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Consciousness in the Universe is Scale Invariant and Implies an Event Horizon of the Human Brain

Dirk K.F. Meijer* and Hans J.H. Geesink**

ABSTRACT

Our brain is not a “stand alone” information processing organ: it acts as a central part of our integral nervous system with recurrent information exchange with the entire organism and the cosmos. In this study, the brain is conceived to be embedded in a holographic structured field that interacts with resonant sensitive structures in the various cell types in our body. In order to explain earlier reported ultra-rapid brain responses and effective operation of the meta-stable neural system, a field-receptive mental workspace is proposed to be communicating with the brain. Our integral nervous system is seen as a dedicated neural transmission and multi-cavity network that, in a non-dual manner, interacts with the proposed supervening meta-cognitive domain. Among others, it is integrating discrete patterns of eigen-frequencies of photonic/solitonic waves, thereby continuously updating a time-symmetric global memory space of the individual. Its toroidal organization allows the coupling of gravitational, dark energy, zero-point energy field (ZPE) as well as earth magnetic fields energies and transmits wave information into brain tissue, that thereby is instrumental in high speed conscious and sub-conscious information processing. We propose that the supposed field-receptive workspace, in a mutual interaction with the whole nervous system, generates self-consciousness and is conceived as operating from a 4th spatial dimension (hyper-sphere). Its functional structure is adequately defined by the geometry of the torus, that is envisioned as a basic unit (operator) of space-time. The latter is instrumental in collecting the pattern of discrete soliton frequencies that provided an algorithm for coherent life processes, as earlier identified by us. It is postulated that consciousness in the entire universe arises through, scale invariant, nested toroidal coupling of various energy fields, that may include quantum error correction. In the brain of the human species, this takes the form of the proposed holographic workspace, that collects active information in a “brain event horizon”, representing 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 network synchronicity, as required for conscious states. In relation to its scale-invariant global character, we find support for a universal information matrix, that was extensively described earlier, as a supposed implicate order as well as in a spectrum of space-time theories in current physics. The presence of a field-receptive resonant workspace, associated with, but not reducible to, our brain, may provide an interpretation framework for widely reported, but poorly understood transpersonal conscious states and algorithmic origin of life. It also points out the deep connection of mankind with the cosmos and our major responsibility for the future of our planet.

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Key Words: Life algorithm, Scale invariant consciousness, Human Brain Event Horizon, 4-Dimensional brain modeling, Brain hypersphere, Supervening brain workspace, Universal Consciousness, Soliton-guided biology, Toroidal modeling, Field-receptive workspace of brain, Electromagnetic frequency bands, Cosmology and Consciousness, Fractal nested toroidal geometry, Bio-photons

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Introduction

Consciousness can be defined, as a state of a semi-stable system that has developed in a cooperative and cyclic operating mode so that it has become “causally self-observant”. Thereby, it can not only predict aspects of the local environment, but also can integrate memorized information and future-directed projections into a personal worldview that serves individual survival, development and social communication (Forshaw, 2016a, b). Yet, in this paper an even wider context for consciousness is offered, in which our individual mind is seen as a part of a larger universal consciousness, being instrumental in the entire fabric of reality. This concept is based on our earlier consideration of an extended mind (Meijer, 2015) and our recent observation that life processes are sustained by a discrete pattern of electromagnetic wave frequency bands (Meijer and Geesink, 2016). Consciousness, therefore, is not only a human faculty and implies a reflective state that both involves information integration as well as subjectively “feeling” of past and future events. It requires a graded complexity of life systems to deal with the requirements of multi-tasking and ecological maintenance. This cognitive structure is build up out of coded coherent information in our brain, that is constantly adapted and renewed through integration and superposition of wave information (Meijer, 2015, Geesink and Meijer, 2016a and b). Coherence may represent a common denominator of neurophysiological and biophysical approaches to brain information processing, operating at multiple levels of neuronal organization, from which cognition may emerge as its cardinal manifestation (Plankar and Jerman, 2011). Another complementation of the known neuronal communication system is proposed to address the ultra-rapid response times of the brain on the basis of a dedicated photon/soliton mediated information network, that serves to connect the nervous system with a holographic mental workspace (see later).

In order to have a better understanding of scientific and artistic endeavor of humanity as treated recently by the first author (Meijer, 2017), it is obviously necessary to address the item of human consciousness and self-consciousness, since these phenomena lie at the common basis of both activities (see for a comprehensive review on the character of consciousness, Annala, 2016. A central item in brain research is the question whether consciousness should be conceived solely as an

emergent phenomenon, as related to the extreme neurological complexity of the brain or rather that the central nervous system is embedded in a much wider context in which it also receives (quantum) wave information, partly unrelated to the known senses. However, it remains an obvious question how humans develop self-consciousness and obtain basic knowledge of the type called qualia (Chalmers, 1995). The *hard problem of consciousness* is the problem of explaining how and why we have qualia or phenomenal experiences and how sensations acquire characteristics, such as colors and tastes.

Human consciousness is characterized by awareness, volition and cognitive reflection, operating within a neural workspace. The latter is conceived as a nested organization of biophysical sites on the micro- to macro-levels of the brain (Meijer, 2014b). Within this workspace, a bicyclic flow of information was envisioned, of which the deep *vertical* aspect is related to a flux from sub-atomic particles up to atoms, molecules, cellular organelles, neurons, to neuronal networks. This process acts in concert with a second, *lateral* horizontal, flux in the brain, in which non-local quantum entanglement as well as holographic projection may play a role. This double *rotational* (toroidal) information flow may explain neural binding and instantaneous connections with other parts of the body. Both types of information flow provide the basis for integration of active information that returns to itself (a modality of self-consciousness), including modalities of universal consciousness.

Toroidal information flux (see Fig. 1) is postulated by us to provide the basis for the existence of consciousness at the different scales of the Universe. There are distinct reasons to choose the multidimensional symmetrical aspects of the double vortex torus, a geometry that may mimic a combination of transversal, longitudinal and circular waves (Haramain, 2014; Bjerve, 2015, see Fig. 1). The nature of electromagnetic toroidal excitations as developed in physics was reviewed by Papasimakis *et al*, 2016, and their interactions with inorganic matter by Tsyтович *et al*, 2007, while potential role as information collectors and carriers in life systems have been discussed by us earlier (Meijer and Geesink, 2016). We consider the following aspects:

- The torus has a topology, with its internal channel-like structure (see Fig. 1), in which various types of information carrying waves



allow the coupling of different modalities of wave information such as photons, solitons and electrons (Meijer and Geesink, 2016 a and b).

- The torus is a favored geometric structure in physics and is applied for the description of elementary particles from the micro- to macro-scale of the entire universe (Papasimakis *et al*, 2016; Williamson, 1997; Tozzi, 2015; Merali, 2008; Poplawski, 201; van Putten, 2002; Hamein and Rauscher, 2007).

-Nested torus geometry shows similarities with twistor theory of Penrose (see Fig. 1), that have for instance been applied as a space-time unit in string or M-theories (Witten, 2003), thereby reducing the large number of extra dimensions common in string theories.

- The torus model integrates the present time as resulting from past and future wave projections, Baez and Vicari, 2014 (see Fig. 2), and the negative energy of its inner channel/wormhole may allow retro-causal effects and reversed flow of time (Ford and Roman, 2003).

- Toroidal processing of data offers the advantage of de-coherence protection and quality control of information (Van de Bogaart, Forshaw, 2015) and is used in music theory. The Toric code is an efficient method for topological quantum error correction that requires a 4th spatial dimension

(see Wikipedia, Quantum error correction). This aspect could play a pertinent role in the supervening mental workspace, conceived as an event horizon equipped hyper-sphere, as proposed in the present paper.

-The (double)nested torus represents unity in diversity, and its entangled fractal character shows the features of a multifold building block of space-time, as an interacting configuration of various wave fields that influence life organisms (see for illustrations Hamein, 2016; Brown, 2016; Thomson and Bourassa, 2016; Bjerve, 2016).

2. Torus geometry can model consciousness at all fractal levels of the universe

The torus model, apart from micro-physics, has been extensively used in current cosmology. The well known “doughnut” torus shape, created by energy vortices.

NASA (2004) discovered that so-called black holes in our universe seem to exhibit a doughnut shaped torus formations (Holzhey, 1994). It is also interesting to note that recent developments in string theory predict that black holes (Fig. 2) can exist at *any* scale: from the microcosmic scale

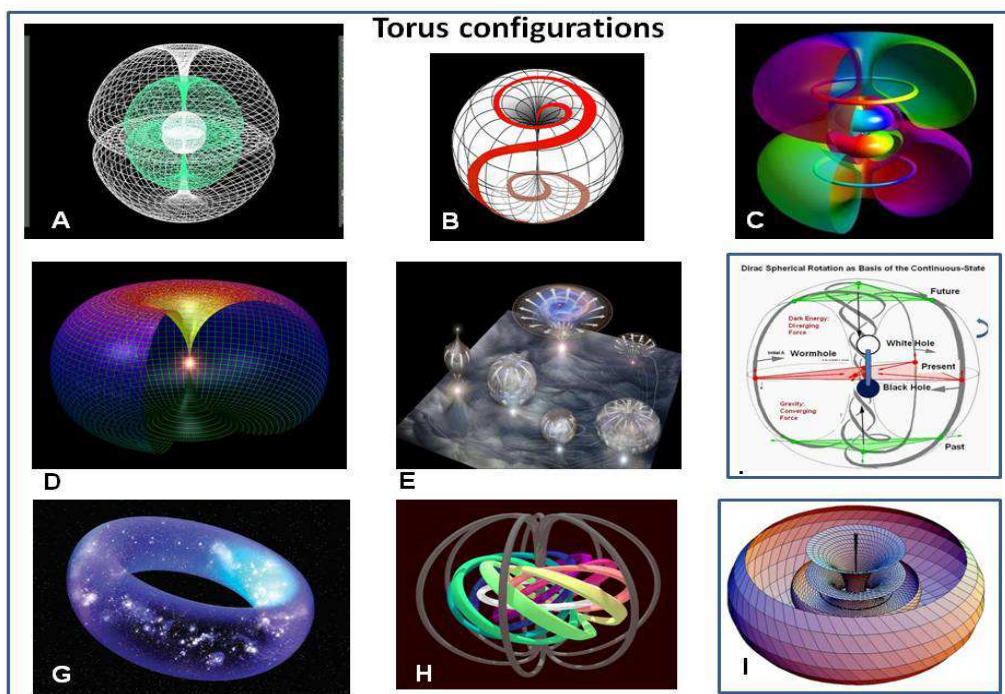


Figure 1. Various modalities of toroidal geometry: A: Nested torus structure B: Torus trajectory (red) C: Atomic structure as double torus, D: Filled space-time structure with singularity, E: Torus network, F: Dirac spherical rotation showing toroidal trajectories in relation to time G: Donut model of the universe, H: Knot structure in torus as metaphor for attractor/standing wave, I: cartoon of a twistor as a supposed space-time unit.

of particles to the macroscopic huge scales of black holes, as observed in remote galaxies. In fact at CERN in Switzerland the Large Hadron Collider might be capable to spawn *black holes*.

The connecting principle of quantum information in the material universe

We usually talk about two seemingly separate worlds: that of material particles and that of a hidden wave world with its force fields, such as gravity and dark energy. The special feature of the work of Verlinde, 2011, 2016, is that the author brings the two aspects together in the form of quantum information as the most fundamental building block of the universe, as also pointed out earlier by Meijer, 2012. Matter and thus particles can be seen as condensations of force fields that interact and both can be described with quantum information, that is actually a form of energy (see later). The special property is to bring the various types of field information together. In quantum theory, energy is quantized: thus consists of discrete vibrational units (vibrating strings or loops). The space is also quantized according to the theory, thus divided into small space parts. This matrix of such space units is usually called space foam, bearing units that function as operators. Known examples of such elements are twistors (Penrose) related to nested torus geometry. Such units are supposed to operate on every fractal scale, from very small (Planck scale) to very large (black holes), and can be conceived as the collection points of the various force fields: gravity-, dark energy-, zero-point energy-, electromagnetic-, and Higgs fields etc.

In this manner, such operators integrate quantum information and store it on the edge of each fractal unit, that in the case of the black hole was called the "event horizon". Quantum information, like energy, is never lost. Verlinde 2011, used the holographic principle, invented by the Nobel laureate 't Hooft (see for holography aspects Sieb, 2016; Batiz, 2107; Alfonso-Faus, 2011). The leading principle is that every object is fully described with information gathered on a screen around the object (the event horizon). The entire universe and also galaxies, suns, planets and even living systems are to be regarded as toroidal organized information fields each projecting digital information on their respective event horizons. It has been experimentally demonstrated recently that:

1) information is in fact a form of energy: when information is removed from a quantum system, energy is released in the form of heat (entropy), (Bérut et al, 2012; Toyabe et 2010; Peterson, 2016).

2) this also applies to the quantum world. Binary units (bits, say a kind of yes/no questions) are then Qbits, but now information can mix (superpose) and can show entanglement with other states of quantum information (Lloyd, 2007, Nielsen and Huang, 2000).

3) the suggestion of Verlinde, 2011, 2016 and earlier Zeilinger, 2000, 2003, is that the information is intrinsic to matter (and even the source of it!). Consequently atoms and their constituting elementary particles such as electrons contain information, that can be calculated (in Bits of Qbits), forming a deeper information layer of reality that we cannot observe directly (yet).

It should be noted that:

a) The information carrier of choice in physics is not the electron but the photon (being particle and wave simultaneously). Photons can have very different energies (vibration frequency), they can be in different spin states (kind of spinning motion) that can occur in various rotation axis, they can be polarized (various vibration directions) and they have momentum (speed and direction of movement). The number of variations in the above-mentioned combination of properties is very large! One could call the entangled properties of each photon a kind of particle information (Zeilinger, 2000, 2003). It is of interest that attractive forces between photons perse, may lead to polarization entangled photon pairs and solitons as a sort of quantum matter (Firstenberg *et al*, 2013).

b) Photons may interact with atoms and thereby share their intrinsic information. These elements can store the interaction effects as entangled information, registering the subtle changes in the characteristics listed above, and thereby create a kind of particle/wave "memory" (Nielsen and Chuang, 2000, Lloyd, 2007, Lugo *et al*, 2015).



