Information is omnipresent across local as well as nonlocal spectra of manifestation. In the quantifiable domain its effects may be measured by the degree of reduction of uncertainty in a given system. Thus, at the quantum level, even quantum paradoxes might find their natural explanation in the framework of the hyper-dimensional setting, without violating the Occam's razor parsimony principle in explanatory range. This interface between the "quantum void" and the quantum-governed manifestation forms is *the very connective system between the Quantum and the Sub-quantum regimes*, ensuring the Sub-Q-mediated Information guiding of control effectors acting in our physical world. In our brain, as well known by direct observation, a powerful information may suppress a less powerful one, too. From this perspective, mind may be seen as performing the quality management of the different information sets.

Here, it is of paramount importance to clearly differentiate Information, as an intentional modality with meaning, from basic quantum information as physical information (**Meijer, 2012; 2013**) As well defined by **Mukhopadhyay**, **202; 2021**, the Information mechanism can be seen as an opportunistic assertion of properly selected configurations into causal execution. Conversely, breaks in the causality chain can be seen as some kind of loss of Information.

16.4 Informational Physics Is Not Identical to to Math or Quantification.

Our post-materialistic perspective points to a fundamental inconsistency of currently used equations in Quantum Mechanics considered as providing an accurate description of nature, as long as Information is not included in them as a crucial modulation factor. The Aharonov-Bohm effect of energetic fields affecting each other at a distance represents a compelling proof of nonlocality in physics, but lacks the crucial information content in both fields. In order to make physical sense of non-local phenomena, the "physical" origination of

space, time and Information, as the fundamental mega-reference frames of reality should be taken into account in all kinds of manifestation.

The trans-Planckian pre-space-time is governed by widely more subtle variants of energy than the physical one, and is likely making up about 69% of all the energy in the universe. At a cosmogonic scale, this unconceivably fine-structured Sub-Q stuff is supposed to have been existent before the instantiation of the Planck scale at 5.3 x 10^-43 sec from the "beginning point", where pure condensed Information containing all the information accumulated in a previous variant of universe, transcends the confluence point to the new one (Chris H. **Hardy, 2020**).

The "Big Bang" happening only at 10⁻³⁶-10⁻³² sec. marks the beginning of the inflation period leading to the formation of the Higgs field and the first Higgs bosons at 10^-10 - 10^-4 sec, which indicated that mass may be just an effect of a wave/particle/Higgs field interaction. It is a bewildering observation that at the early development of the universe in the pre-space-time condition, before creation of the first quantum at the Planck-scale phase, the light propagation velocity limit "c" for the whole EM spectrum did not apply. The space-time coordinates were only born at the Planck limit where the Higgs field and first elementary particles gained mass. Yet, in the pre-Planckian domain, where "conventional" energy was not still existing, that is at the time of the first Quantum emergence, there was a breathtaking level of a non-physical energy variant available (10^19 GeV), where obviously no relativistic or quantum laws apply. This existential domain, "quintessentially" linked to cosmic consciousness, accounts for the ongoing Information storage and propagation properties of the super implicated "source field" for any observable in our material, quantumcontrolled, measurable universe. Torsion waves, propagating at velocities up to 10^9c may account for cosmic-scale connectivity patterns. Interference effects of such torsion wave dynamics can result in a coherent universal holographic representation and may be expressed also in quantum entanglement as a communication modality running beyond spacetime constraints. In this view, entanglement arises from the primordial self-referential spin processes, (Hu and Wu, 2013; Meijer, 2021, Brueck and Meijer, 2020) as the driving force behind quantum mechanics, spacetime dynamics and consciousness".

Moreover, in a quite recent publication of **Hardy and Brandenburg** (**2016**), proposed a fundamental connection existing between gravity and entropy as based on a sub-Planckian wide spectrum of frequencies, instantiating a sub-quantum pre-spacetime physics. This corresponds to a cosmogonic informational data bank expanding up to the Planck frequency. In this view, pre-spacetime frequencies correspond to virtual particles (Hardy's "sygons" - Klein's Sub-Q units) that by interference will create the Higgs field itself, a process resulting in the creation of all the elementary particles known from the Standard Model of Quantum physics. Spacetime wave/particle dualism is therefore consistent with conscious set theory, which implicitly incorporates the nonlocal realm, This, lead S. **Darmos (2021)** to postulate that the entire wavefunction of the universe and the nonlocal realm are one and the same.

The fundamental questions arising from the above analytic attempt are:

- Where is (and what is) the *observer_*in these experientially "normal" and reversed conditions, while his cognitive functions remain unimpaired in both?

- Where is the control instance configuring the exact content sequence and thematic of a specific dream?



Figure 49: The flow of information in the whole universe from micro- to macro-levels (bottom to top), conceived as a nested toroidal operation that is fractal and scale-invariant and is initiated in a knowledge realm underlying the known wormhole matrix (quantum foam) at the Planck scale. A Sub-quantum space is separated by a transition zone from the Zero-point energy field with typical vortex energies. Supposed quantized string activities produce elementary particles, atoms, molecules and life systems. The latter contain dedicated holographic memory spaces at the cellular and brain (organ) level. The human brain integrates, internally and externally, guided conscious states to be also mirrored in a 5-D event horizon memory workspace, associated with the brain. Further fractal and self-similar properties in a quantum fluid universe provide the architecture of cosmic macro-structures and imply that the universe is conscious, with a mental attribute that is non-material in a physical context.

Indeed, the fundamental question we must reply before any perspective (and prospective)-related considerations on relative reference frames, is whether we can decently place the observer in any conceivable frame of reference. The only reasonable answer to this question might be supplied by the Sub-Q aggregative informatics, operating along a vector of complexity increase. This prompts us to the conclusion that (according to "like to like' axiom) an observer may apprehend or connect only to fundamentally similar Informational essence to his own. The Sub-Q theory, thus, posits the `observer` as a highly complex, informatically multi-layered entity, able to increase its own awareness, knowledge and wisdom by an informational resonant coupling process. The different layers inside the "observer's` own internal structure *are* relatively non-local, and connectively *correspond* to the universal relative non-locality of which it is part, (**Fig. 49**).

Brain conditions (Meijer and Korf, 2013) without EEG activity (characteristic for some NDE and OBE instances),

may therefore correspond to data transfer blockage for sensory inputs and their actual information processing mechanisms. Of note, this implies also potentials for later conscious recovery and reintegration into memory banks accessible to conscious reporting and screening.

This brings the study of nonlocal/local connectivity into the scope of serious experimental scientific exploration. Memories, stored in non-local Sub-Q landscapes are not affected by the physical brain during such conditions. Any given space-time structure related to actual/virtual mental/emotional modulators has to be consequently treated as an implicate-order-embedded nested workspace. The latter implies a focal confluence spot of all past-present-future Information configurations relevant both for individual, as well as for species-related conservation requirements. Preferred and delayed information retrieval/actualization pathways are imprinted on the available nonlocal and atemporal domains of holographic global (universal) information storage and processing matrix.