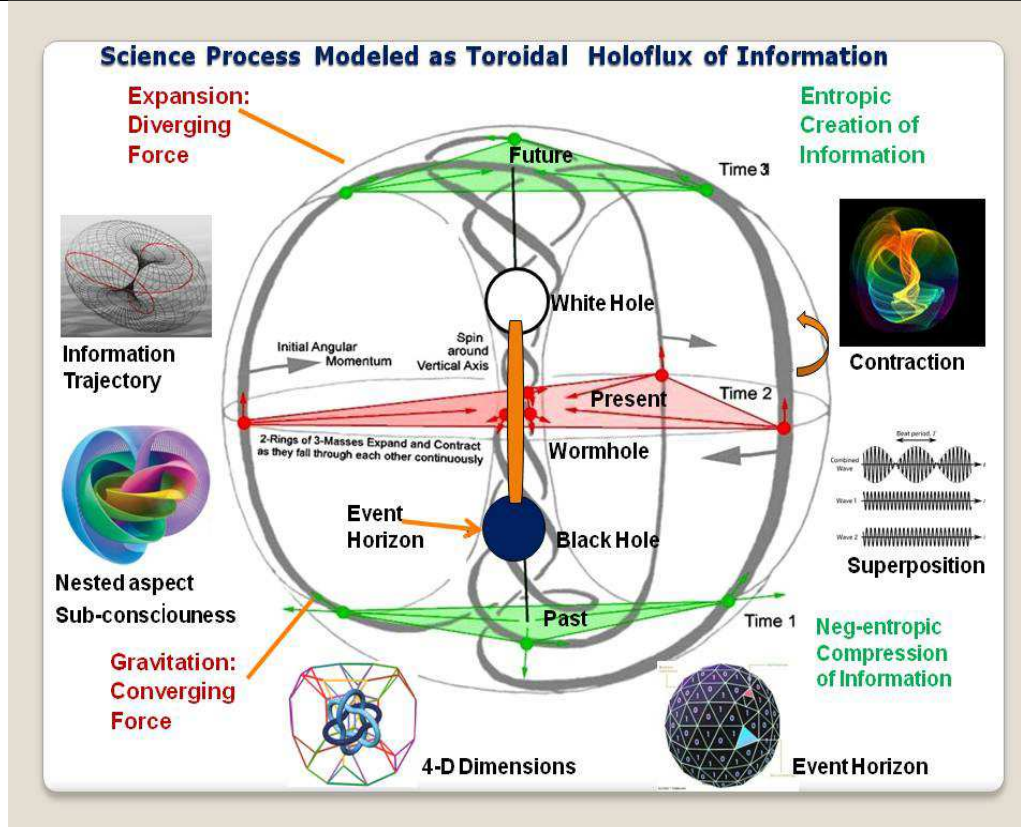


Figure 2. A tentative cosmological torus model for describing the re-bounce of the universe in a circular universe concept. This geometric approach models the information Universe at fractal scales. The surface trajectory of information quanta is shown in grey patterns (see also inset left above), including their interactive processing in the inner core of the torus with potential wave coupling/conjugation by superposition (see inset right middle). The nested (self similar) aspect and 4-D dimension of the torus are indicated via the insets left below. The dynamics of the torus is implicit by an inherent rotation axis and recurrent flow of wave information in a bi-spiral flow pattern. The integral state of the torus depicts a supposed stage of our universe in which all information is collected and gravitationally compressed into a terminal black hole, in which all information is holographically projected on a virtual screen (its event horizon). Information is projected on the black hole horizon and proposed to be passed through a wormhole structure that is inherently connected to a white hole. The latter is instrumental in dispersing the particular information into a next (nested) version of a cyclic universe (Meijer, 2015). Aspect of time in the model is represented by the colored triangle planes: red plane depicts the present time as a back projection of past and future waves, according to the transactional interpretation of quantum physics by John Cramer, green plane below indicates the past time, and green plane above the future time, (figure modified from Stan Tenen, 2002 as shown in a PPT presentation of Amoroso, on Dirac spherical rotation).

c) Thus, information always arises from *interactions* and according to classical information theory, information/entropy represents the *potential* to ask yes/no questions in such an event with regard to a particular system (Lloyd, 2007, Meijer, 2013). According to these concept information is in fact the sum of *expected* information obtained from such yes/no questions. An example is DNA in our cells which in itself contains a lot of *potential* information (digitally expressed in Bits), yet is only clearly expressed in the cell in relation with RNA and proteins.

d) The intrinsic (hidden), information of an object is therefore the result of the entanglement of the stored (individual) information from the various constituting particles, providing a sort of global information by converting all of this information

into a coherent information matrix, that is dynamic in time (Keppeler, 2013, 2016). Some link this matrix with the so called zero point energy field. (Laszlo, 2007, 2012; Setterfield, 2002; Nation *et al*, 2012).

e) That we cannot directly perceive this information aspect, is traditionally ascribed to a hidden 4th *spatial* dimension (not the dimension time!), which cannot be observed in our 3D world, but can be mathematically derived. Such supposedly compact 4th dimension could also explain the creation of dark matter in our 3-D world through selective wave exclusion in the ZPE field, according to the so-called Casimir effect (Wongyun, 2013; Green and Levin, 2007).

f) Recently it has also become clear that even space-time itself may be derived from the above-mentioned quantum fluctuation field and, in



particular, through the entanglement of quantum information that is locked in. Instrumental in this respect are a sort of “short cuts” in space, that connect one part of the space with another, via a so-called wormhole structure. This concept is called EP = EPR conjecture. (Maldacena and Susskind, 2013; Susskind, 2016; van Raamsdonk, 2010). This wormhole concept (geometrically quite similar to the central channel of the torus) was already known from the physics of black holes, but now appears to be present at every fractal scale in the universe up to the Planck scale where it constitutes the aforementioned *quantum foam* (Haramain, 2016; Ford and Roman, 2000; Lloyd, 2007; Loll, 2011, Wikipedia/quantum foam).

It is assumed that information entering a black hole from the outside is not lost, but, as mentioned above, rather is being projected on its outer screen, called the “*event horizon*” (Maldacena and Susskind, 2013; Pourhasan, 2013; Haggard and Rovelli, 2014; Susskind, 2016; Lloyd, 2007). From this information-radiating screen, the collective 2-D information of entangled black holes can be holographically projected into the 3D representation of our world. It is presently discussed whether the emitted waves either represent chaotic information or coherent information. The latter could, for example, arise by constructive interference with existing information in the universe and the resulting updated information could be integrated in a general knowledge field (Bohm *et al.* 1980, 1987, 1993). Such a field may function as template for a supposed simulation of the universe (for references see Meijer, 2015). A recent theory (Pourhasan, 2013; Haggard and Rovelli, 2014) claims that information can also pass through the black hole structure, via a connecting wormhole (a sort of short cut in space-time) to an intrinsic “white hole”, that instead has an anti-gravitational character, that can disperse the stored integral information in order to start a new version of our cyclic operating universe (see Fig. 2). This model for the final fate of our Universe (the so called big bounce, Meijer, 2015) might predict that information of a newly formed universe is integrated in a *nested* configuration with the preceding one (Haggard and Rovelli, 2014; Poplawski, 2010).

Information and Life processes

Life is not possible without a continuous integration of internal and external information.

Information from the outside world is essential to the maintenance of vital processes, since all biological systems “feed” on information. (Grandpierre, 2014; Farnsworth, 2013). It should be realized in this respect that a living system does not just detect and generate information, it also transforms it. Such biological cybernetics should display the following features: it should be: a) instantaneous and generalized; it cannot be a gradual “diffusion” of information through the system, as that would work too slowly; b) capable of receiving every type of information from the environment (electromagnetic, acoustic, thermal, chemical, mechanical, gravitational); c) able to receive the same information selectively over different fractal biological orders of magnitude; d) it must incorporate information of various parts of the organism and the whole configuration at the same time; e) it should be protected against an excess of information and apply some kind of information quality control; and f) it must ensure minimal loss and distortion of information, and therefore ensure a maximum fidelity of transmission.

3. The nested torus in modeling fractal aspects of the cognitive process

To model deeper levels of brain function, fractal conditions are required in geometric terms (Gardiner *et al.*, 2010; Bieberich, 2012; Freeman, 2006; Kida *et al.* 2015; Meijer, 2014). The present authors prefer to postulate a *nested* torus modality in modelling cognition (see Fig. 1 a), indicating deeper layers of the self-similarity and recursive elements. This in the framework of a scale relativity space-time concept (see for an introduction Wikipedia/Scale relativity), and further highlighted in toroidal terms in the concept of a fractal-holographic universe (Haramain, 2007, 2016; Bjerve, 2016), see Fig. 3.

This, mathematically substantiated, self-similar cosmic character was also described as a *cellular* universe (Anjamrooz, 2011). Fractal properties may also provide a link to deeper layers of information processing in the brain (Vitiello, 2015; Reddy and Pereira, 2016; King, 2003; Gardiner *et al.*, 2010). Examples of *subliminal information* (see Wikipedia) are intuition and serendipity, that are supposed to arise from the sub-conscious domain of the human mental apparatus (Bernstein, 2005, Rousseau, 2011). The human body and brain have earlier been described in fractal terms (self-similar repeats), that imply deep layer



holographic communication (Pribram, 2004). The latter may not only explain the extremely rapid reactions of the nervous system (Meijer and Korf, 2013), but also the coupling of conscious knowledge to sub-consciously induced intuitive impulses, and mental states.

The nested torus in this respect is seen by us as a fundamental aspect of quantized spacetime. Interestingly, twistor geometry, that was intended to unify quantum mechanics and general relativity and to define gravitation, can also be used for solving non-linear Schrödinger equation to obtain solutions for *soliton wave phenomena* (Dunajski *et al*, 2004). Recently, Hamein *et al*, 2016, postulated a collective wormhole background on the Planck scale (see Fig.10) that may underly our reality and could explain the partially directed character of biological and cosmic evolution, as have also be indicated by Melickh and Khrennikov, 2016. Dynamical systems in the physical world tend to arise from dissipative (actively spreading) systems, always including some driving force, that maintains the motion. The dissipating driving force tends to balance the initial transients and settle the system into a typical, future directed, behavior, known as an *attractor* (Keppler, 2013, 2016). An attractor can

even constitute a complex set with a *fractal* structure, known as a *strange attractor* (Wikipedia). The latter aspect promotes a *collective and coherent* behavior that can lead to flux-maximization.

In the framework of the present model, both the subjective unconscious and conscious aspects (Tammietto, 2010, Jahn and Dunne, 2004; Bernstein, 2005; Schwartz *et al* 2005; Rousseau, 2011) can, in principle, be modeled as information flow and recurrent storage, taking place in a nested toroidal setting, since the human brain organization clearly shows functional *circuitries* and obvious *fractal* properties (Gardiner *et al*, 2010; Bieberich, 2012). In addition, highly subjective elements such as intuition and serendipity, that may represent crucial elements in most of the major scientific breakthroughs and/or technological innovations (Meijer, 2017a), should be taken into account. In this respect, breaking the barriers or removing the “filtering” between the conscious and unconscious is widely discussed in relation to meditation and induced dream states. (Jahn and Dunne, 2004; Bernstein, 2005; Schwartz *et al* 2005; Rousseau, 2011).

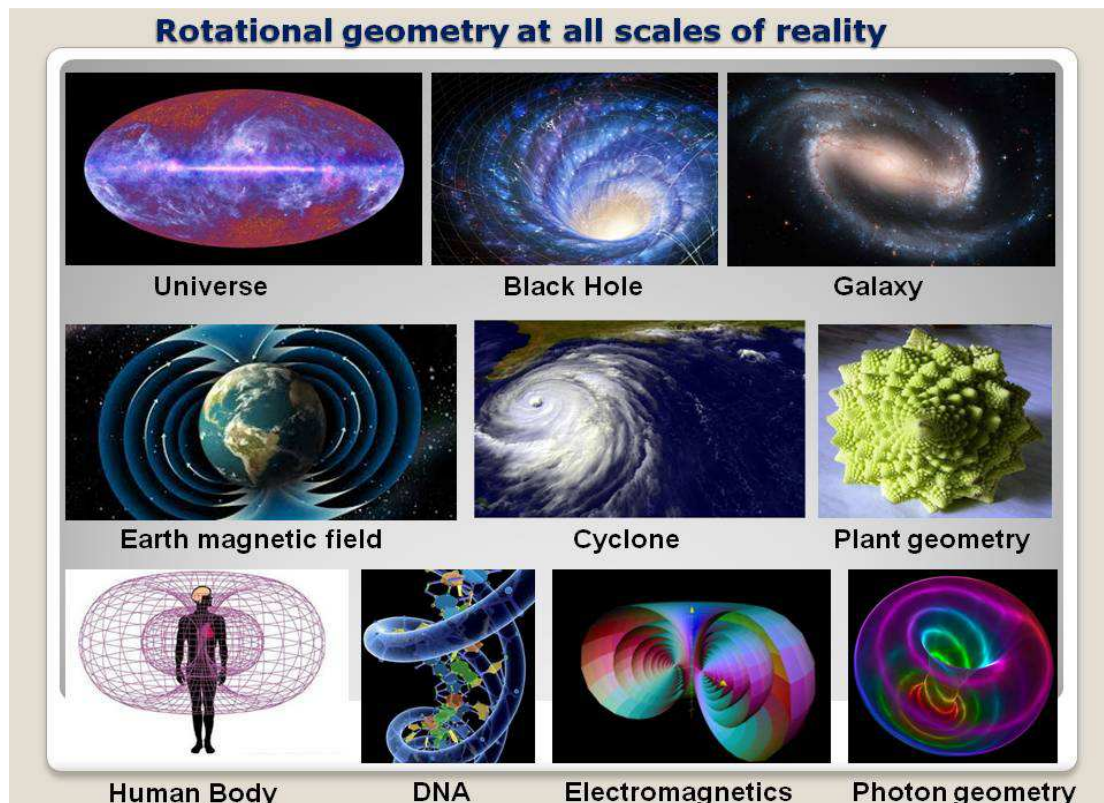


Figure 3. Toroidal geometry shows identified structures in the whole cosmos, from macro-(left above) to micro (right below) scales of the fabric of reality. The inset, left below, depicts the supposed nested toroidal geometry of the human body, heart and brain.

In this framework, it is presently discussed whether biological evolution was a purely random process or that it rather constituted a partly guided event on the basis of primordial information that was expressed through electromagnetic wave patterns that were present from the very start of our universe (Melkikh, 2014, 2016). It is of interest, in this respect, that the pattern of EM frequency radiation bands that were shown by us to promote life processes, can be mathematically approached by a selected tempered Pythagorean acoustic scale (Geesink and Meijer, 2016 a) and that a phonon-guided mechanism (phonon is an acoustic wave) is a plausible mechanism in a biological field context (Meijer and Geesink, 2016).

4. Multi-dimensional space-time in the toroidal brain model: consciousness models, including a 4th spatial dimension

Several previous studies have postulated that to understand integral brain function, a fourth spatial dimension is required (see table 1 below and also Wesson, 2014). These proposals are related to a long standing discussion in physics on the dimensional structure of reality, that in fact was initiated by Minkowsky and Einstein, who instead of the usual 3+1 space time model, with a non-symmetrical time dimension, proposed a 4th symmetrical time dimension in addition to the three spatial ones (*Block universe*).

All of the really fundamental physical dynamical laws are invariant under time translation and time reversal. Moreover, the concept of the “now”, the brief interval that divides the past from the future, is absent in all fundamental mathematical formulations, both in classical physics and in quantum physics. In the block universe according to Minkowski, our actual universe, being all our moments, past, present and future, coexist, but we can’t directly see or experience that fact. We experience our moments serially, one after the other, such that only the present moment is what’s actual for us. The Wheeler-DeWitt equation also suggests a model in which all of time is laid-out (just as the space dimension is laid-out), and all times are equally real: the movement of time is considered to be just an illusion of human perception (see Meijer, 2015).

In 1921-1926, Kaluza and Klein proposed the Kaluza–Klein theory, being a unified field

theory of gravitation and electromagnetism, built around the idea of a fifth dimension beyond the usual four of space and time. It is considered to be an important precursor to string theory (Miller, 2013). In 1926, Oskar Klein gave Kaluza's classical five-dimensional theory a quantum interpretation, to accord with the then-recent discoveries of Heisenberg and Schrödinger.

More recently, Randall postulated the Randall–Sundrum model (also called 5-dimensional warped geometry theory, Gabella, 2006), imagining that the real world is a higher-dimensional universe described by warped geometry.

According to Carter, 2014a and b, the demonstration of time-like non-locality, logically requires that time is more fundamentally a dimension of space. While our classical universe appears consigned to constant motion along that spatial dimension, the quantum world seems not so constrained: the wave function reaches across time as it reaches across space. An imaginary spatial dimension is considered an actual “direction” in the universal spatial fabric, orthogonal to the real dimensions and measured in imaginary units.

Table 1: Four spatial dimensions (hyper-dimension) and one symmetrical time dimension are required for defining (self)- consciousness: current literature (author/shortened title)

- Sirag, 1981:** *Consciousness, a hyperspace view*
- Tiller, 1999:** *Predictive model of subtle domain connections*
- Smithies, 2003:** *Space, time & consciousness*
- Carter, 2014:** *Consciousness and perception of higher-dimensional quantum space-time*
- Meijer and Geesink, 2016:** *Phonon-guided Biology in 4-D toroidal geometry*
- Beichler, 2012c:** *The Evolutionary Imperative of Consciousness*
- Tozzi, 2016:** *Towards a fourth spatial dimension of brain activity.*
- Hardy, 2016:** *Non-local processes and cosmic hyperdimension of consciousness*
- Irwin, 2014:** *Consciousness in quantized spacetime*
- Wesson, 2014:** *Looking for the fifth dimension*
- Brandenburg and Hardy, 2015:** *Entropic gravity in pre-spacetime*
- Fingelkurts, 2014:** *Present moment, Past and Future: Mental Kaleidoscope*

Similarly, Kaluza’s theory (Gabella, 2006) derives the electromagnetic field extending



throughout the first three dimensions of a 4-space.

It was postulated that only a 4+1 space time structure, (thus with an extra spatial dimension), allows a unity of relativistic and quantum physical reality (Beichler, 2012c), including time-symmetric operation and backward causation (Meijer, 2012 and 2015). This also allows causal and tensed-time modalities, that are essential for self-consciousness and reflection (Carter, 2014).

Quantum information mechanisms were recently used to model human consciousness as well as the unconscious in relation to conscious perception (Martin *et al*, 2013), in which various modalities of non-locality were discussed. Of note, entanglement and non-locality may not only apply to spatial separation, but also a temporal one. It was proposed by Martin *et al*, 2013; Baaquie and Martin, 2005 that archetypical information can be stored as quantum information in appropriate fields and that consciousness may be controlled by quantum entanglement from *outside the* classical 4-D space-time configuration, (see also Luminet, 2016).

We hypothesize, in this respect, that gravity, in a concerted action with the opposing dark energy (anti-gravity), is partly instrumental in the manifestation of consciousness at all levels of the Universe, including the human brain (see Fig. 9). This principle of recurrent information flow, in this view, can be extended to the entire scale of the extremes of spin networks, life organisms and our planet, as well as the macrocosmos (entire universe, Fig. 3). Recent progress in physics/cosmology have been attained in the further defining of the nature of space-time (Maldacena and Susskind; Green and Levin, 2007, Susskind, 2016). Another major finding is that physical information should be seen as a modality of energy and that information and energy can be mutually converted to each other (Bérut *et al*, 2012; Toyabe, 2010; Peterson *et al* 2016), confirming previous ideas on three fundamental building blocks for the fabric of reality (Meijer, 2012): matter, energy and information. A recent study of Aharonov *et al*, 2013, even indicates that information can be physically separated from the matter it describes.

The information generated in the universe is supposed to be holographically projected in so called event horizons and in turn also broadcasted from these virtual screens by

bidirectional (forward/retrograde) projection, (Fig.2). Event horizons, collectively may thereby contain all integral information reflecting the integral history of the fabric of reality (Luminet, 2016; Haggard and Rovelli, 2014). According to a fractal-holographic view the same patterns are repeated at each scale and the whole is present everywhere at all times, in a unified geometric field as earlier proposed by Wheeler and Feynman, 1945.

5. Electromagnetic aspects of dynamic models of consciousness

Many scientists have earlier suggested that basic information reaches our brain *from outside* (Persinger, 2008, 2015; Grof, 1987, Jahn and Dunne, 2004), since the nervous system may also function as a receiver of subliminal signals. One could regard this as a physically defined "extrasensory perception". Yet, the alternative view is that we have to take into account a "sixth" sense in the form of a *vibrational, resonance sensitive macromolecular apparatus* in each of our cells (Hameroff and Tuzcinsky, 2015).

These receivers act as vibrational, resonance sensitive elements in cells and act as receptors and as emitters of quantum information, which functions as resonant oscillators with specific resonance frequencies, which are coupled with a natural quantum field (Rouleau, 2014). The particular cellular sensors are composed of flexible three dimensional structures of proteins, oligo-nucleotides and elements of the cell skeleton, that mutually communicate through discrete wave resonances and are sensitive to fluxes of photons, phonons, excitons and related quasi particles such as polarons (solitons) and polaritons. This bio-sensing apparatus, situated in an apparently electromagnetic cell, was tentatively called *electrome* (de Loof, 2016), and is under the continuous influence of natural occurring internal as well as external electromagnetic fields (Meijer and Geesink, 2017).

The latter potentially include interaction with either the all pervading zero-point energy field (Setterfield, 2002; Laszlo, 2007; Keppler, 2012; Caligiuri, 2015), or to physically defined mental dimensions (Grof, 1987; Jahn and Dunne, 2004; Beichler, 2012b). Also, bio-photonic type of communication (Dotta, 2013), gravitationally sensing of information present at the Planck scale (Penrose, 2014) and even information projected from event horizons of black holes have been implied (Maldacena and Susskind, 2013). In this



respect it is worthwhile to mention that, based on quite solid evidence, the brain has been described as an electromagnetic workspace (McFadden, 2007; Pocket, 2012; John, 2001, Fig. 4).

The collective field concepts may constitute an interpretation framework for poorly understood phenomena such as mental states such as intuition, telepathy, far distance observation as well as near death experiences (see Radin, 1997) as well as near death experiences (Beichler, 2012c; Bókkon *et al*, 2013) and Psi phenomena (Radin, 1997; Beichler, 2012b; Rousseau, 2011), to mention only some of the many studies available on this topic.

“The universal force of electromagnetism controls all biological response” as Hawking noted in “A Brief History of Time”. Indeed, living systems are under the continuous influence of electromagnetic fields and it is proposed in the present paper that the native, non-trivial, photon/electron vibrations exhibited by such scalar fields are shared with resonating proteins and nucleotides that control cell function throughout the hierarchy of living systems.

This research area was pioneered by Fröhlich (coherency in molecular vibrations, only recently directly demonstrated by Lundholm *et*

al, 2015) and Popp (impact of bio-photons in life processes). In the two preceding decades, the biofield concept rapidly expanded to *in vivo* experimentation and multiple clinical approaches (Reite *et al*, 1994; Battleday, 2014; F. Fröhlich and Mc Cormick; 2013; Foffani, 2003). Abundant information on this dynamic research field can be found in: Fröhlich, 1968; Addey, 1993; Sedlak, 1993; Davydov, 1977; Cosic, 1997; Popp, 2005; Prakash, 2008; Funk, 2009; Cifra *et al*, 2010; Levin, 2012; Plankar *et al*, 2011; Bischoff and Del Giudice, 2013; Brizhik, 2013; Fröhlich, 2014; Muehsam, 2014; Rouleau and Dotta *et al*, 2014; Belyaev, 2015; Pang, 2016; Hammerschlag, 2015 and Liboff, 2017.

An integral model for harmony-like resonance as an explanation for self-consciousness was earlier proposed by Lehar, 2003, 2012, proposing that the synchrony observed between cortical neurons is not a signal in its own right, but rather a manifestation of a larger standing wave pattern that spans the cortical region in question, and that the structure of the standing wave encodes certain aspects of the structure of the perceived object or grouping percept.

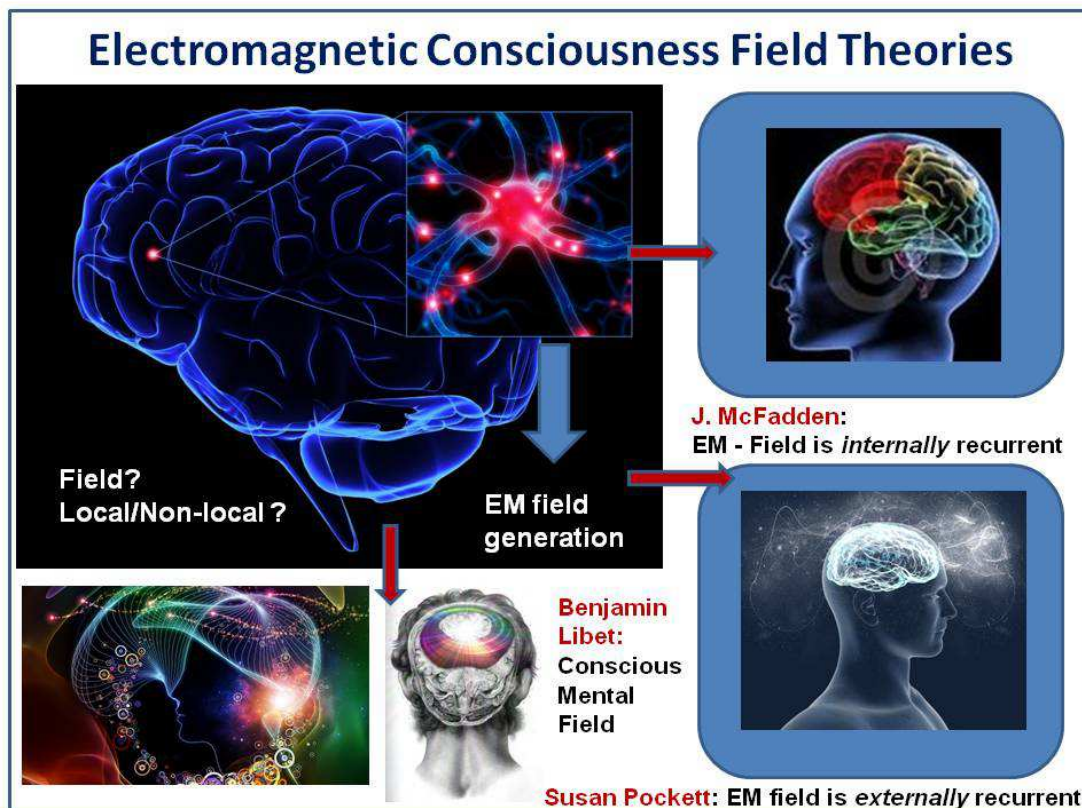


Figure 4. Current models of consciousness on the basis of long-range electromagnetic fields that may explain the simultaneous binding of distant brain nuclei involved in integral perception processes

A dynamic electromagnetic network was earlier revealed by us in a meta-analysis of 250 biological/medical studies that showed discrete EM frequency bands that promote or sustain life conditions (Geesink and Meijer, 2015, 2017; Meijer and Geesink, 2016, 2017). The interplay of such discrete electromagnetic radiation frequencies in the guiding of cellular function, also makes clear that life systems can, in principle, obtain sufficient *external* information to further explain their integral life complexity. A *torus* model was proposed in these studies for a coupled *bio-photon/phonon/soliton guided life* principle, (Geesink and Meijer, 2015, 2016; Meijer and Geesink, 2016).

Since the particular EM field pattern was recently fully confirmed analysing 110 reports on radiation therapy for a range of cancer disorders (Geesink and Meijer, 2017), and also in traumatic brain injury, pain relieve as well as tissue and bone regeneration, a *novel biophysical principle* seems at stake, (see Geesink and Meijer, 2017). Moreover, the particular discrete EM field frequencies were also shown by us in inanimate nano-materials and sound induced geometric resonance patterns (Geesink and Meijer, 2015) and are compatible with music theoretical algorithms (Smoyer, 2005). Such a long distance EM field may provide the very basis for the ordering and functional integration of cells, and operate through an intrinsic connection with physically defined universal information field(s) (Meijer and Raggett; 2015, Meijer, 2012). We postulated that this defined principle can also be instrumental in neural integration of the earlier mentioned qualia and consequently in the development of mental states and human (self) consciousness, (Meijer and Geesink, 2016).

Quantum states, as related to discrete far-infrared waves, therefore, can also be considered as co-instrumental in the astrocyte/glia/neuronal networks that may play a role in cognitive processes (see: Pereira and Furlan, 2007; Pereira, 2007, Fig. 5). In this respect the inter- and intracellular Ca²⁺ gradients and ion-oscillations may play a pivotal role since Ca²⁺, due to its electron constitution can function as an outstanding information carrier (Pereira and Furlan, 2007; Meijer and Geesink, 2016; Meijer, 2015). Especially the established spiral wave movements of Ca-ions, called cyclotron modes, are highly promoted by terrestrial magnetic fields (Zioutas, 1996). Cells

that are normally rather refractory for external EM wave modalities, become very sensitive to such radiation via perturbation of cytosolic Ca²⁺ oscillations. Rotating spiral Ca²⁺ waves have been reported in many studies (see for references Zioutas, 1996) and photon energy is transformed in kinetic energy of the gyrating ion (gyro-resonance).

The pivotal role of Ca²⁺ ions as informational second messengers in brain function, related these studies, have been described at micro and macro levels (Pereira and Furlan 2007; Pereira, 2017; Marcoli, 2015; Hagenston, 2015). Neuron/astrocyte mediated Ca²⁺ flux lead to activation of Calmodulin associated kinases (CMK11), calmodulin, NMDA-receptor/channel proteins and quantum resonance within Ca-channels that may stimulate synaptic neurotransmitter exocytosis (Fig.5) Calcium ions couple extracellular stimuli to cellular responses and the generated Ca²⁺ waves can carry encoded photon wave information (Rao *et al*, 2008) and likely includes the generation and flux of biophotons and thereby provide a fundamental basis for a *partially phonon and soliton guided conscious perception* (Meijer and Geesink, 2016).

Very similar EMF frequency bands were detected in clay minerals that are known to possess semi-conducting and quantum wave transforming properties (Geesink and Meijer, 2016), as well as in distinct sound induced geometric patterns as produced by Chladni and analyzed by Ritz (see Geesink and Meijer, 2015, 2016; Meijer and Geesink, 2016). This indicates that this biological/physical principle may operate in both animated and non-animated systems. Such electromagnetic fields may also have bridged information processing required for the creation of first life (Davies, 2014; Farnsworth *et al*, 2013; Melkikh *et al*, 2014 and 2016).

Cellular plasma water is generally supposed to act as a transfer medium for internal and externally applied electromagnetic waves to biomolecules (Del Giudice, 2010; Sahu *et al*, 2013; Fuxreiter, 2005; Zhang *et al*, 2009; Bono *et al*, 2012). The cellular plasma exhibits a highly arranged 3-D geometric structure and under the influence of EM fields act as a liquid crystal, that exhibits surface interactions with macromolecular structures such as DNA and proteins (Meijer and Geesink, 2017).



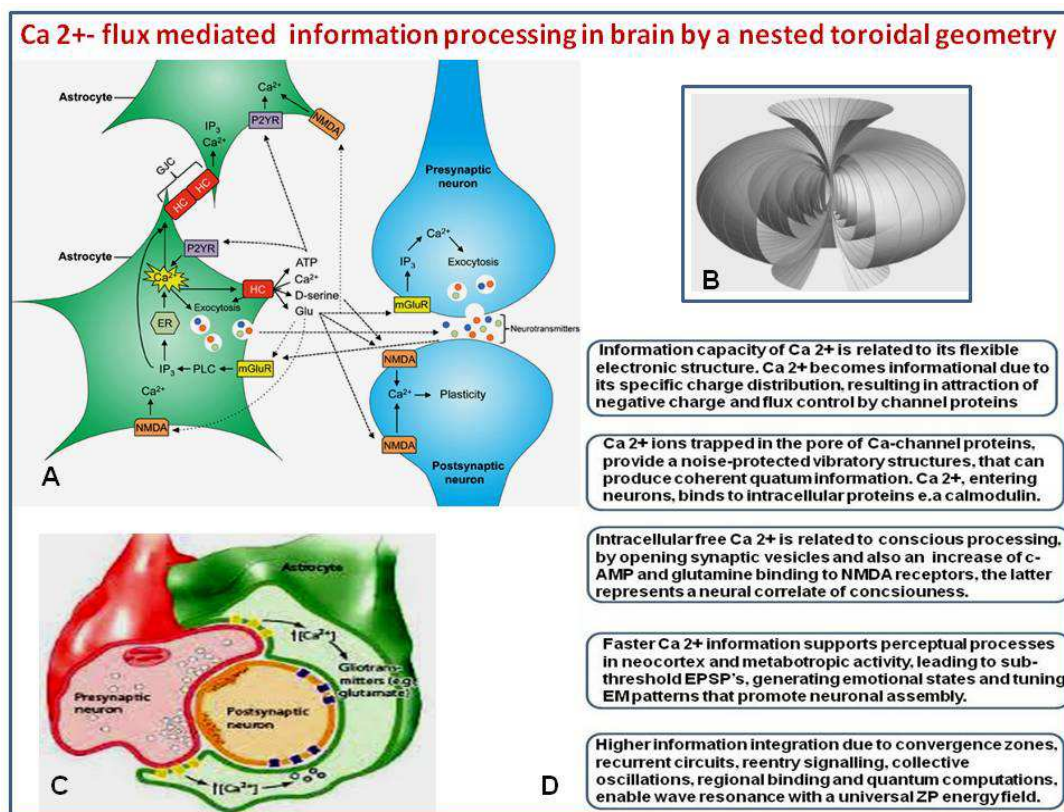


Figure 5. Ca²⁺-mediated information processing in communicating brain syncytia of neurons, astroglial cells that may result in rotational information flux at various fractal scales of brain networks that can be modelled by toroidal trajectories of information energies.