Such "choices" imply divergences in the quantum potential along predeterminate modulators that operate in nonlocal regime. Therefore. we propose extending their representation downwards, beyond the photon-like elementary particles, into their constituent Sub-Q units, far below the Planck limits, into the infinitesimal Sub-Q units, where Information couples to space-time in the first place. There we find the hyperdimensional origination point for infinite combinatorial variants of energy-disguised information at all manifestation scales of the universe. At all scales, reality is implemented in this manner at the meeting spots of opposed causation vectors that are manifest in their time-symmetric perspective or in trans-temporal regimes. Thus, the apparently non-solvable conundrum of the link between a mental space-time and the physical one (the false dualist assumptions in cognitive philosophy) simply vanishes here, because the coupling is a built-in feature of reality from its very inception (**Fig.49**).

How can the internal and external Information be processed in mental domains and reflected in their neurophysiological correlates? Brain's "potential energy" is but one of these correlates of phase transition dynamics, allowing both internal-generated and externally originated information matrix variants to couple, via translating (sub)quantum mediation chains, through sensitive quantum processor nanostructures inside neuronal functionally specialized sites. Yet, a guiding field-receptive structure is a second prerequisite. The presently proposed noetic fields, related to vacuum fluctuations at ZPE, may be best expressed in terms of Sub-Q physics, where information-led, hierarchically organized ether flux variants, get a shared dynamical manifestation domain at both sides of the interdimensional ZPE barrier, thus allowing for free, both non-local and local purposeful information exchange. Here, photon-mediated field polarizations evolving at superluminal velocities are at work, implementing Cramer's purposeful time-symmetric Informational transactions, thus suppressing *any non-conformal probability variants* as related to future (present) actualizations (**Brueck and Meijer, 2021**).

Quantum time-entanglement effects might suggest some interesting cues about continuous matter creation/de-creation processes, as a more attractive and accurate symmetry-breaking description for the Universe than the obsolete "Big-Bang" concept. Introducing our Sub-Q understandings, we extend Penrose's Planck-scale space-time granularity deep down toward infinitesimal values, where unity-derived diversity is emerging as a common denominator for all conceivable descriptions of nature (**Fig.42** and **49**). This does no way contradict recently gained understandings portraying fundamentals of the QM such as the quantum jump, more recently described in terms of Quantum Trajectory Theory. It seems compelling to agree with Schrodinger's rejection of the photon's indivisibility, and to take a more critical approach regarding the pure

random/probabilistic nature of Quantum transitions. We should be searching for a more accurate understanding of the quantum jump as a sequential process running at extremely high time resolutions. We may confidently rely upon sub-quantum tenets, if the electron is seen as a superposition of multiple vibrational modes distributed in interchangeable coherent frequency bands (besides potential decoherence ones). A smooth transition through a series of intermediary states seems to make perfect sense, and is a perfectly consistent finding with the infinite divisibility of quanta.

Of note, our Subquantum concept smoothly accommodates dualist and non-dualist kinds of approach, by invoking an interdimensional connectiveness of information ("mental") and space/time (matter/energy) configurations. We strongly support information storage and retrieval aspects from noetic fields of increasing complexity gradients, passing the ZPE transition zone and implementing formation of mirror-like (subtle) energy-linked by information resonance at both sides of the ZPE limit. The currently proposed polarization/depolarization mechanisms of the particle-embedding quantum vacuum, running at the interface level may well apply to similar events in the media surrounding sub-quantum entities and their combinatorial variants. At a sufficiently high-resolution approach, superposition spectra of this process at particle/quark level of manifestation gets still more evident. At such resolution scales, local and nonlocal phenomena may converge into a unified field concept based on fractional charge and spin potentials as allowed (and predicted) by the Fractional Quantum Hall effect. This brings us the conjecture of our analytic landscape, in which the infinite configurational plasticity potential, inherent to Sub-Q domains, might build up stabilized systems of standing coherent Sub-Q wave superpositions that represent archetypal patterns, able to modulate informatic dynamics in time under that run in a 5- dimensional brain model (see **section 15)**.

A comprehensive pioneering attempt addressing such an appealing hypothetical construction can be found in the early book of **Klein, 1990,** written in Romanian language, 1990, - "The poly-dimensional holistic paradigm", published 2019 in Bucharest - where a 9D extended Minkowski/Kaluza space-time-information reference is suggested as a compelling description option for a sentient universe. A sub-quantized space-time perspective, extending well below Planck scales, thus transcending the Penrose quantum spin network configuration limits, might easily accommodate proto-conscious experience units and their combinatorial patterning potentials.

Retro-causative vectors may be conceived evolving as nonlinear (and non-random) events, implementing local configurations of a universal orchestrated cosmic harmony, while at the same time stabilizing an equilibrium state between local and non-local regimes. This view requires a conceptual reversal of the Penrose/Hameroff conjecture's bottom-up orientation that implies coherent microtubular brain oscillations that are converted to material experiential forms by finding congruence with related gravity information at the Planck scale. We hold that consciousness is not primarily dependent on the very existence of a local brain, but that rather the non-local feature of the neural system introduces the supervenience that is essential for realizing conscious states.

Yet, retro-causally induced quantum effects originating in zero-point fluctuations (themselves orchestrated by higher control instances), may correlate with Planck-scale induced experiential ones, thus impacting protein conformation effectors. Also, variations in space-time geometry result from information-charged sub-quantum dynamics and not the other way around. They may be stabilized in a quantum gravity context, as nonlocally stored memory patterns, which may be "recalled" by resonant superposition constellations of quantum spin events (Stapp's "queries" evolving in time-symmetry conditions). From this perspective, no confinement conjecture of mental events to topological or functional defined neural networks is tenable, and the

assumption of a "personal universe" forming under pure genetic and epigenetic modulators has to be replaced by some kind of continuity hypothesis. A scientific exploration of the laws governing this kind of field expressions seems at this point fully justified, especially seen according to our shared views on the complexity increase as prerequisite for an information-driven evolution process, replacing obsolete Darwinian tenets.

Seen as a local representation of a universal consciousness and expressed in terms of noetic fields, the "individual universe" concept seems to exclude decoherence by immersion into matter/energy-controlled media, rending it in its trans-temporal nature into an "immortal" entity. Escaping entropy increase is a never vanishing one, self-engineered by a top-down acting vector that is poorly recognized in conventional main-stream bottom-top approaches.