The absorption spectrum between 0.1 THz and 100 THz of solvated bio-molecules is remarkably sensitive to changes in fast EM fluctuations of the water network. There is a long range influence on the hydration bond dynamics of the water around binding sites of proteins, and cellular water is also shown to assist molecular recognition processes.

“Biological water” supports itself by coherent dipolar excitations and terahertz/femtosecond infrared interactions and these dynamics extends well beyond the first hydration shell of water molecules. (Chaplin, 2000; Johnson, 2009; Tielrooij, 2010; Mentré, 2012).

Recently, Henry, 2016, derived the characteristic frequencies involving inorganic ions in aqueous solution. This was done on a universal quantum-mechanical basis, by relating the molecular weight M of any solvent or solute species to a frequency F using the mass-energy equivalence coupled to the Planck-Einstein relationship. Expressed in quantum frequencies, F was transposed to 76 octaves, in order to get a frequency range corresponding to musical

sounds. Interestingly, a water molecule was characterized by M=18 g·mol⁻¹, leading to a characteristic frequency F=54 Hz (according to the octave hierarchy this is equal to 432 Hz). Consequently, common inorganic ions in cell plasma and other fluids, can be related to water from a purely harmonic like viewpoint. The 432 Hz value of water molecules is remarkably similar to the central frequency in our earlier proposed sequence of coherent eigenfrequencies (Geesink and Meijer, 2015, 2016). In these studies, we identified 12 basic coherent EM frequencies with discrete values of 256, 269.8, 288, 303.1, 324, 341.2, 364.7, 384, 404.5, 432, 455.1, 486 Hz, in addition to 12 decoherent frequencies, that were positioned just in between these coherent frequencies: 249.4, 262.8, 278.8, 295.5, 313.4, 332.5, 352.8, 374.3, 394.1, 418.0, 443.2, 470.3 Hz. As mentioned above, all additional frequencies of the entire wave range, either below or exceeding the above mentioned values can be derived by octave hierarchy (see for details of the calculations Meijer and Geesink, 2016). It is of interest that Gramowski *et al*, 2015 reported on the enhancement of cortical network



activity, being important for conscious perception, by stimulation with selective EM fields that fully confirmed the frequency algorithm proposed in our studies (Geesink and Meijer, 2015, 2016, Meijer and Geesink, 2016, 2017).

The identified electromagnetic life-steering modality resembles the pilot wave/implicate order concept of David Bohm, 1980, 1987, that also has physically be defined by others (Laszlo, 2007) as the zero-point energy field, and is known from the field stochastic electrodynamics (Keppler, 2012, 2016; Caligiuri, 2015). Understanding and further exploiting the involved morphogenetic code, especially its highly regulative aspects, requires to understand not only the molecules and genes involved, but also the algorithms and computations that are performed by cellular networks in making decisions about anatomical growth and form (Levin, 2016). We hope that our hypothesis will further invite studies into the conformational states and functional information networks of living cells and thereby, in the future, will provide a further physical basis for the suggested phenomenon of morphogenesis (Sheldrake, 2009; Pokorny, 2013; Levin, 2016).

6. Evidence for a supervening resonant mental workspace

Subjective conscious experience exhibits a unitary and integrated nature that seems fundamentally at odds with the fragmented functional architecture of the brain that have been identified in neurophysiological studies, an issue which has come to be known as the *binding problem*. In the construction of following hypothesis we implicitly leave behind the differentiation between the assumed *conscious and un- or subconscious* parts of human awareness, simply since we believe that any perception-experience-action cycle must contain varying proportions of information related to *both* aspects. It is generally agreed that the supposed boundaries between these classical "mental compartments" are arbitrary and that intentional and especially emotional factors influence the relative involvement of deeper layers of mind (also see for this aspect Schwartz *et al*, 2005, Tammietto and de Gelder, 2010; Jahn and Dunne 2004, Rousseau,2011). This has become evident in a large variety of conscious states as influenced, for example: by emotional feelings, meditation, hypnosis, vivid dream states, rhythmic sound exposure, use of psycho-active

agents and life threatening events that induce near death experiences.

Furthermore we postulate earlier that a dedicated part of the total brain activity is employed for the dynamic and ongoing construction of an *integral personal universe/worldview* (Meijer and Korf, 2014), in which consciousness represents a *meta-phenomenon* (Linton, 2015). Such an integrated representation of the outer world should not only include our individual "autobiography" but also the intrinsic interactions with the external world, including the physical laws that determine it. It requires that we *recognize* our memories as true events as having relevance and significance for the present. The latter recognition aspect can only be realized if we see the present not only as a product of the *past*, but also as the anticipated (simulated) outcomes of multiple *future* projections. In other words there is no worldview of the present without probabilistic projection of our potential future and the latter implicitly signifies our long-term freedom of choice.

Such an *internal* impression of the self, however, should be permanently validated via an integral and versatile external "state of art" of our Self that also should include potential subliminal and unconscious interactions, including time-retrograde (backward) projections of future events. The latter could be called "remembering" of the future, a process that have been physically defined and experimentally demonstrated earlier by *Aharonov, 2010*, in so called soft-stimulation quantum experimentation.

We postulate therefore that an *external* memory workspace is operating in the human brain in a 4-D setting. The latter can take into account the hidden interaction with all natural forces/fields and also can integrate symmetric time and thus an aspect of backward causation. The proposed field-sensitive information workspace could function as a *non-material and wave field-like* simulation domain for a spectrum of mental representations. These may undergo a superposition with the internal worldview, in order to monitor the quality of our individual being (Fig.9) This "software-like" mental program should exhibit an extremely fast response time, make immediate selection within a spectrum of multiple simulations possible. It also should offer the integral organism an optimal qualitative and quantitative impression of the current state of the whole body as embedded in its environment and its development.

We envision such a monitoring system as *supervening* the basic neuronal communication networks, in order to generate a *global* type of a mental field. By this guiding space-time domain, synchronic oscillations in the cortico-thalamic region of the brain would be induced through resonant coherent and condensed electromagnetic vibrations (standing waves) and/or attractor type of quantum information. The latter could, for example, be derived from non-linear and bidirectional interaction with the stochastic zero-point energy field (Keppler, 2012; Caligiuri, 2015). Yet, it should be mentioned here that the "binding by synchrony" concept is not without problems (see relevant overview in Wikipedia/binding problem). Instead of synchrony perse, the proposed supervening workspace could induce an adjustment of the timing of action potentials relative to the oscillation cycles, and this can lead to a drastic acceleration of processing speed. This model for a perceptions-guiding radiant workspace, also provides an interpretation network for as yet, poorly understood phenomena such as pre-stimulus brain responses, psi phenomena and intuition (Tiller, 1990, Grof, 1987; Jahn and Dunne, 2004; Hameroff, 2012; Rousseau, 2011).

Our field- receptive mental resonance model is based on the following considerations:

-Ultra-rapid brain responses. In earlier work (Meijer and Korf; 2014, Meijer, 2015), it was reported that our brain, studied under a wide variety of experimental condition, shows extremely rapid response times, that are not compatible with the known time frame of synaptic transmission and processing of action potentials: a) even subliminal stimulations of less than 50 milliseconds informing the perceiver were reported (in e.g. hidden advertisements), b) linguistic studies illustrate the extreme speed of cognition: meaningful as opposed to nonsense words can already be distinguished within 50 milliseconds c) The time-lag of "unconscious" to "conscious" experience ranges from 0.3 - 0.5 sec (Libet, 1994, 1996). The latter observations collectively show that complicated, culture-specific, information is recognized in our brain prior to reaching conscious perception of these events (see also Radin, 1997). In general, this implies that information processing by the brain is much faster than the rate of overall neuronal transmission/action potential propagation, as well as post-activity restoring metabolic processes as reasoned by Rahnama *et al*, 2010.

Two alternative mechanisms were proposed to deal with this discrepancy: a) it has been shown that during a nerve impulse multiple sodium-channels are opened over a whole axon region *at the same time*, by which the speed of propagation is largely increased compared to classical concepts. (Helias *et al*, 2010, see also Wolf, 2006). Waldhauser *et al*, 2016, interestingly, reported that episodic memory retrieval operates through an extremely rapid reactivation of sensory information, a sort of mental time travel that, interestingly, can be influenced by transcranial magnetic stimulation. The present field-receptive workspace model may therefore provide a more definite answer, since it postulates a bidirectional phase-conjugating holographic communication on the basis of photon/soliton wave transmission (see later).

-Fractal and Cyclic workspace. In a previous study (Meijer, 2015) cognitive brain activity was modeled within a fractal and bi-cyclic operating workspace that exhibits two orthogonal streams of bi-directional information: In addition a third information channel was suggested to be operating between a supposed magnetic brain field and global external electromagnetic fields, either related to atmospheric magnetic fields or to interaction with vortex-like quantum fluctuations of the all pervading zero-point energy field, as for instance put forward by Keppler, 2012 and Caligiuri, 2015 (see Fig. 9). Several studies indicate that the total brain exhibits a fractal organization, housing non-linear type of information processing (Freeman, 2006; Bieberich, 2012 and Gardiner, 2010; Reddy and Pereira, 2016) that explains various observations on periodicity in electromagnetic activity, as shown for example in EEG registration.

-Toroidal organization of the brain. We postulate here that toroidal geometry is an essential feature of the proposed *field-sensitive resonant workspace*, taking into account the known information integrating and coupling potential of the torus as well as its divergence aspect, resulting in an externally directed radiation of information (Meijer and Geesink, 2016). There are recent studies using fMRI scanning indicating the involvement of toroidal geometry in various aspect of specific brain parts with topological and spatial mechanisms and even indications that the whole brain brain is embedded in a hypersphere, as a model for a



higher 4th dimension (Tozzi and Peters, 2015, 2016 a, b; Knierim and Zhang, 2012). Certain repeating patterns may be related to a toroidal architecture of attractors (Mc Naughton *et al*, 2006; Akhmet and Fen, 2014) and the known alpha, beta, gamma and delta brain waves may reflect preferred frequency bands as related to toroidal eigenvalues (see later).

-Top-down resonance. It has been proposed by others (Lehar, 2003 2008) that a global (non-local) standing wave patterns in the brain exhibit a top-down operating *harmonic resonance* property of neuro-computation, that encodes complex spatial patterns in the brain and induces the synchronicity of neuronal networks required for conscious perception. This author illustrated this with the earlier mentioned geometric patterns of Chladny, like we did also more recently (Meijer and Geesink, 2016). However no distinct frequency band were identified in Lehar's studies. We have shown that these patterns may be linked with solitonic wave resonances, according to a sequence of coherent EM frequencies, suggesting a sort of harmonic-like kaleidoscope. Many examples of distinct EM frequency bands of brain cells, neurons and different glands have been identified (see Persinger, 2016, and Hartwich, 2009; Gramowski *et al*, 2015), that resemble some of the individual eigen frequencies of the geometric/acoustic pattern proposed by us, supporting the idea that communication of life information through coherent EM radiation is a widely spread phenomenon.

We propose that the pro-life EM frequency bands identified by us may literally act in concert as "tonal octave-based symphony" to provide living systems including the brain with such a harmonic like resonance patterns. Such "tonal" projections, that in a global manner, organize synchronicity spatially and temporally in essential organs in the body (heart and brain), may originate from a supervening resonance field, that imposes a coherent vibrating 3-D imprint in the cortical region, producing an *integral* modality of consciousness.

Universal/Cosmic Consciousness. The presence of a "steering" functional mind field may provide an interpretation framework for phenomena that still seem to escape scientific verification. A most important aspect is the often mentioned modality of Universal consciousness also called Cosmic Consciousness. This concept, that information can

take a universal character and that all information is stored in a general knowledge field or universal consciousness, can be treated from a number of backgrounds and perspectives (reviewed recently by Meijer, 2017). The concept is well known from the work of David Bohm, 1980, 1987, who coined the term implicate order and Erwin Laszlo, 2007, who introduced the Akashi field concept. The latter author linked his concept with the physics of the zero-point energy field (ZPE) that, as previously mentioned, was later also applied in stochastic electrodynamic models for consciousness by Keppler, 2012; Caligiuri, 2015 and De la Pena, 1994. Such an, all pervading, cosmic field can in principle exchange information with the supposed 3-D and 4-D workspaces associated with the brain (see Fig. 4 and 8 respectively). An important recent study from Princeton showed that two, and possibly more, brains can become interconnected, looking at the brain f-MRI scans of speaker and listener. It was shown that the brain activity patterns of such a communicating couple are clearly correlated in a sort of wave resonance, mirroring, effect (Hasson *et al*, 2012, Wackerman *et al*, 2003, Radin, 2004, Richards *et al*, 2005, Standish *et al*, 2004, Pizzi *et al*, 2004)). This study also invites further investigation into mechanisms of telepathy and so called synchronicity (Schwartz *et al*, 2005, Jahn and Dunne, 2004, Grof, 1987, Rousseau, 2011).

-PSI framework. A closely related aspect of an event horizon memory workspace is labeled with the term *psi phenomena* such as clairvoyance, distant viewing, telepathy, psychokinesis and near death experiences (NDE). The latter aspect is documented in thousands of international reports and nowadays open to scientific inquiry (Lake, 2015; Greyson, 2010; Schwartz *et al*, 2005, Bókkon *et al*, 2013). The specific components of this experience, often with a long lasting psychic impact on the recovered patient, include so called out of the body experiences, tunnel visions, and a remarkable clear and holistic state of awareness, verbally reported by the particular patients in retrospect. This is claimed to occur in the absence of the cortical activity that are normally shown in EEG's during vivid dream states. The typical descriptions of a felt dissociation from the body, in addition to an experienced *total life-panorama* (Lake, 2015, Greyson, 2010, Schwartz *et al*, 2005, Pereira and Reddy, 2016), as reported by a part of the NDE cases, may point at the existence of the radiant resonance mind field (Meijer, 2013),



as considered in the present study. Such a "personal double" (Vitiello, 2001) that can largely influence cognitive brain function, is somehow persisting while other brain functions seem defective. This overall picture may indeed point at a supervening field character that is not directly dependent on normal brain activity and is open to the input of huge amounts of personal information apparently originating from an *external data source*. In our model such a potential universal knowledge field would involve a fourth *spatial* dimension (see Fig. 9).

-Non-material mental aspect. The implicit suggestion of a *non-material* and *extra-corporal* mental workspace, that supervenes our neural system and provides the dominant part of self-consciousness (the big "I"), that acts in addition to our daily experienced conscious state (called the small "I"), is supported by earlier and also more recent observations in fNMR studies that long term memory is *not correlated with scaled sizes of the brain*. Savants with normal brain size can demonstrate a huge, disproportional, memory space (entire novels and even contents of telephone books are memorized in detail). Hydrocephalic patients that have only 5% of normal brain volume (micro-cephaly) can show quite normal intelligence and social behavior (Forsdyke, 2014). Other striking examples are patients with a largely destroyed forebrain that maintain a quite normal life (Sasal *et al*, 2016). Even the known split-brain patients that seem to develop two different types of consciousness in, the isolated, right and left *halves* of the brain, in fact show this aspect. In addition, split-brain patients with disconnected hemispheres even perform better at some cognitive tests (see Sasai *et al*, 2016). In more general terms, the aspect of non-material mental aspects of consciousness have been strongly pursued from neurological (Nagel, 2012), bio-physical (Keppler, 2016), philosophical (Kadруп, 2016), quantum-physical (Henry, 2005) and evolutionary viewpoints (Grandpierre, 2014).

-Alternative consciousness states. A recent paper of Tononi (2016), reviewing the integration of information consciousness concept, mentioned an interesting view of Sullivan (1996), that another type of consciousness becomes manifest in meditative states that in fact can be considered as rather information content-less, and could reveal a normally hidden part of consciousness that is normally masked or filtered

away by the busy default activity of our brain (see also Jahn and Dunne, 2004; Rousseau, 2011; Martin, 2013 and Schwartz *et al*, 2005). Disembodied NDE information related to dark energy/matter has been proposed also recently by Gaiseanu, 2017.

-Requirement of rapid photonic brain communication. The ultra-rapid monitoring system that is implied in the brain and is supervened by the supposed field-receptive workspace, is, as mentioned above, unlikely a direct product of the known synaptic transmission and axonal nerve impulse propagation: it rather requires a versatile high speed communication system. As an example, it has been shown theoretically that the biological brain has the possibility to achieve quantum bit computing at room temperature, superior when compared with the conventional processors (Musha, 2009). Sun *et al.* (2010) experimentally demonstrated that neurons can conduct photon signals. They suggested that bio-electronic and bio-photonic processes are not independent biological events in the nervous system, and their synergistic action may play a significant role in neural signal transductions. Importantly, Wang *et al* (2010) presented the first experimental proof of the existence of spontaneous biophoton emission and visible light induced delayed ultra-weak photon emission. In their experiments they used *in vitro* freshly isolated rat's whole eye, lens, vitreous humor and retina. As a consequence of their findings they proposed that the photochemical source of retinal discrete noise, as well as retinal phosphenes, may originate from natural bioluminescent photons within the eyes (Bokkon, 2009, 2013). Thus, a potential candidate is a photon/phonon-instrumented messaging network, that may operate parallel with neuronal transmission apparatus, as described extensively by Dotta *et al* (2013) and Bókkon *et al* (2009) and on an electromagnetic basis. The earlier mentioned classical work of Popp (2010) and Fröhlich (1968) on the morphogenetic guiding role of bio-photons and phonon/solitons respectively, in cell systems seem to be compatible with each other (Meijer and Geesink, 2016). Rouleau and Dotta (2015) and Muehsam and Ventura (2014) pointed out that, at atomic and sub-atomic scales, biological systems can be influenced by subtle energies and that these enable a higher order discourse that influences the metabolic and electromagnetic output of cells. This system can principally interact with outer



electromagnetic fields such as the earth magnetic field (Rouleau and Dotta, 2015; Persinger, 2016) and is orders of magnitude more rapid than the neuronal transmission system. The efficacy of such a non-chemical communication system are fully in line with recent findings on bio-photonic information processing in microtubuli (Mavromatos *et al*, 2002; Rahnama *et al* 2010; 2012; Bandyopadhyay, 2013; Sahu *et al*, 2013, 2014).

-ZPE field/ brain interactions. Dynamic coupling of the brain with ZPE field modes has recently been proposed as a universal mechanism underlying conscious systems, (Kepler, 2016), on the basis of stable attractor dynamics by which the ZPE, in fact, becomes a *substrate of consciousness*. 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. 6 and 9). Thus, Kepler envisions discrete long range EM frequencies, that are expressed in brain in the well known gamma and theta oscillations and according to the author are related to coherent oscillations in cell water, resulting in information integration as conceptualized by Tononi *et al*, 2008, 2015, 2016. ZPE field has traditionally be seen as the domain for quantum fluctuations of pairs of wave/particles and their antipodes (Daywitt, 2009; Setterfield, 2002). Of note, a virtual photon (electromagnetic) part, that, among other effects, is instrumental in the generation of van de Waals forces, and a particle/antiparticle pair part (Dirac Sea) should be distinguished here. Both originate from the Planck vacuum, composed of dipoles that start to rotate due to interaction with moving charges, by which a magnetic induction field is produced. Thus free charges perturb the vacuum by polarization and exerting a van der Waals attractive force on the Planck particles (Daywitt, 2009).

Generally, neurologists are hesitant to accept an extra messenger system along with the prevailing related assumptions of the neuron doctrine. Yet in physics the photon is the generally recognized carrier of information between atoms and molecules and (not only for this reason) perfectly fits into the context of a versatile and dynamic brain structure. This is

certainly the case if photonic wave information would be protected against de-coherence in the brain environment through the influence of low-frequency phonons, realizing that a dominant aspect of de-coherence is via phonon coupling with the environment and that an acoustical mismatch between the immediate and wider environment of the quantum system could largely prolong coherent states at low frequencies (Davies, 2009; Lambert, 2013).

Creation of matter and bidirectional flow of matter. Recent studies (Dupays, 2013; Wongyun, 2013 and Lamoreaux, 2007) indicate that virtual quantum wave/particles of the field may be converted in real particles in so called compacted spaces/cavities, in which a Casimir effect leads to quantum wave squeezed states that produce various types of elementary and dark particles (Fig. 6). Since ZPE and dark energy fields are present throughout the cosmos they should also influence life systems and human organisms. In our brain tissue compacted spaces/cavities are abundantly present, such as synaptic clefts in addition to micro-tubular, DNA string and membrane compartments (Persinger, 2008, 2014, see Fig. 6).

The latter schematic representation illustrates this process and the generated wave/particles involved. Apart from photons and electrons, also mixed states of these wave/particles (Solitons/polarons and polaritons) can be formed by toroidal coupling. Tachyons and Majorana particles that are supposed to travel back in time, may be responsible for supposed *backward causation*, observed in double split quantum interference experiments by Wheeler (see Meijer, 2015). The phenomenon of backward or retro-causation was also critically discussed by Davies, 2014; Murphy 2011; Auletta *et al*, 2008; Hameroff, 2012; Sheehan, 2011; Torday and Miller, 2016; Tabaczeck, 2015; Campbell and Bickhard; 2010 Wolf, 1989, and Shoup, 2011. Retro-causation could play a role in the post-stimulus time delay in conscious detection as established by Libet, 1993, that was explained by him through so-called back-referral mechanisms (Libet, 1994, 1996; Hameroff, 1999). As mentioned before, future states of quantum waves can actually influence past states, was experimentally demonstrated by Aharonov, 2010, in so called soft stimulation experiments, a procedure that prevents wave collapse by usual measurements.



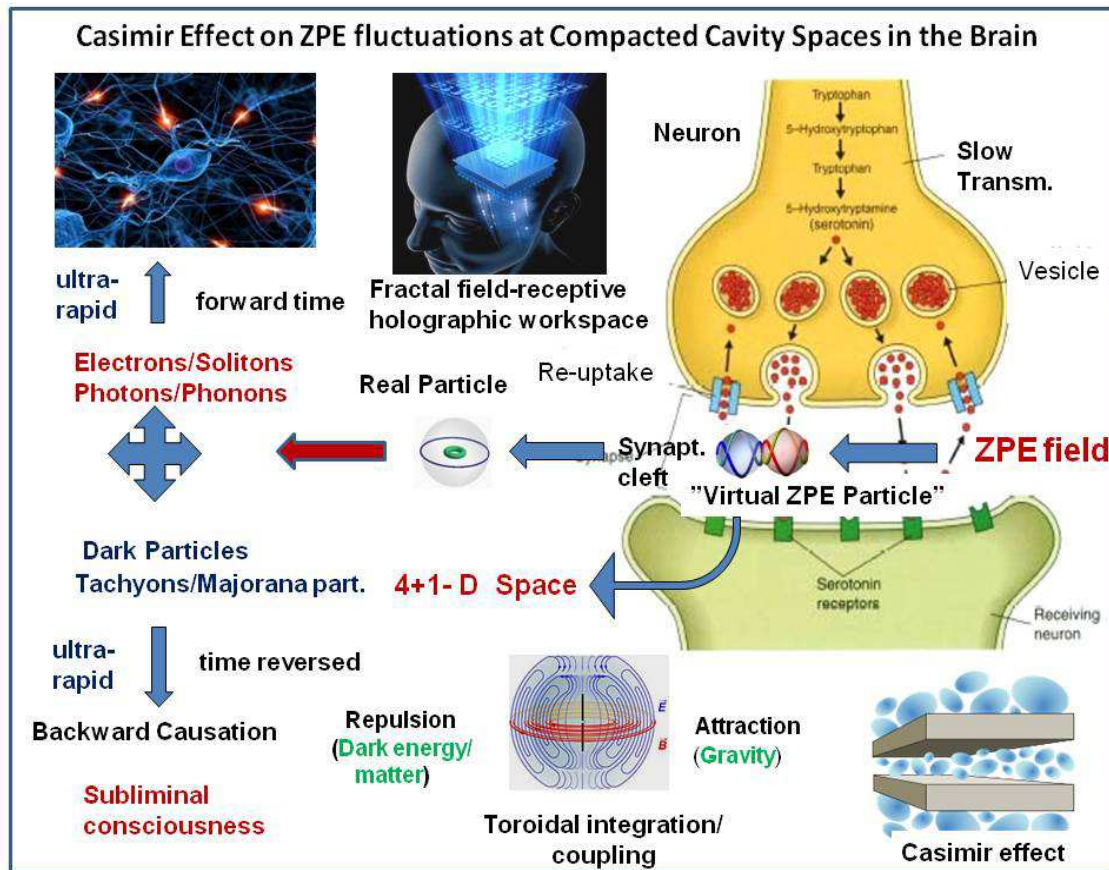


Figure 6. Interaction of neural structures with the all pervading zero-point energy field. A neuronal synapse is shown, with a synaptic cleft that exhibits compacted space dimensions that enable the spatial conversion of a spectrum of matter/antimatter ZPE virtual particles (Casimir effect, inset right below) to various types of real particles such as neutrino's, bio-photons, electrons and dark particles. The latter enable extremely rapid photon fluxes in a time reversed mode enabling backward causation. The toroidal background of a quantized 4+1-dimensional spacetime (middle below) can integrate repulsive and gravitational forces to electromagnetic energy flux.

- Integration of Dark energy/matter in brain function. Apart from electromagnetic and ZPE fields, two other major fields should be taken into account: that of gravitation and dark energy/matter. The latter supposed cosmic anti-gravity force, that together with gravity, is assumed to pervade cosmic space at all fractal levels, including human life. Gravity (an attractive or conversing force) can, apart from consciousness, be regarded as a phenomenon that we are implicitly aware of throughout our life. It's counterpart dark energy (repulsive or diversing force) may not only drive expansion of our universe, but also at the human level may exert an entropic force that produces physical information. Both forces have been linked to perturbations of the zero-point energy field (Green and Levin, 2007). As treated above, gravity has been conceptualized as a compensatory entropic reaction to the

displacement of holographically stored information, a phenomenon that accompanies the related movement of material objects in the universe (Verlinde, 2011, 2016, Jacobson, 1995, and Padmanhadan, 2008). Recently, Verlinde, 2016, suggested that the cosmic dark matter may reflect a type of information displacement that does not only occur in the related holographic information screen, but also in the bulk of spacetime (Verlinde, 2016). McCoss, 2017, on the basis of entropic gravity recently proposed that the universe exhibits nested small-world networks at all of its scales and that intelligent life (agency of life) is instrumental in producing neg-entropic entangled information that is wrongly attributed to dark matter. Interestingly, Brian Green (see Green and Levin, 2007) made clear that dark energy, apart from sustaining the known three large dimensions, may be involved in the stabilization of the potential of multiple



compacted dimensions, that according to these authors, have a *toroidal character* and that these hidden space-time structures may provide a link between topological and geometric properties. This supports our idea of an information integrating torus/twistor geometry as a fundamental building block of space-time at all levels of reality, by some called small-world networks.

Some authors have suggested that dark energy/matter plays a crucial role in cognitive and conscious states in the brain. Benjamin (2003, 2007) argued that in living matter three different axions (supposed candidate for dark matter) exist parallel to electron, proton and neutron, respectively. Pitkanen, 2010 suggested that axions can form condensates that can transmit information to any other wave/particle and make them suitable as pilot waves in the Bohmian sense (Bohm, 1980, 1987, 1993). It is thus possible that the entire visible body, is permeated by an invisible body of dark matter/energy, that contributes to creation of (self)-consciousness, as a product of mutually recognizing resonant structures in brain and associated fields. Kozłowska and Kozłowski, 2016, calculated the energies of heavy photons and neutrino's as candidates for dark matter and concluded that these are located in a 4-D timeless space-time, being in interaction with the human brain. In addition, ring dark solitons in toroidal Bose-Einstein condensates have been discussed by Toikka *et al*, 2013.

-Information conservation in NDE in Life panorama's. As mentioned above, some NDE patients experience and report a panoramic and holistic overview of their entire life in stunning detail, and some reported the meeting with persons that died earlier, of which it was validated that the particular patient could not have obtained any information on their prior death (Greyson, 2010). All this occurs in the absence of cortical brain activity, as measured by EEG, putting the question: where did all this information come from? (Lake, 2015; Greyson, 2010, Pereira and Reddy, 2016; Bókkon *et al*, 2013). A striking example of NDE experiences was reported by Ring and Cooper (1997), investigating the NDE reports of 30 individuals that were completely blind from birth and thus could not build up a normal visual memory. They verbally described their NDE in vivid and transparent visual terms that matched such experiences of NDE cases with normal sight. The

presently hypothesized field receptive workspace may function here as the connecting information matrix between the photon/phonon/soliton communication system in the brain, and the assumed universal consciousness field, that thereby enables the sensing of subliminal information and also may explain mental capabilities and trans-personal experiences such as NDE.

The present authors stipulate that NDE experiences in themselves do not provide a real proof for life after death. Yet, some speculate that an *extra-corporal* resonant personal workspace may contain information that, after decoupling from the dying brain, is preserved after bodily death. This may be due to known principles in quantum physics, that information cannot be destroyed. Readers interested in this type of issues should read the scientifically objective book of Braude, 2003, on "Immortal Remains" or study a special issue on this topic of the Journal of Consciousness Exploration & Research with papers of Pregnolato and Pereira, 2016, Kastrup, 2016 and Pereira and Reddy, 2016, among many others. In the latter publications a cell-soul pathway is proposed on the basis of electromagnetic radiation properties. Hardy, 2016 takes a space-time approach by positioning individual consciousness and the Self in a *hyper-dimension* in which death is the just the severing of the link between this domain and the brain/body, leading to an independent holographic semantic field on a personal basis. The latter resembles the proposal of Irwin, 2014, seeing consciousness as a quantized space-time language that can be described by quasicrystal mathematics of the E8 geometry. It was also suggested that that self-consciousness could continue outside the body, but remains at the level of Planck-scale geometry, as related to generation of biophotons in which visual imageries are coupled to long term visual memory an NDE seems driven by visual processes (Bókkon *et al*, 2013).

7. The concept of field-receptive, resonant, memory workspace: the event horizons of the brain

-Supervening toroidal mental workspace. From the abovementioned phenomena it is obvious that a "final theory" in physics in the future, should describe *both* the *material* and *mental* aspects of reality and consequently must integrate a testable model of consciousness and



self-consciousness. Such a comprehensive model of the whole should also be based on a mathematical and geometric framework and be compatible with a completed theory of quantum mechanics as well as an integrated description of the cosmos at the micro- and macro scale. The hypothesis that toroidal information flux is a fundamental aspect of our universe from macro- to micro scales and that gravitational integration and compression leads to a universal memory space of which individual human self-consciousness is a discrete part, should be further investigated (see for more information on this aspect Hamein *et al*, 2016).