We, therefore, support the idea of an independent *mental modality* of the universe as the new paradigmatic fundament in scientific thinking. A Sub- Q theory has to be invoked as a reliable candidate for a more accurate model, instead of the classical Quantum mechanics with its inherent features of randomness, uncertainty and weirdness, as being compatible and even determinant for their phenomenological integration with neurobiological processes. Regarding the circular processes in brain function in the neural/non-neural Information exchanges (**Meijer and Korf, 2013**), we postulate both a "vertical" (physical from macro to micro scales, and a "horizontal" (across multi-cellular brain centra), both conceived as a bidirectional flow of Information (corresponding to a hyper-space and hyper-time), running in a nested holographic system. Related to the brain event horizon theory specifically, see **Fig.27** and **section 9**), fractal scales should be enlisted between the "atomic" and "multi-cellular" modalities, bearing in mind of course all the correlations this spectrum has, both downwards and upwards, with the respective scales.

Ascribing to sub-Planckian domain as a container of geometric and math relations as Information transition modalities, is only adequate as long as we see "pure Information" a non-quantifiable, essentially eidetic, phenomenon We may reliably consider energy configurations at all scales (subquantum & subtle ones included) as instrumental expressions of background Information dynamics. The very "event horizon" of the brain, (**Meijer and Geesink, 2017**), implies a conceptual delimitation of local brain function, in which the holographic concept of Information storage and transfer seem to solve its scale insensitiveness, since an information processing apparatus in our view extends beyond any definable "horizon". Therefore, It should be described in relation to its corresponding phase-space. Both individual and supra-individual consciousness may impact neural network connectivity functions by way of transient neural correlates.

Memory is not bound to them, but may be replicated in conditions of similar connectivity patterns forming inductively in the system. Indeed, information *storage* capacity is not limited to brain as an organ. Empirical evidence is revealed in reports on various Psi phenomena (**Beauregard et al.,2018; Radin, 1996**) and also post-transplant personality data transfer (**Klein, 2020 a b**), supporting the non-local distribution of memory data in the super-fluid quantum space). In this respect the present authors fully agree on the treatment of Psi conditions, especially NDE & OBE. Certainly, such states allow for a conscious glimpse into the "future" parametric conditions of the Self, after its disconnection from brain's quantum constraints (**Meijer, 2019**). In relation to this, we are excited with the perspective of dream-space and time, and its correlation to our physical ones. What is the control instance for the dream's *specific content*? Beyond some easy-to-understand drop in self-referential criticality by brain's lowered EMG activity, all the "normal" consciousness parameters are fully preserved, and "used" in coherent activity patterns of the Self in this phase-space.

We certainly support the conceptualization regarding the Bohm's pilot wave's (and its superpositions') lack of

the collapse of the wave function, as in this particular case we are dealing with double-checked (antero/retro time flow) factual information variants, and not probability waves. Further on, quantum field fluctuations at the ZPE are generated by information dynamics running at both sides of this interdimensional barrier, through infinite velocity transfer allowed by the Sub-Q range. The ZPE field is inherently defined as dynamic through permanent actualization by the supposed back-reaction of pilot-wave guided particle trajectories and this ever-changing background enables free will. Yet, we might probably have slightly different ways to approach the "free will". Klein postulates the "choice" effect as a predeterminate purposeful patent of nature, having a trigger function in the active involvement of sentient beings into their specific task-oriented ambient integration.

16.5 Cyclic Models and the Future of the Universe

Gott,1998, Steinhart, 2007 and Penrose,2010, and many other scientists, have theorized on cyclic (rebound) models of the Universe. If our universe, in the far future, comes at its end in a big crunch it will undergo a new start through a renewed inflation (**Fig. 50**, inset left above/). These can also be interpreted to mean that our own reconstructed Big Bang, that is often seen as the real start of the present cosmos, was rather a reflection of information transfer from a *previous version* of our Universe (**see Fig. 50**).



Figure 50: The sequential epochs in the evolution of our universe, also depicting the very far future of a "living" Universe (see black box), in a cyclic time model (top left) in which the universe takes care of its own reproduction (after **Kurzweil ,2005**)

Each cosmic cycle, consequently, would not encompass identical information, rather each rebirth may contain novel information, leading to an ever growing complexity and intelligence of cosmic life (**Meijer,2013a ; 2015 , see also Fig.50**). Related to these theories, some assume that advanced forms of intelligence will collect and

compress all available relevant information of biological and also hybrid forms of life and thereby may be able to *simulate* the complete history of mankind (**Barrow and Tippler, 1986, Tippler, 1995).** In this respect it is speculated that our descendents will master the physics of black holes or wormholes, seen as giant portals to other universes. These giant cosmological structures could be manipulated to pass the required information as a recipe for the birth of a new version of our universe (an engineered Big Bang, see: **Vaas, 2006.**

All this, bears a clear relation with the various modalities of the so-called Anthropic principle (**Barrow and Tippler, 1986**), stating that the universe seems physically *fine-tuned* in order to, in some stage, produce intelligent life such as humanity. The latter is directly related to the emperical natural constants present in the current equations that are supposed to mathematically describe the reality we can observe. Michael **Brooks**, **2018** explained: A large question in physics is the way our theories of nature require us to inject a set of arbitrary numbers to make them reflect reality. There seems to be no rhyme or reason for these numbers: they are just there, and we must measure them in experiments.

• The standard model of particle physics requires at least 19 such numbers, including the fine structure constant, also known as alpha, the mass of the Higgs boson, and a bevy of others characterising particle masses and interaction strengths.

• To reproduce physics in general, you must add in the gravitational constant (aka "big G"), the speed of light and the Planck constant, which gives the basic size of quantum things.

• The standard cosmological model requires another 12 parameters, including the Hubble constant, which describes the universe's expansion rate, and factors to do with dark matter and dark energy densities.

For example, the fine structure constant, also known as alpha, is a relevant case. Alpha lies at the centre of a theory Dirac initiated and Feynman worked on: quantum electrodynamics, or QED. This is the quantum theory of the electromagnetic force, and describes the interactions between light and matter. Alpha determines their strength. It is itself constructed from the speed of light, the electron's charge, pi – few physical theories are complete without pi – and a couple of other fundamental constants, carefully arranged so that it is just a pure number, independent of human influence: 0.00729735, just a whisker away from 1/137.

Change this number by 0.1%, and you change the universe. Increase it too much, and protons repel each other so strongly that small atomic nuclei can't hold together. Go a bit further and nuclear fusion factories within stars grind to a halt and can no longer produce carbon, the element on which life is based. Make alpha much smaller, and molecular bonds fall apart at lower temperatures, altering many processes essential to life. On Earth, at least, alpha keeps itself within strict bounds. Lab experiments show that the most it could vary by a few parts per 10 billion. That makes it 100,000 times more accurately pinned down than "big G", the constant that determines gravity's strength, for example.

But as Dirac had hinted, perhaps electromagnetic interactions were weaker or stronger in the past, or are different in distant parts of the universe. That could be important at a time when physicists seem to have reached an impasse in their efforts to unveil deeper truths about reality. "We have a basic set of equations that is half a century old and has never been contradicted by any measurement," says Carlo Rovelli at the University of Aix-Marseille in France. "If we found a measurement that differs from this, it would be a big deal:

finallysomething really new!" Paolo Molaro, who researches variations in constants at the Astronomical Observatory of Trieste, Italy, agrees. "If variations are present, they would reveal new physics," he says.



Table 2: Mechanisms for information transmission and signalling, that promote connectivity in the Universe

That could include the presence of extra dimensions, for example. String theory, one candidate for a nextgeneration theory of physics, proposes the existence of tiny, curled-up dimensions we can't see. That has effects on things like alpha. "The status of the quantities we call constants is somewhat downgraded if you believe there are extra dimensions," says cosmologist John Barrow at the University of Cambridge. "If there are really nine or 10 dimensions of space, with only three large, then the true unchanging constants of nature live in the total number of dimensions and the three-dimensional shadows that we observe are not true constants." One possibility is that the fine-tuning aspect is related to relational quantum physics on the basis of a multi-dimensional, fractal and holographic structure of the universe.

The Holographic Principle holds that the information in any region of space and time exists on the surface of that region. According to Mitchell and Staretz, 2010, a Quantum Hologram (QH) is the discovery that the event history of all macro-scale matter is continuously emitted (broadcast) non-locally and is received by and interacts with other matter in its environment through a subtle process of exchange of quantum information. This is an extension of the abovementioned process of quantum emission/absorption, and is analogous to the non-local quantum entanglement of particles. The holographic framework also supports the idea of the nonlocality of mind: the omnipresent and omni-directional transfer of influence (including thought, emotion, and intention at the quantum level instantly, simultaneously and ubiquitously, through wave-like or field-like resonance (Fig.51), wherein spatial and temporal factors are inconsequential. It is also related to interconnectedness of non-local resonance occurring within the underlying zero-point field, that connects all matter, energy and information in the cosmos. According to Germine, 2004, layers of the holographic, universal "now" go from the inception of the universe to the present. Universal Consciousness as a holographic projection is considered as the timeless source of actuality and mentality. Information is experience, and the expansion of the "now" leads to higher and higher orders of experience in the Universe, with various levels of consciousness emerging from experience. Evidence from a wide variety of contexts indicates the capacity of the mind for total recall of past life events and for access to universal information, indicating connection with the holographic surfaces of prior "nows" and with the Universal holographic boundary.



Figure 51: Learning mode of the Universe, PCAR=Phase Conjugate Adaptive Response, (from *Mitschell at al., 2011*), as an interplay of consciousness and zero-point energy field mediated, global, memory

Mongan, 2007, linked the Holographic Principle to the quantum wave function, demonstrating that local interactions between quanta of mass may have instantaneous and non-local effects effect on the wave function throughout the universe. The most basic order of information is the fundamental quantum of spatial volume, the earlier mentioned Planck space, which has a variable energy, called the vacuum energy (see section on ZPE). There is a fundamental relationship between the Holographic Principle and the vacuum energy (**Mongan, 2007**), which can account for a variety of non-local phenomena (**Laszlo, 2004**). Information is extracted from the wave function as we move higher and higher in the hierarchy of "worlds," until we reach the highest dimension of information, the boundary of the Universe, which is in constant and instantaneous interaction with the "worlds" beneath it. Holograms can correlate and store a huge amount of information, and have the advantage that the inverse transform returns the results of correlation into the spatial and temporal patterns that form the elements of the dynamic universe). About seven years ago, Andrew **Strominger, 2014** a string theorist at Harvard University, inferred that our universe is an image projected backwards in time from a hologram located at the boundary of the cosmos, in the infinite future.

The particles and atoms in our body are "entangled" with each other: they receive and transmit information not just by biochemical means, but by a process, known in quantum physics, as "phase-conjugated quantum-resonance", (see Fig. 51).

16.6 The Relevance of Holistic Science

In the creation of scientific thought, apart from rationality and sufficient overview of present scientific knowledge, subjective elements like serendipity, intuition and "feeling the future" can play a major role in scientific breakthroughs and technological innovations (**Fishbein, 2005; Bernstein, 2005; Kastrup, 2017).** Also, the important role of directed creativity should be mentioned here (**Plsek, 1996**): Problem solving is an important activity, yet the primary identifying and exposing of a hidden problem is obviously crucial in this respect.

Progress in science requires a solid analysis of the process itself, implying careful observation from an appropriate intellectual "distance", (Meijer, 2018). This, should include the views that are offered by scientific metaphysics. In relation to this it should be realized that science is a human faculty and that for a deeper penetration into the fabric of reality it is essential to understand how we observe and interpret with our individual memory as influenced by personal bias. It is urgent to obtain a better insight in the processes of observation, perception, and intuition in relation to the basics of human consciousness. Progress in conscious studies may therefore constitute a prerequisite for fundamental progress in science (Barus, 2001; Bohm & Peat, 2008; Keppler, 2013; Filley, 2016; Meijer & Geesink, 2017).

The design of a scientific hypothesis requires both knowledge of the past as well as vivid anticipation of the future, related to the particular concept. This has much to do with imagination of how things could work out, in particular if cardinal changes would be made in the assumed prerequisites that underlie the present concept and that may block visions on potential innovation. Information, as a product of interaction thereby exhibits a clear dynamic and active character (see for the general aspect of information: see **Meijer**, **2012**, **2013**, **2014**, **2015**). It was recently pointed out by **Langan**, **2017**, that, intrinsically, in the ongoing process of science endeavour, a metaphysical language will be created that finally should enable a global coupling of mind and physical reality in a language with sufficient expressive power to picture a comprehensive description of reality

or even a "theory of everything". Such a higher order language should be able to explain itself and thus the biological origin of mental activities of scientists in which minds it exists.

This implies that the universe would share a linguistic structure and dynamics of the theory provide a metaphysical language that can even take a mathematical format and was called Cognitive-Theoretic Model of the Universe (CTMU). Thus, the CTMU is a theory which says that reality is in fact a self-modelling universal language. Langan proposed that in such a teleological causation, ordinary events are predicated on the generation of closed causal loops distributing over time and space. This loop-structure reflects the fact that time, and the spatial expansion of the cosmos as a function of time, flow in both directions: forward and backward as well as outward and inward, in a new kind of medium or "manifold". This concept is very much in line with the present toroidal model approach, as depicted in the present, (**Fig. 52**), **a**nd may reflect the ultimate integration of scientific and artistic endeavour, (**Meijer, 2018**).