We hypothesize here that the human brain is supervened by a 4-D field-receptive resonant workspace containing nested 2-D holographic information screens (event horizons), and thereby is able to simulate 3-D representations of the personal functional state in the brain. This dynamic knowledge field is hypothesized to function as a general reference source that entertains a bidirectional information flow with the entire organism (see Fig. 4 and 9). It should also be defined as an internal model of the self, that is instrumental in quality control and function as a “back-up system” for the whole organism. The present hypothesis, may for some imply that a part of our memory is *external* (extra-corporal and non-material), but it should be realized that we situate this workspace in an extra (fourth) spatial dimension, that is not visible for humans, so that differentiation between corporal and extra-corporal is trivial. As mentioned above, we consider our concept to be compatible with present neurological and trans-personal observations such as brain to brain connection as recently experimentally demonstrated by Hasson *et al*, 2013, Wackerman *et al*, 2003, Radin, 2004, Richards *et al*, 2005, Standish *et al*, 2004, Pizzi *et al*, 2004), and the life panorama’s reported in stunning detail by the many registered near death cases.

-Quantum coherence mediated brain function.

It was earlier debated if quantum wave information in the brain can really become expressed, taking into account the supposed extremely short coherence times. That is, if there is no efficient shielding from the environment (see discussion on this topic in Hameroff and Penrose, 2013, Hagan *et al*, 2002). Yet, Sahu *et al*, 2013 a, b, 2014, clearly demonstrated quantum a

spectrum of coherent vibration bands in isolated micro-tubuli, and suggested this phenomenon as the very basis for information processing in neuronal systems.

Interestingly, it was more recently indicated that coherent quantum processing in the brain can be realized in an additional manner, since singlet state phosphorus spin states are remarkably resistant to de-coherence even in the wet and warm conditions (Fisher, 2015, see Fig. 7). Enzymatic hydrolysis of extracellular pyrophosphate, in which phosphorus atoms can be in a quantum entangled singlet state (*P), results in quantum entangled phosphates at distant sites in the brain. This occurs since the entangled phosphates are incorporated into, so called, quantum entangled Posner-molecules, complexed with multiple Ca²⁺ ions. Two pairs of such Posner molecules can undergo binding reactions to form quantum entangled Posner-dimers. Transport of entangled Posner-molecules from the extracellular spaces into glutaminergic neurons can subsequently be mediated by endocytosis into presynaptic vesicles and action of vesicular glutamate transporter (VGLUT). When entangled Posner-molecules in different neurons undergo binding reactions and hydrolysis, this can lead to massive release of calcium within the neuron, mediating glutamate release from pre-synaptic neurons and thus *to non-local quantum correlations* in postsynaptic firing (Weingarten *et al*, 2016).

-The role of information transfer in extra-neuronal matrix in in brain. In order to define alternative mechanisms for intercellular communication, a number of studies focused on the prominent role of Ca²⁺ waves in the astroglial space (Marcoli *et al*, 2015, Pereira, 2017), that can now be detected by two-photon microscopy. In this respect the potential relation with ultra-rapid communication routes in the brain via myelinated axons of white matter, that act through guiding of bio-photons or polarons (solitons) and polaritons, was proposed (Kumar *et al*, 2016; Matsuura and Wasaki, 2014; Lanzalaco, 2012, 2015a, 2015b). White matter, representing at least 45% of the human brain, contains millions of communication cables that deserve much more interest in this respect (Fields, 2008) and also in relation to connection of the cerebral hemispheres and magneto-reception.



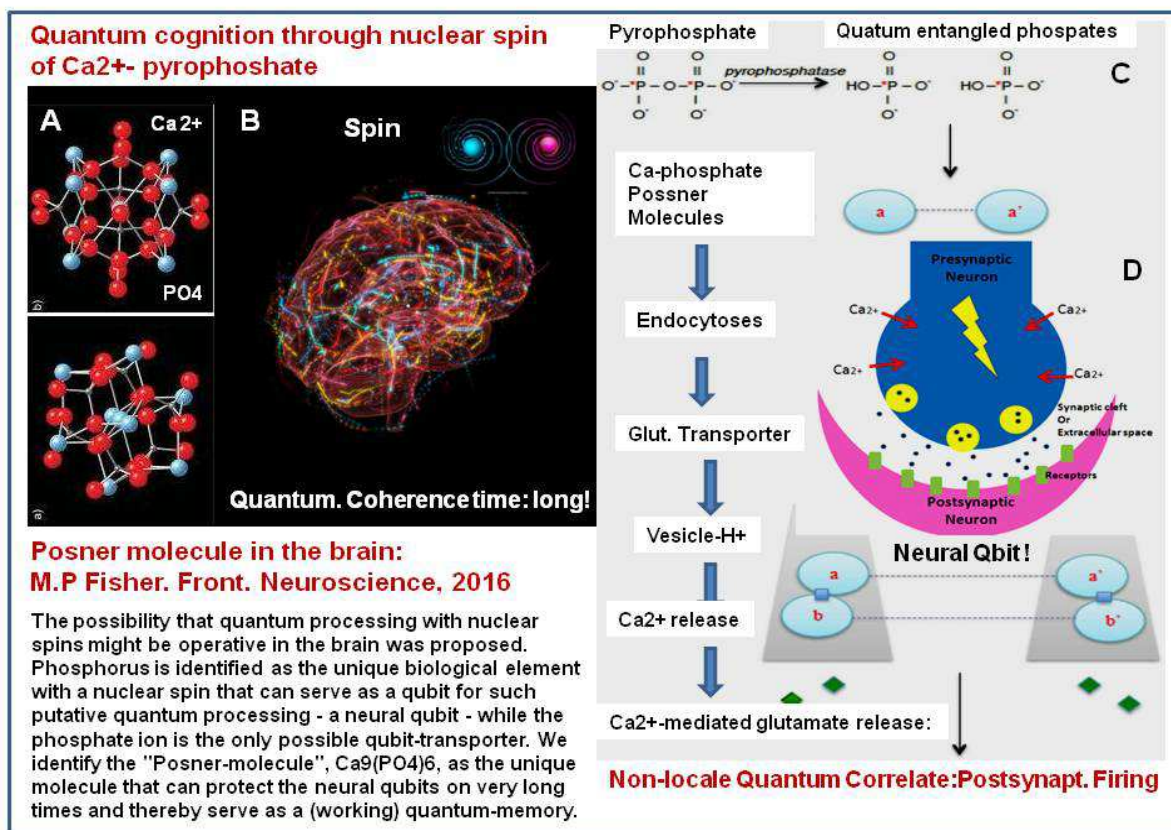


Figure 7. Quantum coherence in the human brain: quantum entangled phosphate groups (C) exhibit nuclear spin that is remarkably resistant towards decoherence in wet and warm tissue of the brain. Ca- pyrophosphate complexes (A) in extracellular space are endocytosed by neuronal transporters by which entangled spin information is distributed throughout the brain (B). After uptake in neuronal space and breakdown of the complexes, massive release of Ca²⁺ is generated, that in its turn affects neuronal glutamate information processing in a non-local entangled modality.

Magnetic fields have been shown to easily pass skin, skull and brain tissue (Murphy and Persinger, 2011, Nummenmaa *et al*, 2013, Bonmassar *et al* 2012, Babbs, 2014) and this have been related to a toroidal computing process of neural oscillations and Ca²⁺ pulsing, in which all collaborative effort of glia cells also plays a role (see also Pereira and Furlan, 2007; Pereira, 2017). These aspects highlight the rising interest for electromagnetic correlates in consciousness studies (Liboff, 2017; Prakash *et al* 2008), in which, among other mechanisms magnetic activation of slow acting voltage-gated Ca²⁺ channels could play a prominent role (Bonmassar *et al*, 2012). Interestingly mitochondria in general could play a significant role in propagation of EM field propagation (Thar and Kuhl, 2004).

-Photon/phonon/soliton-mediated communication. Photons are intrinsically quantum objects and, by their nature, long-distance carriers of information. Annala, 2016, stressed their importance in relation to consciousness. Indeed, 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. With regard to the proposed ultra-rapid photon/phonon mediated communication, the present model is in line with the recent findings of Bókkon, 2009, Dotta, 2013 and Persinger, 2015. Both the particular 4D-mental holographic domain and the supposed *universal consciousness field* (defined as implicate order by David Bohm, 1980, 1987) and more recently as a ZPE stochastic electro-dynamic field by Laszlo, 2007, Keppler, 2016 and Caligiuri, 2015) should be seen as crucial "steering" modalities that mutually communicate with the *whole nervous system of the organism*, including its neuronal networks with their conscious and non-conscious aspects. Bidirectional communication between the mind and such an extended mental workspace (formed by multiple event horizons) is proposed to occur by toroidal integration of the abovementioned information spectrum in both the physical and mental domains. Mutual communication is seen as being instrumented by



magnetic flux and photon/phonon/soliton mediated wave resonance and/or phase conjugation. This process operates between this mental workspace and the associated neuronal/cavity landscape of the material brain (see Fig. 6). It is of considerable interest that individual neurons and connectomes of neural tissue in Alzheimer models, that exhibit memory loss in the hippocampus area, can be reactivated by photonic pulses to corresponding cortical cells, using the technique of optogenetics. This 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 channelrhodopsins (Tonegawa *et al*, 2015). This

procedure could mimmick the supposed photonic communication from the 4-D mental workspace as proposed in the present paper.

-Binding of brain centers and external forces.

The present model may offer a potential solution for the so called binding of distant nuclei within the brain as well as for the interaction with environment in which our organism functions. This, by realizing that all the physical forces in nature are implicitly operating, not only within our skull, but also undergo continuous (bidirectional) interaction with force fields (electromagnetic, zero-point energy, gravity, dark energy, see Fig. 9). Of note, these essential processes may have been manifest from the start of biological evolution.

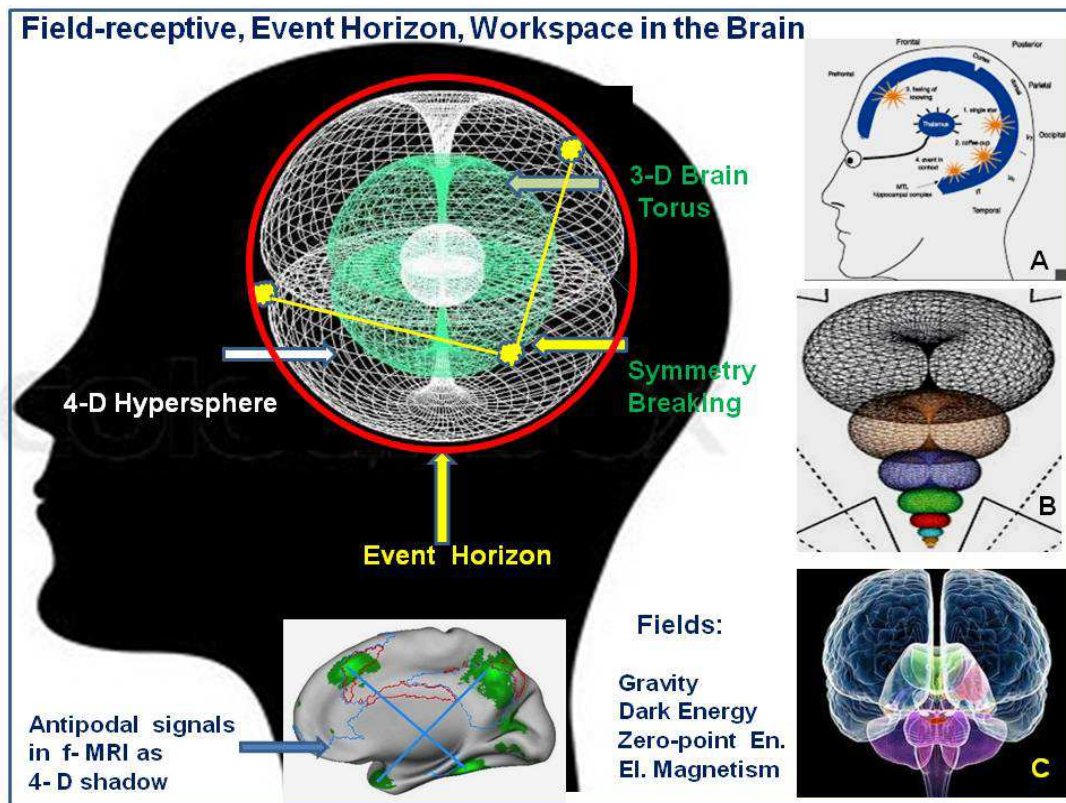


Figure 8. Field receptive, event horizon model of consciousness, depicted in various representations: Main picture: postulated double-toroidal field integrating the 4D- hypersphere workspace with the event horizon surface, projecting the integral individual information as an internal model of the self. Note that the 4-D hypersphere is pictured within the skull, but that it can exhibit an extended localization, surrounding the brain or even the whole organism (see also Fig. 9), due to fractal properties and can also be positioned at a micro-scale at or within the brain cells or extracellular space. Embedding of the 3-D toroidal domain of the brain within a 4-D hypersphere is therefore multidimensional and fractal at various levels of organization. Symmetry breaking occurs from the 4-D hypersphere to the 3-D internal brain torus, of which the traces can be detected by series of f-MRI scans of the brain as antipodal activity domains in the brain tissue (inset middle below). Insets at the right A: Supposed broadcasting centers in brain that may explain binding and global synchrony, according to Baars B: Fractal organization of information scales in the extended brain. C: Hemi-spherical anatomy of the brain resembling a toroidal geometry.



The toroidal coupling and final integration of these forces generates an integral information platform (to be seen as a back-up model of the self), that by definition enables both the internal and external global binding of the whole neural system. According to Ranama *et al*, 2010, stated: "It is not possible for a scalp EEG to determine the activity within a single dendrite or neuron.

Rather, a surface EEG reading, is the summation of the synchronous activity of thousands of neurons that have similar spatial orientation, radial to the scalp. Synaptic transmission and axonal transfer of nerve impulses are too slow to organize coordinated activity in large areas of the central nervous system, as mentioned before.

Sancristobal *et al*, 2014, suggested that neural gamma oscillations frequency locking is instrumental in the efficient routing of information between two cortical areas, but only if there is a precise and active control of the particular coherent frequencies. Therefore, a dedicated, field receptive, workspace, holographically associated with the human brain seems a prerequisite for such fine tuning. It may act as a fractal series of information storing "event horizons" (Fig. 9 b) and is permanently linked with the brain as an integrating toroidal structure with a nested character, (internal 3D-brain torus within a more extended 4D- torus, see Fig. 9).

-4-Dimensional (hypersphere) aspect of the brain model. A 4-sphere is set of points on the surface of what is known as a hypersphere. The prefix "hyper" refers to 4- (and higher-) dimensional analogues of 3D spheres. In mathematical terms, a 4-sphere, also called *glome* or generically *hypersphere*, a glome can be built by superimposing two 3-spheres whose opposite edges are abstractly glued together: obtaining a topological structure, the *Clifford torus*. A Clifford torus is a special kind of torus (donut shape) that is a minimal surface which sits inside a glome and is equipped with intricate rotations, called *quaternionic movements* (Fig. 1). The hypersphere, requiring four dimensions for its definition just as an ordinary sphere requires three, is not detectable in the usual spatial 3-dimensions and is thus challenging to assess. Fig. 1 shows the possible ways to cope with a 3D visualization of a glome. In the paper of Tozzi and Peters, 2015, it was hypothesized that brain activity is shaped in guise of an hypersphere which performs 4D movements on the cortical

layers, giving rise to a functional Clifford torus where mental operations take place (see Fig. 8). Experimental analysis of fMRI scans and theoretical clues lead the authors to conjecture that the resting brain activities of the brain connectome (a sort of default network, Sporns *et al*, 2013) may be embedded in a torus lying on the surface of a hypersphere (see section 6).