Figure 52. An integral scheme depicting the Construction of Reality, with its material (right part of the figure) and mental (left), aspects. This concept assumes a central quantum information field, that provides the very basis for creation of our universe and dynamically evolves further through cyclic feed-back processes from the present reality, in which natural (among others human) and artificial intelligence play crucial roles in observation and participation (see text for further explanation).

Both in art and science some kind sort of creativity process plays a role. The creative process has also been described as a circular process exhibiting a stepwise process that might also fit the artistic modality: The artist identity, vision, intention(s) and insight, the engineering of the art object, the building or construction of the art object, the exposition and use of the artistic product, that in its turn contributes to the identity of the artist). Every original idea is imaginative, because only imagination can trigger creativity. This is why imagination is just as essential in science and technology as in the arts of our world.

The difference between these two pairs of fields is that in science and technology imagination is largely disciplined rather than free. What motivates science disciplines is the objective truth requirement. Yet, Pauli stated: "it is more important to have beauty in one's equations than to have them fit experiment..." Revolutionary art at all times has served this function of preparing for the future. The faculty we use to grasp the nature of the "out there" is our imagination. Somewhere within the matrix of our brain we construct a separate reality created by a disembodied, thinking consciousness. This inner reality is unconnected to external space and exists outside the stream of linear time. This inner spectral vision amounts to a mental "opinion", unique to each individual of how the world works...

Table 3: Relevant Literature Supporting our Concept of Universal Consciousness and Correspondence with the Present Concept. (Author/Title/ Correspondence)

Amoroso Physical basis of Consciousness - Noetic theory of consciousness

Atasoy et al. Human connectome and harmonic brain modes - Harmonic frequency modes in brain

Baars and Dehaene Global Workspace model - Long dist. broadcasting communication brain

Bandyopadhyay et al. Fractal Information geometric musical theory ---Fractal musical brain language

Beauregard et al. Post-material psychology -Theory, research and application of the mental

Bovenkamp, Wave matrix physics. – Cosmic Philosophy and Future

Bradley, Intuition as a holographic phenomenon of - Intuition from holographic memory

Brown, Unified Physics and Entanglement Nexus of Awareness-Spacetime of information and wormhole structure

Cacha et al. Nonsynaptic model of longterm memory - Engrams as phys. waves in interfacial water

Cacha et al. Genomic consciousness in neurons - Solitonic interactions with DNA

Carniello et al. Water as Conduit in Cosmic entanglement - Universal role of H_2O in cosmic order

Clymer Evolution of information rules - Simulation of Universe Quantum state

Currivan, The Cosmic Hologram. – Information at center of creation

Darmos Quantum Gravity and role of Consciousness - Role of consciousness in physics

Di Base Holo-informational model of consciousness - Superimplicate order in organizing Mind Diez Faixat, Beyond Darwin - Hidden rythm of evolution

Facco/Greyson Implication of Near-death Experience - Altered states of consciousness

Fingelkurts et al. Operational Architectonics theory - Operation of a mental brain domain

Fischer, Quantum Cognition in Brain – Nuclear Spins and Ca2+ signalling in brain

Georgiev et al. Quantum physics of synaptic transmission - Q. tunneling in neurotransmitter Release

Glattfelder Consciousness of reality - Information, consciousness and reality

Goff Foundations for a new science in consciousness - Panpsychist account of consciousness

Görnitz, Quantum Theory as universal Theory – Cosmic consciousness

Goswami, Creative Evolution – Idealism and the selfaware universe

Goodman et al. Two-Brain hypothesis - Electro-ionic/ Electromagnetic brain

Grandpierre, Biologically Organized Quuantum Vaccuum - Origin of cellular life

Greyson, Nature of Mind and Consciousness - Is consciousness only produced by the Brain

Hameroff/Penrose, Orchestrated Objective. Red. Theory - Q- coherent oscillation of tubular proteins

Haramein et al., Unified Spacememory network - From cosmogenesis to consciousness

Hardy, Hyperdimensional model of consciousness - Systemic ontology of the universe Hu and Wu Spin-mediated consciousness Mc Fadden, Conscious Electrmagnetic Field - EMF - Spin as mind-pixel in consciousness fields in brain Hunt et al. Easy part of hard problem Mitschell, Quantum Hologrsm - Nature of - Resonance theory of consciousness Consciousness Irwin K New approach to hard problem Mukhopadhyay, Science of Information - Quasi-crystalline language in spacetime - Communication in the Universe Irwin L Supernal dreaming Neal, Integral Relativity of Awareness - On myth and metaphysics - Role of photon/phonon symphonic resonance Nunn, Landscape of Mentality- Consciousness and time Ivaldi, The ERA of Good Living - Geometrics and life systems Penrose, Shadow of the Mind - Missing science of Joye S R Pribram-Bohm Holoflux Theory of Consciousness consciousness - Holofield theory and implicate Order Pereira et al The Consciousness and Cosmos framework Kastrup Universe in consciousness - Universal field of consciousness - Monistic idealism in consciousness studies Persinger/ St- Pierre Physical bases to Consciousness Keppler, ZPE, Common basis for memory and consciousness-- Unified, non-local cosmic brain energ ZPE guided brain attractors Pockett, Electromagnetic field theory –Cconscious and non-Klein/ Boyd, Sub-Quantum Model - Brain mind interface conscious fields Kraikivski Systems of oscillators for conscious percepts Poznanski Brain and neg-entropic entanglement Distant space-time matrix as operational map - Consciousness guiding encoded in ZPE field Lanza, Biocentrism. - Universe guided by life processes Pribram, Consciousness reassessed – Holographic memory storage in brain Laszlo, Akashic Field – Quantum cosmic symphony Radin, Entangled Minds -Psychic phenomena and brain function Laviolette, Cosmic Ether- Sub-quantum kinetics Savelev et al. DNA resonance code as neural code Lefferts, Cosmometry - Holofractal nature of cosmos - Proton oscillations in DNA morphogenetic field Meijer et al. Mental attribute of Universe Sarfatti, Bohm Pilot wave Theory- Retrocausallity - Superfluid quantum space guided consciousness Sbitnev, Quantum Consciousness in Brain -Meijer, Quantum Physics in Consciousness Studies -Hydrodynamic superfluid wave guidance Event horizon field receptive workspace of brain Searle Addressing hard problem of consc. Merrick, Interference – Grand scientific musical theory

16.7 The Relation of Science and Art

According to new physics, the observer and the observed are somehow connected, and the inner domain of subjective thought turns out to be intimately conjoined to the external sphere of objective facts. Through the complementarity of art and physics, these two fields intimately entwine to form a lattice upon which we all can climb a little higher in order to construct our view of reality. Understanding this connection should enhance our appreciation for the vitality of art and deepen our sense of awe before the ideas of modern physics. Thus, art and physics, like wave and particle, can be seen as an integrated duality: They are simply two different but complementary facets of a single description of the world (**Meijer, 2018**). Integrating of art and physics will kindle a more synthesized awareness which begins in wonder and hopefully ends with wisdom.