Our hypothesis, of a field receptive toroidal workspace, is fully in line with these recent proposals for toroidal models in the functioning of specific brain cells, neuronal networks, functional parts of the brain as well as the whole brain (Tozzi and Peters, 2015; Knierim and Zhang, 2012). For example, it has been hypothesized that hippocampal "place cells" create donut-like topological templates to represent spatial information. In particular, the findings of Tozzi and Peters, 2016, suggest that nervous structures process information through topological as well as spatial mechanisms. These authors modeled the brain by embedding it in the 4-D space of a Clifford torus and by analyzing f-MRI and EEG scans of cortical surfaces in time, consistently identified *antipodal points or shapes*, interpreted as traces or shadows of the symmetric information located in the supposed 4-D hypersphere (see section 5 and Fig. 8). By analyzing the fMRI and EEG patterns of 14 different patient studies, they observed reproducible topography and signal propagation throughout a subsets of regions that are shared across multiple trajectories. The spherical structure displays a double torus shape, *i.e.*, the trajectory followed by a particle inside the torus is closed. Each energy/information movement on the torus leaves traces on its surface that collectively build up its event horizon.

The presence of a glome or hypersphere can be detected invoking the Borsuk-Ulam Theorem (BUT), which states that every continuous map from a hypersphere to a 3D Euclidean space must identify a pair of antipodal points (*i.e.*, points directly opposite each other) (Fig. 8, middle below). This leads naturally to the possibility of a region based, instead of a point-based, geometry, in which collections of signals are observed as surface shapes, in which one shape maps to another antipodal one. The 4-D informative projections to 3-D spacetime is supposed to occur by symmetry breaking into single activities (see Fig. 8). Our human time perception, for example results from a symmetric structure in 4-D that contains aspects of past and future. In the proposition of this



hyperspace/toroidal model (Tozzi *et al*, 2017) the brain is totally embedded in such a 4D hypersphere, that enables the instantaneous global connection between different parts of the brain connectome. The authors suggest that this may also help to solve longstanding questions concerning our psychological activities such as mind-wandering and memory retrieval. In particular it represents the ability to connect past, present and future events, in a single, coherent, toroidal screen, glued together in a sort of mental kaleidoscope. Interestingly, the authors see the model of the brain hypersphere as a *fourth spatial brain dimension*, where mental operations take place both in physiological and pathological conditions. The connectivity patterns observed in the resting brain might constitute a “signature of consciousness”, reflecting a stream of ongoing cognitive processes.

It has also been proposed that spontaneous activity is highly variable among individuals, depending on local brain differences, somato-sensory awareness, age span, race, culture and so on. In this framework it has been proposed that features of a brain signal with spectral peaks in preferred bands (alpha, beta, gamma, delta and so on), see also Plikynas, 2015, and provide a basis for feature vectors in a 4D Euclidean space. In one torus type of mechanism, the periodically repeating pattern of so called grid cells in the brain have been related to a supposed toroidal architecture of the attractors (Mc Naughton *et al.*, 2006). The ultimate test for this model would be direct measurement of the synaptic-connection patterns in the brain and connected glands, which may reveal toroidal patterns in the particular fractal brain regions.

It is of interest that Tozzi and Peters, 2016b, gave their work a much broader context by applying their hyperspace toroidal model and the Borsuk-Ulam theorem to a cosmological interpretation of evolution of our universe, in which the start of the universe is envisioned as a loss of dimensions from a multi-dimensional symmetric manifold, picturing a pre-big bang scenario. Merali, 2008, earlier commented on the doughnut-shaped universe concept (Aurich *et al*, 2008, see Fig. 1). The striking similarity with the 3-D brain as a “personal universe”, supervened from a 4D- toroidal hyperspace domain, again points to a scale invariant symmetry breaking as a dominant feature of reality. In this respect it was put forward earlier that a hyperspherical universe, in which the present universe is nested

in surrounding a toroidal hypersphere, can directly be derived from Einstein’s relativity theory on the basis of a re-interpretation of the Klein-Gordon equation, as performed by the famous Italian mathematician Fantappié (see Galloni, 2012, Chiatti, 2007).

8. Comparison with other current models for consciousness

In which aspects does our model differ from or resembles to earlier proposed concepts on consciousness and it’s supposed neural correlates?

-Global workspace models. These models are often inspired by the “Global workspace theory” of Baars *et al*, 2013, Dehaene, *et al*, 2003. Table 3, left column). The various postulated concepts cannot not be treated in detail here, (see Seth, 2007, for a short but adequate review). Interestingly, many of these models are based on an *internal self-model* in the framework of a supposed global workspace. In the latter models the unresolved problem of instantaneous binding of distant brain nuclei, in relation to our *integral* observation and sensing of our world is approached by assuming multiple “broadcasting” hot spots in the neural networks of the brain that according to the authors may communicate via resonance of standing waves, phase coupling or even spiral vortices (see Fig. 8 A). Some even consider the integrating activity of this broadcasting of information as the very process of realization of consciousness (Baars *et al* 2013; Tononi, 2008, 2014, 2016; Dehaene, *et al* 2003), in which consciousness is just brain-wide sharing of information, that is, in the global workspace. However some aspects remain to be established: what is the physical mechanism behind this supposed “broadcasting” phenomenon (electromagnetic, holographic, or photonic see Fig. 8 A). In what form is the particular information send and also how is the received information in the cortex integrated to conscious moments with meaning? We propose that such a complex phenomenon requires an internal, information integrating, workspace, in which the broadcasted information can be put into the context of the entire memory space of the organism. It may also function as a workspace that is instrumental in top-down predictive-coding, in generating representations of past and potential future events. Thereby it may stabilize sensory input in an attempt to minimize error-prediction of free energy, as proposed for a



default-mode network of the hierarchic organized and wave- interference apparatus of the brain (Carhart-Harris and Friston, 2010; Sengupta *et al*, 2013), that is build up during life. Yet, our model differs from the supposed default-mode system since it is placed in a 4-D setting instead of a 3-D brain neuronal network. Of note, as an alternative for discrete brain networks, a system of cortico-thalamic eigenmodes was proposed by Robinson *et al*, 2016, which is in line with the toroidal electromagnetic eigenvalues, identified by us (Meijer and Geesink, 2017).

-Relation with connectome and default brain networks.

The natural candidate for such a toroidal information flux domain in the brain is the spatially embedded network of the so called human connectome: a non-stationary, highly dynamical structure in the brain, characterized by complex topological geometry (Sporns *et al*, 2013; Carhart-Harris and Friston, 2010). Various additional models have been proposed earlier to deal with the spatial and temporal integration of network activities in the brain (for a short overview see Bressler, 2008 and Wikipedia on Binding problem). It is generally assumed that a default network that operates spontaneously in resting conditions (mind wandering, introspection, monitoring of the mental self, integration of cognitive processes) as a modality of inner awareness and competes with an external awareness network that operates during goal-directed behavior related to external sensory input (Heine *et al*, 2012, Bekovich-Ohana and Glicksohn, 2014). It is unknown how a functional equilibrium between these two anti-correlated systems is executed, but it stands to reason that this should be mediated by a *supervening network* that contains an updated and integral overview of our total memory/images of past and future events, coupled to personal worldview. Only this may enable top-down predictive coding and contrastive analysis on the basis of both conscious and unconscious states.

- A meta-cognitive form of consciousness will contain a graded modality of hierarchically referential ordered and bodily determined working structure that is essential for fully coordinated action, and was earlier called "individuated information utilized in action" (Jonkisz, 2015). Interestingly, such a conscious state space (Bekovich-Ohana and Glicksohn, 2014, Brandenburg *et al* 2016), was modeled by a geometry of two concentric spheres (not unlike

our torus model), representing a phenomenological space with three dimensions: time, awareness and emotion. As mentioned above, we tentatively add to this configuration a toroidal fourth dimension of self-consciousness in continuous contact with an extended consciousness or awareness continuum that is defined by us and many others as *universal consciousness*. The latter aspect rejects the usual framing of a mental workspace as a dualistic concept, since we envision our proposal of the extended brain as being *derived* from universal consciousness, as the very source of all that exists (see Goswami, 1990). A similar discussion was raised in relation to the very elegant consciousness model of Fingelkurz *et al*, 2010, 2014, called nested operational architectonics of the brain. In this model it was postulated that an electromagnetic brain field (see also Kida *et al*, 2016, for a fractal representation) connects a mind-subjective space-time to a distant physical space-time.

-Multi-dimensional models. Our model is, at least to some extent, related to earlier proposed quantum/spacetime models of Pribram, 2004 and Mitschell and Staretz, 2011 (the holonomic brain), as well as the electromagnetic brain theories of McFadden, 2007 and Pockett, 2012.

It also bears some resemblance to the orchestrated objective quantum reduction model of Hameroff and Penrose, 2014, the TGD universe framework of Pitkänen, 2016, and relates to the so called dissipative information brain model of Vitiello *et al.*, 2001, (see table 1, right column), as previously reviewed by Meijer and Raggett, 2014.

Implicitly, a major difference with the abovementioned models is, that it is not solely related to the known neuronal/astroglial based central neural-system, but *in addition* proposes an associated mental workspace in a 4D context (see also Beichler, 2012 a,b,c; Carter, 2014). This workspace mirrors our total of experiences and is sensitive to relevant information derived from various force fields of nature such as geomagnetism, gravity, zero point and dark energy. We presume, as stated before, that it also contains an even larger connecting modality in the sense of a *universal consciousness*, as it is inferred by us (Meijer, 2017, in preparation). In this sense, our model supports that of Haramein, 2007 and 2016 (dual toroidal geometry in physics and cosmology), as well as the model of Hameroff and Penrose, 2014.



Table 3: Current neurological and neural-correlate models (left) and quantum/spacetime models (right). References to the neuro-correlate models can be found in Seth, 2007, and for Quantum models see Meijer and Raggett, 2014 and references of the present paper.

Current Models of Human Consciousness	
Neuro-correlate models	Quantum/Spacetime models
Global Workspace model- Baars/Dehaene	Wholeness/Implicate order model - Bohm
Multiple Drafts theory- Dennett	Quantum field model- Jibu/Yasue
Dynamic Core/Neural Darwin. model- Edelman	Quantum brain dynamics - Umezawa
Information Integration theory- Tononi/Koch	Dissipative brain model- Vitiello
Thalamic Cortical Rhythms model- Llinas	Holonomic mind model- Pribram
Coalitions of Neurons model- Crick/Koch	Attention quantum zeno effect model- Stapp
Field models- Kinsbourn/McFadden/Pockett	Psychon brain dynamic model- Beck/Eccles
Subcortical models- Penfield/Merker/Ward	Ion-channel coherence model- Bernroider
Internal and World Simulation model- Revonsuo	Orch. Obj. Quant. Reduct.- Hameroff/Penrose
Retinoid model- Trehub/Metzinger	Spin- mediated Consc. Model - Hu/ Wu
Self-model theory- Metzinger/Hesslow/Grush	EM- field models- McFadden/Pockett
Sensimotor Theory model- O'Regan/Noë	Holographic Resonance model- Mitschell
Supramodular Interaction theory- Morsella	Hierarchic model conscousn.- Kaivarainen
Multilevel Feedback model- Haikonen	Dual-time Supercausality model - King
Intermediate Level theory- Jackendorf	Topological Geometro Dyn. Mode I- Pitkänen
Radical Plasticity thesis- Cleeremans	Poised State Quantum model- Kauffman
Collorary Discharge Attention model- Taylor	Photon Med. Consc- Bókkon/Dotta/Persinger
Attention to Memories theory- Izhikevich	Noetic Field theory - Amoroso/DiBiase
Bicameral Mind model- Jaynes	Zero Point Energy model- Keppler/Cagliuiri
Operational Architectonics model- Fingelkurts	Neural Field theory- Robinson
Self Comes to Mind model- Damasio	Infinite Spiral Staircase model- Hardy
Free-energy Unified Brain theory- Friston	Nuclear Spin Neural Qbit model- Fisher
Triple aspect monism model- Pereira	Oscillating Agent Quantum model- Pliukynas

The latter addressed quantum gravity mediated communication with information on the Planck scale. The holonomic models mentioned in table 1 of Pribram, 2004, Mitchell and Staretz, 2011, and Amoroso and DiBiase, 1999, largely stimulated our concept.

9. Final considerations

In the present paper we present the concept of a *non-material, field-receptive, resonant, mental workspace, that is part of a universal mechanism of rotational information flow that operates scale invariant at all levels of the fabric of reality*

We shortly summarize its backgrounds here:

- The extremely rapid functional binding of cortical structures that have been demonstrated requires a non-local, field-like, connective mechanism and cannot be explained by relatively slow neural transmission mechanisms
- Multiple external fields to which our brain is exposed and that may influence its function, require an orchestrated *receptive* apparatus having both wave receiving and transmitting

properties. Receptive here thus has a double meaning: that of receipt and recipe.

- The toroidal coupling and integration of very different wave energies can produce strong attractor/standing waves that are powerful enough to induce coherent *resonance* patterns with cortical brain structures known to be correlated with conscious states
- The proposed mental workspace is regarded to be non-material, but in relation to the individual brain, entertains a non-dual wave/particle relation according to quantum physical principles: it is directly dependent on the brain physiology but not reducible to it
- The bidirectional flow of information between internal and external electromagnetic fields enables to build up a personal mental model that is instrumental in simulations of actualized representations of the individual status as a basis for quality control of the whole organism
- The proposed mental workspace collects the complete experiential spectrum of information of an individual, within a system of nested event horizons as part of a 4-dimensional toroidal hyperspace that enables continuous updating and



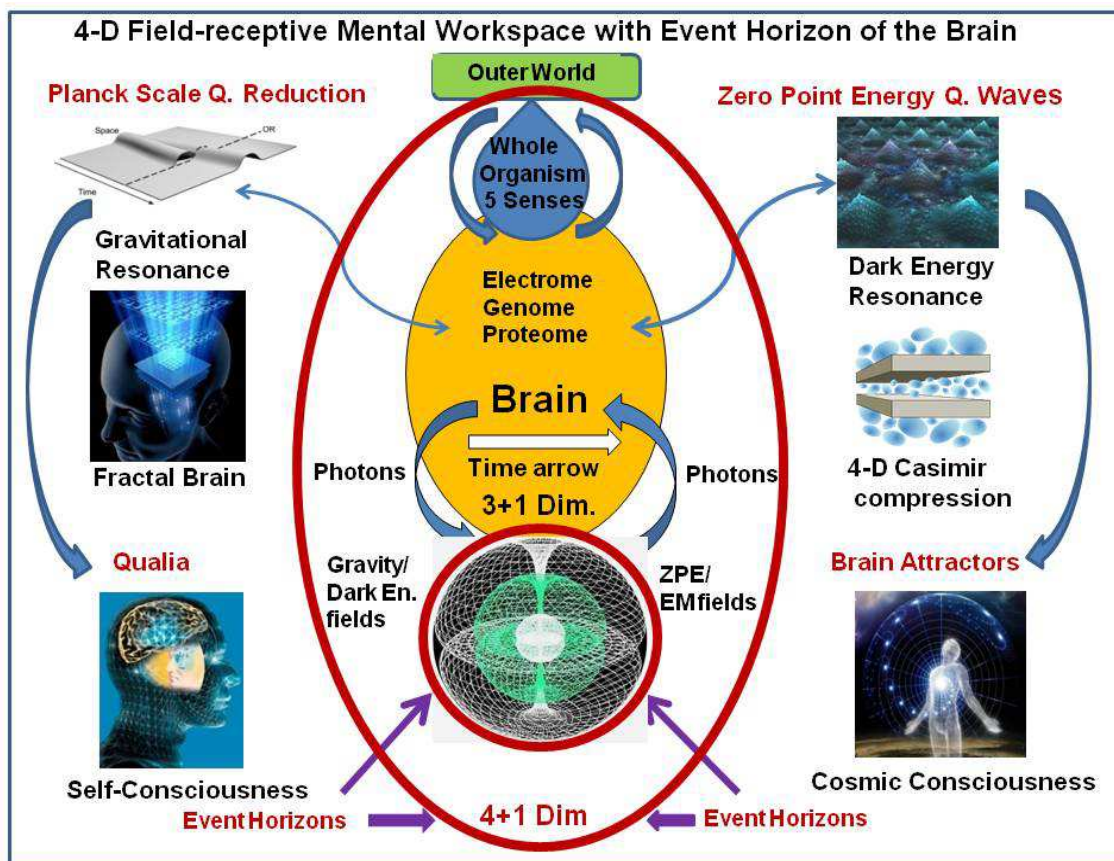


Figure 9. Modeling of brain/ mind relation in a 4+1-dimensional space-time framework (4+1 implies 4 spatial dimensions and one single dimension of time, on the basis of energy trajectories in a nested toroidal geometry. The opposing forces of Dark energy (diverging force) and Gravity (converging force) 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 a 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. The 4th spatial dimension allows individual self-consciousness since an extra degree of freedom is required for self-observation and reflection, while in the 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. Bottom-up information flow from the Planck scale, combined with top-down information conjugation from the ZPE field, constitute the event horizon of the brain, also integrating gravitational and dark energy related force fields, and supervenes the physical brain. Event horizons of brain and whole body are depicted in red ellipse and circle respectively.

quality control of internal and external information.