With regard to the required inspiration of scientists and artists, in their own way of analysing/representing nature, it could be postulated that they both may derive essential information by intuitive mental contact

(meditation, serendipity, synchronicity) with an information domain that is supposed to be underlying our three-dimensional local space-time geometry (**Meijer, 2012, 2013, 2014**). This dynamic electromagnetic field was proposed by David Bohm as an implicate order that through wave interference (so called pilot waves) guides matter in our common (explicate order) world. Bohm argued that we cannot directly observe this dimension but that we can experience it in listening to the wave-world of music with its wonderful mix of memorizing and anticipating harmonic wave patterns up to complete symphonies. **Table 3**, lists the current studies that support the idea of the sort of cosmic (universal) consciousness that Bohm may have foreseen and that are largely compatible with the concepts of the present authors.

16.8 Mental Transcendence and Psi Phenomena

It is well known that various kinds of mental transcendence such as meditative states can inspire artists to see objects in very different perspectives. (**Meijer, 2018**). Such conscious states can also be induced by removal of an intrinsic neural "filter" in our brain that normally prevents such experiences, for example by certain programmed forced ventilation techniques or through use of psycho-active drugs (**Kastrup, 2017, Meijer et al 2021**). In science and technology, major breakthroughs have to be attained by intuition or serendipity in which, often in a relaxed state, sudden innovative solutions are revealed or new visions seem to be projected. This in, either a sort of inductive analysis or through a subjective emotional self-transcendence, sometimes felt as a form of personal clairvoyance. Wikipedia defines intuition as follows: "Intuition, a phenomenon of the mind, that describes the ability to acquire knowledge without inference or the use of reason". In the light of the evident importance of this aspect in scientific endeavor, it is surprising that so few systematic studies have been performed on methods to facilitate such productive mental states (**Fishbein, 2005; Kastrup, 2017**). One example is selective electromagnetic stimulation of certain parts of the brain (**Hamblin, 2017**).

16.9 Post-Material Science Theories

Beauregard et al., **2018**, in and excellent article, proposed that there are three basic types of postmaterial theories, that may be required for explaining the various categories of empirical evidence examined in current Psi research:

Type I postmaterialist theories: Type I postmaterialist theories assume that phenomena such as consciousness, including non-local consciousness, although they may be "non-material" (e.g. do not meet the classical criteria of having mass and being localized as such), are nonetheless still "physical" and obey physical laws. An example of "non-material, yet physical" is the concept of a field. In physics electromagnetic and quantum fields do not have mass or weight; they are mathematical abstractions which are theorized to produce lawful effects on material objects. This can be thought of as "neo-physicalism" in the sense that Type I theorists posit that energy and information are in essence "physical" even though they are not "material" (i.e. their form and properties are not of classical matter with properties of mass and momentum). Neo-physical theories allow for "info-energy" and "fields" (including "quantum" fields) to exist "independently of matter" and therefore operate in "non-material" yet physical ways. Proponents of neo-physical theories posit that this class of theories can potentially be used to explain phenomena including NDEs, OBEs, and evidence of life after death.

Type II postmaterialist theories: Postmaterialist theories of mind and consciousness existing alongside materialist theories, where both classes of theories are seen as primary and are viewed as not being derivable from (i.e. are not reducible to) the other, and. Type II postmaterialist theories assume that certain phenomena

in nature and the cosmos cannot be explained by materialist explanations and therefore require innovative non-material theories to understand them. Moreover, they view the phenomena as being separate from matter and, in their essence, on a conceptually equal footing with matter and what we experience as material reality. Type II theories are not meant to expand or replace physical theories of the material world. The new theories are meant to compliment them, adding to a more complete description of nature and the cosmos without requiring a re-envisioning of physical theories of the material World.

Type III postmaterialist theories: Type III postmaterialist theories are by far the most controversial and challenging to the mainstream materialist paradigm. These theories expressly predict that phenomena such as mind and consciousness are not only (1) separate conceptually from material systems (Type II theories) and, (2) not created by material systems (Type I theories), but they are also (3) precursors to the creation of matter itself. In other words, they are "primordial to matter itself." At present time Type III theories tend to be offered by big picture visionary theorists who have an eastern background, such as physicist Amit Goswami (Goswami, 1995, Meijer and Raggett, 2014), or theorists who have an affinity for both western and eastern spiritual perspectives, such as physicist Bernard Haisch (Haisch, 2012), physician Larry Dossey (Dossey, 2013), and computer engineer and AI pioneer Bernardo Kastrup (Kastrup, 2014). Type III theories are also seriously entertained by scientists who have strong mathematical and statistical perspectives. An example is Schwartz's analysis of order, randomness and the essential logic of positing the existence of some sort of guiding-organizing-designing process in nature and the cosmos (see Schwartz, 2006).

This paradigm, in our view, represents the next phase toward an even greater understanding of ourselves and reality, has far-reaching implications. It fundamentally alters the vision we have of ourselves. The postmaterialist paradigm fosters positive values such as compassion, respect, and peace because it promotes an awareness of our interconnection. For example, there may be a component of empathy that requires more direct connection between individuals than the physical cues of the face, voice, and body language. We can explore the extent of our ability to communicate with each other nonverbally, across distances. More rigorous and sophisticated studies of telepathy, clairsentience ('clear-feeling'), and empathy would greatly contribute to our understanding of our social bonds, and ultimately, how to improve them. Adopting a postmaterialist paradigm would allow for the investigation into higher or altered states of consciousness without the assumption that they are dysfunctional or a problem with the brain's ability to properly communicate with itself and the environment. Instead, from a postmaterialist paradigm, these states can be recognized as a change in characteristics of the brain's transmission process, which can provide us with much insight into our consciousness, its potential expression, and other aspects of information we do not normally perceive.

The non-materialist principle is increasingly recognized. This, in spite of the recent claim that "consciousness is a state of matter" (**Tegmark, 2015**). For this peculiar concept the author did make a special "invention": that of a supposed "perceptronium", being a hypothetical *substance* that *feels* subjectively *self-aware*, stores and processes information, and ultimately, may therefore turn out as Tegmark's own "discovery of mind". Recently **Jyllka and Railo, 2019,** advocated that consciousness and subjective experience are purely based on concrete physical phenomena. They rely fully on current advances in neurology, while admitting that one is still lacking a satisfactory explanation for these phenomena. Yet the authors claim that this will likely be reached in the near future, and therefore apparently support a kind of *promissory materialism*. In contrast, **Velmans, 2008**, in his work on reflexive monism argues for a drastically novel approaches in neurology, taking into account a seamless psychophysical universe of which we are an integral part and which we can only know in two

fundamentally different ways. It is also striking that, in interesting analysis, **Searle, 2017**, comes to the final conclusion that consciousness must be related to a pre-existing conscious field, while **Goff, 2019**, in his book even states that *the inherent nature of reality is consciousness*. The present authors of this review support the notion that consciousness is existentially primary, and agree with the monistic idealism standpoint that is particularly clearly expressed in the important work of **Kastrup, 2017**; **2018**, on *the universe in consciousness*, (see **Table 4 below**). The latter concept was pioneered in earlier work on the Self-aware Universe of **Goswami**, **(2008)**, as reviewed in **Meijer and Raggett, 2014**. Recently, **Keppler, 2020**, fully in line with this, called this "cosmopsychismm" by stating: There are still the question of the origin of the subjective, phenomenal aspects of consciousness, and the question of the causal mechanisms underlying the generation of specific phenomenal states. The author addressed these questions using a novel variant of cosmopsychism, a holistic form of panpsychism relying on the central idea that the universe is imbued with a ubiquitous field of consciousness. This field is understood as a foundational dual-aspect component of the cosmos, the extrinsic appearance of which is physical in nature and the intrinsic manifestation of which is phenomenological in nature.

16.10 The Present Concept Against the Background of Current Science of Consiousness

In general, in recent reports there is wide support that adequate models for consciousness require a number of novel scientific approaches, clearly supporting the present concept of this paper (see **Table 3** above):

- Multi-dimensionality and the requirement of at least one extra spatial dimension (5D-geometry, Hardy, Tozzi, Fingelkurts, Klein)
- Potential holographic and scale-invariant (fractal) description of reality (Di Biase, Joye, Meijer, Keppler, Mitschell)
- The fundamental role of (primordial) information in consciousness (Mukhopadhyay, Meijer, Tononi, Clymer, Ivaldi)
- Harmonic type of EMF frequency/musical guiding in Brain (Atasoy, Meijer, Bandhyopadhyay, Merrick, Lefferts, Mc Fadden, Pockett, Pribram)
- Long-range communication or broadcasting of signals in brain (Baars, Geogiev, Hu and Wu)
- Involvement of zero-point energy guiding and resonance with life processes (Amoroso, Meijer, Keppler, Poznanski)
- The crucuality of post-material approach (Beauregard, Goff, Searl, Radin))
- The major importance of intuition in cognition (Bradley, Greyson)
- Non-synaptic (bio)-photonic/phononic signal transmission in brain (Cacha, Meijer, Wang, Neal)
- A potential involvement of DNA oscillations (Savely, Cacha, Brown)
- The role of quantum prcesses in biological evolution (Faixat, Meijer, Grandpierre, Hameroff, Penrose, Haramein, Brown)
- The crucial function of water in life processes (Carniello, Persinger, Meijer)
- The fundamental role of quantum information in brain, spin-mediation and simulation (Hameroff, Clymer Sarfatti, Sbitnev)
- A potential role of gravity (Darmos, Hameroff and Penrose,)
- The important clues from near-death experiences and Psi research (Greyson, Facco, Meijer, Kastrup, Radin)

- Cosmic superfluid quantum space, Sub-Quantum space and/or quasi-cristalline language (Irwin, Hardy, Meijer, Klein, Sbitnev)
- The cosmic nature of consciousness (Kastrup, Meijer, Glattfelder, Lanza, Laszlo, La Violette, Nunn, Pereira)
- The crucial roles of tubular- and ion-channel proteins and Ca2+ ion-fluxes (Pereira, Meijer, Hameroff,
- Virtual projective and predictive coding in brain function (Williford)
- Future studies in consciousness require fundamental science philosophy coniderations (Glattfelder Goff, Searle, Penrose).

16.11: Is the Universe Mathematical?

Brown)

According to the Mathematical Universe Hypothesis, MUH (**Tegmark, 2008**), not only is the Universe describable by mathematics, it actually is mathematical! He emphasized over and over again that "although we donot yet know what that mathematical structure is, whether it is related to string theory or loop quantum gravity, etc. but the Mathematical Universe Hypothesis implies that we could truly understand our Universe by figuring out what that precise mathematical structure is. After all, if one penetrates into a sub-particle level with string or brane theory, then these are basically mathematical constructs, and if this is what all stuff is made of, including us, then everything must be just mathematics".



Figure 53: Cartoon picturing mathematical defined and compressed information as the seed for rebirth of the universe.

The theory can be considered a form of Pythagoreanism or Platonism in that it posits the existence of mathematical entities (Fig. 53); a form of mathematical monism in that it denies that anything exists except mathematical objects and represents a formal expression of ontic structural realism. Ellis, 2011, specifically criticized the MUH, stating that an infinite ensemble of completely disconnected universes is "completely untestable, despite hopeful remarks sometimes made. The nature of reality was also discussed in the ontological context of **Penrose's**, 1989; 2004, math-matter-mind triangle. The triangle suggests the circularity of the widespread view that math arises from the mind, the mind arises out of matter, and that matter can be

explained in terms of math. Non-physicists should be wary of any claim that modern physics leads us to any particular resolution of this circularity, since they can hold very divergent views. However, now physics can arguably lay proper claim to providing an effective description of all material processes, if not in practice, then at least in principle. And with no obstacles visible to a full understanding of the dance of matter and energy in space and time, what aspect of the world would not be amenable to an analysis by physics, again at least in principle?

The obvious objection would be to point out that notions such as meaning or beauty or responsibility seem to have been explicitly filtered out of physics, as part of its methodology. To believe that you could remove some of the most important aspects of human experience, and then hope to fully reconstruct them through the mathematical formalism of physics strikes many as absurd. It is like a piece of music of such abstract perfection that the realization of a single performance would destroy its purity. It is common to talk of "the language of mathematics". Yet, the mental attribute of the cosmos, (**Table 4**), has been revealed in a broad spectrum of bio-physics studies.