The particular holographic type of consciousness, situated in the particular event horizons as a sort of bordering memory domains, can effectively function as a nested information workspace, that in humans is instrumental in constructing a *mental model of reality for internal use in each individual*, thus functioning as a global reference system. It is instrumental in the overall monitoring of each individual (of any intelligent species that inhabits our universe). In addition, it should therefore be involved in the fine tuning with and updating of a supposed *universal*

consciousness. The feature of quantum back-propagation can effectively implement a form of adaptive error correction (Goncalves, 2017), as has also been shown in the generation of cyclic/toroidal chaos by Hopfield networks (Akhmet and Fen, 2014).

The present model thus postulates a mental workspace in close connection to our brain. This raises a number of central questions: 1) is there a physical basis for such a workspace or should it be seen as an intrinsic mind/matter dualistic approach 2) If such a disembodied aspect of consciousness exists, how does it communicate with the physical brain? 3) If our



brain is supervened by an updated inner projection of the outside world, and thereby tends to reduce “surprise”, how does this affect free will (choice).

With regard to the potential dualistic aspect, we stipulate that we consider our model as clearly non-dualistic and in this sense, agree with the Operational Architecture model of Fingelkurz and Fingelkurtz, 2010, 2014 on separate phenomenal and neuro-physical aspects of consciousness, stating that *both aspects have an ontological relation but are not reducible to each other*. We respect the related concept of Libet, 1994, 1996, of a mind field, especially in relation to the aspect of retro-causality in conscious experience, but tend to disagree on his suggestion that such a field it is defined by physics that should be entirely different from presently known physical mechanisms (see discussion by Pockett, 2012, 2013).

In fact we are convinced that the mind field or field-receptive mental workspace that we assume, can be adequately described in terms of current physics. We do not think however that such physics can be fully characterized by stochastic electrodynamics (that is classical physics extended with zero-point energy) as proposed by Keppler, 2016. This is, since we see individual consciousness as a reflection of cosmic consciousness that, apart from ZPE field, should include all other relevant force field such as gravity and dark energy, although we agree on the importance of electromagnetic and quantum resonance mechanisms. In our model, the fractal geometry of the torus takes a central position in brain physiology, as was also put forward by Tozzi *et al*, 2015, 2016, 2017 and Knierim and Zhang, 2012. The toroidal generation (scattering) of quasi wave/particles such as polaritons and polarons (solitons) is a crucial aspect of information integration of the various force fields that are involved. Solitons have been proposed widely as axonal information carriers in the brain (Wikipedia), in which myelinated nerve fibres function as light guides for solitons and biophotons in this manner bridging electromagnetic and spin aspect of neural information processing (Kumar, 2016).

With regard to the second point on the communication item, we propose a multifactorial informational connection on the basis of quantum holographic principles (see Fig. 9). Yet, all of the various communication mechanisms mentioned here are clearly *interrelated*. They include long range and bidirectional correlations

of the supervening mental workspace with the physical brain through entanglement and quantum tunnelling. This, in addition to holonomic sharing of quantum information through 4-D to 3-D projection and phase-conjugation (Mitchell and Staretz, 2011). A similar multifactorial process has been proposed in relation to information conservation by event horizons of black holes (van Raamsdonk, 2010; Pourhasan *et al*, 2013; Verlinde 2011, 2016). The 4-D hyperspace aspect has earlier be used for the geometric characterization at the scale of the entire universe, in line with the scale invariant modality of information flux as well as the fractal or cellular organization of the cosmos. The 4-dimensional aspect of the brain was included by us in relation to the aspect of self-consciousness and can also be modelled by toroidal geometry, Meijer and Geesink, 2016.

Torus-like trajectories and knots of information with meaning could, through their recurrent (rotational) information flux configuration, even be seen as an operational form of a neural network in which spatio-temporal neuronal synchronicity can be functionally guided to high efficiency. Recently, Tozzi *et al*, 2017, suggested that a modular oscillation may underlie human brain electric activity, and in particular the known EEG rhythms, alpha, beta, gamma, delta and theta rythms that might have physical counterparts in microscopic features of the universe such as the string theories. They speculate that in the brain this may be related to hidden spatial nervous dimensions and multidimensional torus movements, where take place in guise of particles trajectories travelling on torus-like manifolds. The communication between the 4-D event horizon workspace proposed by us and our 3-D brain could very well be represented by the hippocampus area as a 3-D shadow of the 4-D memory space.

Burke and Persinger, 2013, pointed out that: “consciousness is determined by the physical laws of matter and energy in producing energy and matter. Within the quantum domain that includes Casimir phenomena, whereby virtual particles can be transformed under optimal conditions to particles with mass, there are other perspectives. *Consciousness is a boundary condition between a singularity (black hole) and space within the brain*. Within the human brain the hippocampus has been considered the gateway to personal memory and to the representation of experience as



electromagnetic phenomena within intra-cerebral and extra-cerebral space. The structure of the human hippocampus is similar to two interlocking C-shaped structures that are congruous geometrically with the smaller spherical condenser wrapped and partially interfaced by a larger spherical condenser. *The particular geometry is similar in shape to a toroid with a gap that allows a discrete, because of the dimensions of the gap, leakage of magnetic flux.* It is affected by the polarization or phase vector of the accompanying electromagnetic field that can be matched within the same order of magnitude as the scalar potential for the representation of the geomagnetic field within this space.”

As to the third question on the realization of free choice: our model assumes dynamic bidirectional information exchange between the proposed mental field that informs the individual with regard to the state of the world and the brain. If consciousness and in particular *self-consciousness* is related to permanent contact with the 4-D hypersphere information workspace (see also Prakash *et al*, 2008, Sieb, 2016, Taneichi, 2015) by which probability is converted to meaning, this can be envisioned as a “storyline”, implying that consciousness can observe itself from a geometric distance. This aspect is crucial in the understanding of the earlier suggestion made by Penrose, that consciousness contains an intrinsic non-computable component. Zizzi and Pregolato, 2013, stated in this respect that to approach the non-computable aspect, a sort of mathematical meta-language will be required. In other words: if self-consciousness observes the brain memory and awareness states, by this very act it changes both of them.

The only possibility to address this paradox seems the potential to link or integrate past and future events in the framework of quantum approaches. Relevant examples are the transactional interpretation of quantum physics of Cramer, and the, so called, soft quantum wave stimulation concept of Aharonov, in which future states interact with the past states to create the present, (treated in Meijer, 2012). In the bidirectional flow of energy according to re-interpretation of the Gordon-Klein mass/momentum/energy equation of Fantappiè and the retro-causality considerations of Auletta and Ellis, (reviewed by Meijer, 2012) such a mechanism is plausible.

The present study adds to all this the rotational aspect of torus geometry and negative

energy of wormhole structure, combined with strange attractors and the universality of fractal dimensions. It is of interest that recent calculations of Song, 2007, indicate that consciousness should, at least partly, reside outside the brain and that it is *applied to the brain than rather than generated by it*, as also discussed earlier by Tonneau, 2004. This is so, since the conscious activity of an observer observing the change of an observable is, per definition mathematically not computable (Song, 2007). This implies the involvement of the typical type of probability of a quantum system, that will not endanger free choice and intention of the individual.

An important question was posted by Pitkänen, 2016, in a comment on our previous papers on discrete EM frequency bands (Geesink and Meijer, 2016, 2017), that apparently promote life conditions: “What could be the physical origin of the Pythagorean scale on which the EM frequency bands can be positioned and:”this give excellent reasons to ask whether the 12 note scale could be realized as some physical system. One might hope that this system could be somehow *universal and a geometric realization in terms of wave equations would be possible*”. Recently, our hypothesis was integrated in a comprehensive study on electronic music and universal consciousness (Van De Bogart, 2017, stipulating the relation with music theory and support the observation that the human brain network functions through connectome-specific harmonic waves (Atasoy *et al.*, 2016). In line with our concept, Tozzi and Peters, 2017, reported that a repetitive modular oscillation function can be inferred from the EEG wave patterns and that this constitutes a hidden rhythm that dictates oscillatory activities in biological systems. The hidden aspect was related to long distance interactions based on an additional (4th) spatial dimension as exhibited in multidimensional toruses, where trajectories take place in guise of wave/particles on donut-like manifolds.

We agree that these questions and suggestions provide the very challenge for further substantiation of our hypothesis and this may also be related to our previous suggestion (Meijer and Geesink, 2016) that the apparent musical harmony- like aspect may reveal hidden variables of the so called implicate order as supposed to underlie our daily reality by David Bohm, 1980, 1987. The latter was later ascribed to zero-point energy field by Lazslo, 2007, 2012). If so, this implies that bio-molecular brain



processes are coupled to a fine-scale structure of the universe, as suggested earlier by Penrose, 2014, and further defined in more detail by Hamein, 2016, as a unified, micro-wormhole entangled matrix on the Planck scale. This all-pervading system represents a non-local and retro-causal space memory, operating via recursive information feed-back/feed forward processing of polarizable electromagnetic quanta of the vacuum (Brown, 2016). We may speculate that this represents a pre- big bang information domain, in the framework of biological cosmogenesis. Such a pilot wave system may also have exerted an ordering influence during (pre)-biological evolution, at all scales of the universe.

The present, nested, scale invariant, event horizon concept, thus, implicitly has broader implications than only for brain function. In our earlier work we applied this holographic memory space model also to single cells in relation to the aspect of soliton- mediated protein folding mechanisms (Meijer and Geesink, 2017). We argued that cellular proteins are never alone, not only due to all kinds of molecular interactions in the crowded intracellular space, but also due to the external influence of short and long distance electromagnetic, as well as other type of force fields. Realizing that the extremely complex cell can be seen as a bundling of neg-entropic and life sustaining information, through an ongoing correlation with its environment, each life cell may have acquired a self-referential mode by which it is able to manage its needs, thereby obtaining problem-solving, “cognitive” abilities.

The latter can be seen in the framework of the so called extended evolutionary synthesis concept (Laland *et al.*, 2017) and pervasive information field model of Miller, 2016), both innovative articles that stipulate the major importance of epi-genetic instead of genomic inheritance. We propose that the mechanism of this informational aspect can be readily explained by a holographic memory space that contains the total history and future probability states of the particular cell, that, in our view, surrounds the cell in a hyperspace toroidal modality. We also discussed the potential role of our EM life algorithm in the creation of first life at the edge of pre-biotic evolution (Geesink and Meijer, 2014).

In this respect Walker and Davies, 2013, suggested that the origin of life may be related to a physical transition or shift in causal structure, where the integral cell obtains a bi-directionally operating flux of information, including a

backward causation (blue print type) aspect. Such an “supervisory” unit associated with the cell could well be conceptualized as being created during the abovementioned causal transition, in the form of an event horizon, field-receptive, workspace. This, since the holographic information storage is a universal mechanism, and in this case, being instrumental in order to effectively deal with the steadily rising complexity of evolutionary structures.

It is of great interest also that recent studies indicate that some black holes may predate the Big Bang on the basis of Bohmian quantum trajectories, do not exhibit a singularity and can function as a portal to another universe, by which implicitly the so called loss of information paradox is overcome (Gambini and Pullin, 2013). One of the models that was constructed presents the three-dimensional universe floating as a membrane (or brane) in a “bulk universe” that has four dimensions. The 4-D black hole would have an “event horizon” just like the known 3-D ones. The event horizon is the boundary between the inside and the outside of a black hole. In a 3-D universe, the event horizon appears as a two-dimensional surface. So, in a 4 D universe, the event horizon would be a 3-D object called a *hypersphere* (Pourhasan *et al.*, 2013). That evolution is encoded in a 4-D information structure have also been proposed recently by Sorli, *et al.*, 2017, an article in which our phonon/soliton guided principle of life was discussed and supported.

The present life principle of EM-guided biology, hypothesized by us, is in principle testable. For example, such specific and scalar EM radiation frequencies could be externally applied in *in vitro* and *in vivo* studies, in order to induce a potential beneficial resonance of oscillating cell components, such as proteins and oligonucleotides, that may sustain life. In this framework, the influence of endogenous and exogenous electromagnetic fields in relation to brain function and consciousness, as have been reported in a wide spectrum of previous neurophysiological studies (McFadden, 2007; Pockett, 2012; Libet, 1993; John, 2001) that could be further extended.

Our paper, may directly contribute to an answer on the famous question of Chalmers, 1995: how can something immaterial like subjective experience and self-consciousness arise from a material brain? Yet, the present



authors prefer to rather rephrase this question: if consciousness is indeed the most fundamental aspect of reality (Zeilinger, 2003; Davies, 2010), how does consciousness result in the manifestation of matter? This implies that, so called, panpsychism, at first sight, may be a logical solution to Chalmers question, as put forward in the information integration concept of Tononi *et al*, 2016. Yet the latter may rather be seen as a reductionist approach in the line of current materialistic physics, since one fails to envision the issue from the point of view of consciousness as *primary* (Goswami, 1990; Kastrup, 2016; Keppler, 2016; Struppa *et al*, 2002; Pereira *et al*, 2015).

The central postulate of the present paper, in this respect, is that consciousness can be regarded as the most basic building block of nature and consequently is present *at all levels* of the fabric of reality (see also Meijer 2012, 2014). It can be expressed at each level as a dynamic recurrent informational structure, since nature is equipped with a dedicated quantized background, consisting of a fractal matrix of interconnected (entangled) toroidal wave/wormhole structures, that enables the coupling and integration of various modalities of various modalities of field information, (Harramein, 2016; Brown, 2016).

It may also provide the potential for extra-sensory inter-individual communication and correlated brain signals (Hasson, 2012, Wackerman *et al*, 2003, Radin, 2004, Richards *et al*, 2005, Standish *et al*, 2004, Pizzi *et al*, 2004), since the postulated holographic workspace, projects its active information from a dedicated virtual screen in our brain, as described for event horizons in current cosmology. These projected multi-level fractal wave structures thereby contribute to the *integral wave function* of our universe. The latter, in the form of the ultimate compressed information, in turn provides the necessary recipe for further evolution and a future rebirth of our universe, also operating in a toroidal rebound context, as treated earlier (Meijer, 2012, 2015).

Through deep insights, contemplations, meditation and reasoning we can recognize some intrinsic aspects of such an all-embracing universal consciousness. However, our limited minds, being individual parts of the cosmic consciousness, operate in time-space-energy constraints and inner conditioning, that only partly can reflect the true nature of reality. In spite of this handicap, humanity should realize

that faithful honoring of such a connecting principle may provide a potential to preserve our precious planet and guarantee a real future for mankind.

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