THE FABRIC OF REALITY EXHIBITS A MENTAL (NON-MATERIAL) ATTRIBUTE

(Crucial Aspects of Consciousness Model of Meijer, Klein, Ivaldi/Dal Santo, Diez Faixat)

- In-formation is fundamental, relational, pre-mordial and injects life into matter
- Elementary particles are endowed with internal informational string/wave structure (pan-experiential)
- · Information is processed and integrated through rotational/ toroidal geometric dynamics
- Toroidal processing of information includes information creation and compression
- Toroidal singularity opens to an extra spatial dimension (5-D cosmology) and sub-Planckian space)
- The fifth dimension is a sub-quantum domain or superfluid quantum space with implicate order
- Sub-Q information is expressed in math / geometry and in subjective experience and feeling
- Sub-Q information is non-local and holographic, rendering it scale invariant and fractal
- Life, evolutionary seen, is guided by sub-Q/ZPE information neg-entropic information field
- Brain is 4-D and immersed in a 5-D workspace, bearing an event-horizon information register
- The Event horizon of brain contains collective sub-Q-information for supervening quality control
- Brain is a neurological network, mirroring the cosmic web as to electromagnetic/filament structure
- Brain/ ZPE and sub-Q interactions are bi-directional and retro-causality enables predictive coding
- Symmetry breaking from the sub-Q frequency domain informs DNA/Protein mediated life processes
- Consciousness is cosmic and universal and all reality is immersed in consciousness (monistic idealism)
- Initiation and final fate of our universe is conceived from a circular/rebound black-hole cosmology
- Biophysics requires a non-material (mental) attribute, mirroring non-dual wave-particle conceptions
- Humans and other intelligence are essential observers and participants in the evolution of the cosmos

Table 4: The non-material aspects of the fabric of reality as submitted in our studies

But is mathematics really a language? Does it possess the various properties that are characteristic of other natural languages? Clearly mathematics does not have the same fluency as a natural language and, even more obviously, it is rarely spoken aloud. This suggest that mathematics is really a more restrictive limited form of language. On the other hand, mathematics is also less than a language, in that it lacks the richness, the ability to deal with nuance, the inherent ambiguity and the rich strategies for dealing with this ambiguity. In this sense, mathematics is a limited, technical language in which much that is of deep human value cannot be expressed.

Clearly our present mathematics lacks this essential dimension. But could, in fact, mathematics moves in such a direction? A new mathematics would not simply offer a crystallization of thought but also explore the actual generative activity of the orders of this thought within the body and mind. Such a new formal language would represent a deep marriage between mathematics and the arts (**Meijer, 2018**) and according to **Bohm, 1980**, **1990**, could be seen as a process of unfolding of information. Yet, it would involve a mathematics that requires the existence of another mind to complete it, in an ordered and controlled way, and, in so doing, this mathematics would become the product of some, much deeper order. This brings us back to the question of the unreasonable effectiveness of mathematics of **Wigner, 1960**. It is tempting to suggest that mind and matter, brain and consciousness are two sides of a single process, something that emerges out of a deeper and hitherto unexplored ground. In this sense the order of generation that gives rise to the universe has a common source with the generative order of consciousness. In its deepest operation, therefore, *our intelligence could be said to mirror the world*.

This idea has been expressed in other ways. Carl **Jung, 1955** for example, spoke of the *archetypes*, very roughly defined as those dynamical orders, unknowable in themselves, that underlie the structure of the collective *unconscious*. The archetypes are never seen directly but their power can be experienced in certain universal symbols. In his more speculative moments, Jung also hinted at something that lay beyond matter and mind, but included both. **Mandelbrot's, 1977**, fractal theory is capable to describing and generating figures of infinite complexity; David Bohm's notion of the implicate order is a powerful concept but has yet to find an appropriate mathematical expression. In this sense it could be said that physics, with its reliance on the language of mathematics, must always present an incomplete picture of the universe. Its language is impoverished, for it lacks this basic integration of the four human functions. It can never fully express the essential fact of our confrontation with, participation in, and understanding of nature. Quantum theory is also concerned with the indivisible link between the observer and the observed. And this suggests that it would be to the advantage of physics to develop a similar flexibility in its basic language giving it the ability to explore the rich orders that lie between the observer and the observed (**Table 4**).

16.11 Everything Is Said, But Nothing Has Been Told....

We propose to entertain the discussions around mind/matter affairs, honouring the following principles:

- We all should try to see important matters such as consciousness and information as dynamic *processes*: there is no present state of art nor a state of science: consciousness is rather becoming, as we are ourselves

- We hope to avoid the pitfalls of our language: our symbols collectively form our instrument of interhuman communication, yet these symbols do not weave the fabric of reality. - There are no physical laws that are observer-independent, all our present theories are the product of human reasoning, implying inherent limitations and personal, if not collective bias (**Gefter, 2014**).

- Information can be physical (mass, momentum, charge, spin, polarization), but can also evolve in *information with meaning* (implied by us, for us, (see **Meijer, 2012;2013a).**

- Quantum physics should not be an invitation to construct a virtual reality that replaces our dreams and the predictive coding of our own, free will, brain

- The very meaning of the term monism, in any context, undermines per definition the value of such contexts such as idealism, dualism, non-dualism, two-aspect momism, pan-psychism, pan-experientialism, non-material physicalism: there is very likely nothing in this world that is exclusive

- The present authors support the operator archetype of toroidal processing in the becoming of reality as well as the implicit möbius type of trajectories in which inside becomes outside and vice versa (Fig.47)

- It follows therefore, that we should not only try to ex-plain our ideas (to put them onto a plain outside us), but also to im-plain (internalize/integrate) them in our mind, so that we can steadily grow.

- It is understood that the idea of wave/particle duality is inherently superficial, instead we should imagine a world in which particle and waveform occur *simultaneously*: illustrating a deeper level of observation/feeling

- We should therefore take up the challenge, offered by Adrian Klein: our future concepts should reach deeper levels of reality to become fully original ad fundamental different from earlier proposals in the field

- Zero-point energy per definition constitutes a force field that provides a *transition zone* between our 3-D quantum world and a Sub-Quantum domain, in which the latter bears deep level information as a pro-active (guiding) relational modality, (**Fig.49**).

- The final aim of the cosmos, according to the gospel of the *prophet Mani* (216- 274 AD), was conceived as the reconciliation of mind and matter, being instrumented by the use light. This revelation now seems fully in line with the current theories in trans-humanism and role of advanced civilizations/technology in the final fate and rebirth of our universe, (**Barrow and Tippler, 1988, Kurzweil, 2012; Vidal, 2014, Fig.49**).

- Can we envision a symphonic act of ultimate love, in a repetitive circular and timeless mode, in which countless beings and creatures of past and future, will be seen, recognized and valued as observers and participants in the evolution of the cosmos, and this by something that is far, far greater than us?

- If so, we may anticipate that good and evil, like mind and matter will be unified into a non-dual aspect of the cosmos, having a bi-polar role in the further creation of reality, and somehow may act as subtle balancing mental attribute of the cosmos in the grand design that is at stake.

- In this framework modern studies on near-death experiences (**Greyson, 2013**}, and reincarnation reports (**Klein, 2020a, b**), indicate that death should not be seen as a transition to another phase (**Meijer 2019b**), but rather implies that all living beings are already represented in such a domain during their entire individual life.

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