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Horizon of the Human  
Brain

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

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## 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/soliton 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 4<sup>th</sup> 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.

**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 Tsytoich *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 4<sup>th</sup> spatial dimension

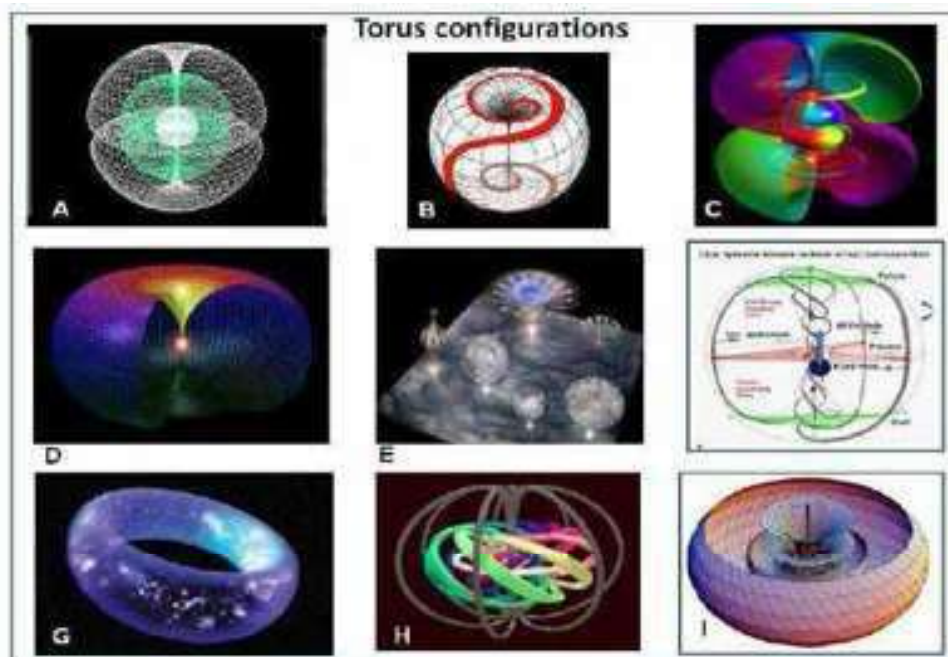
(see Wikipedia, Quantum error correction). This aspect could play a pertinent role in the supervening mental workspace, conceived as an event horizon equipped hyper-sphere, as proposed in the present paper.

-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).

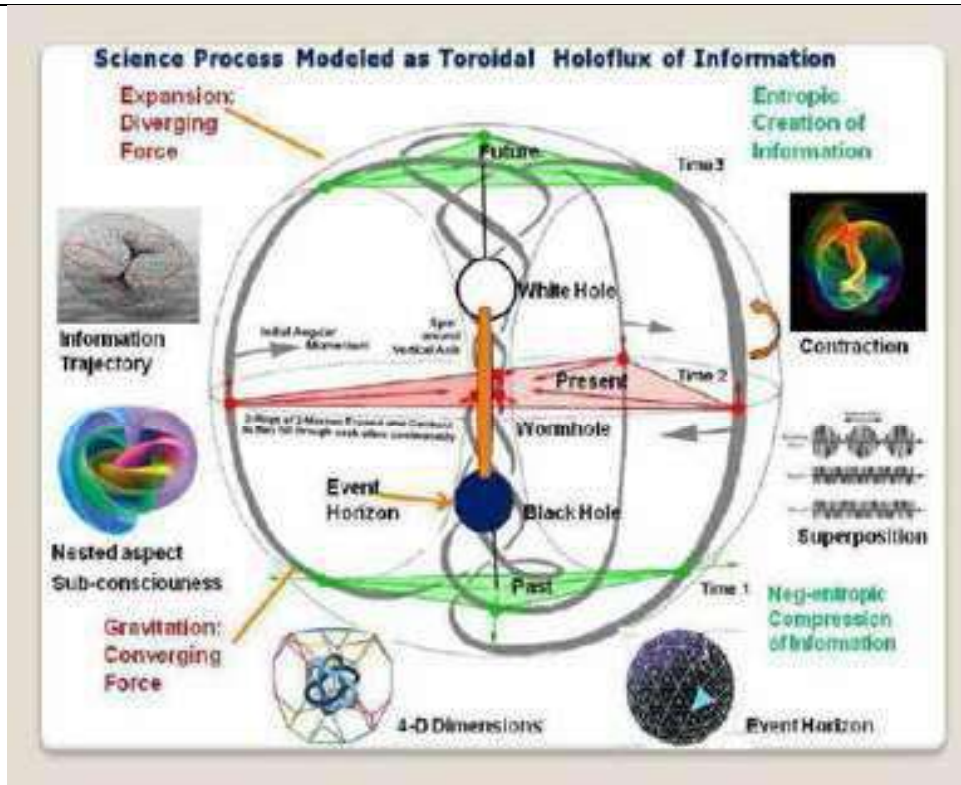
It should be noted that:

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 (Keppler, 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

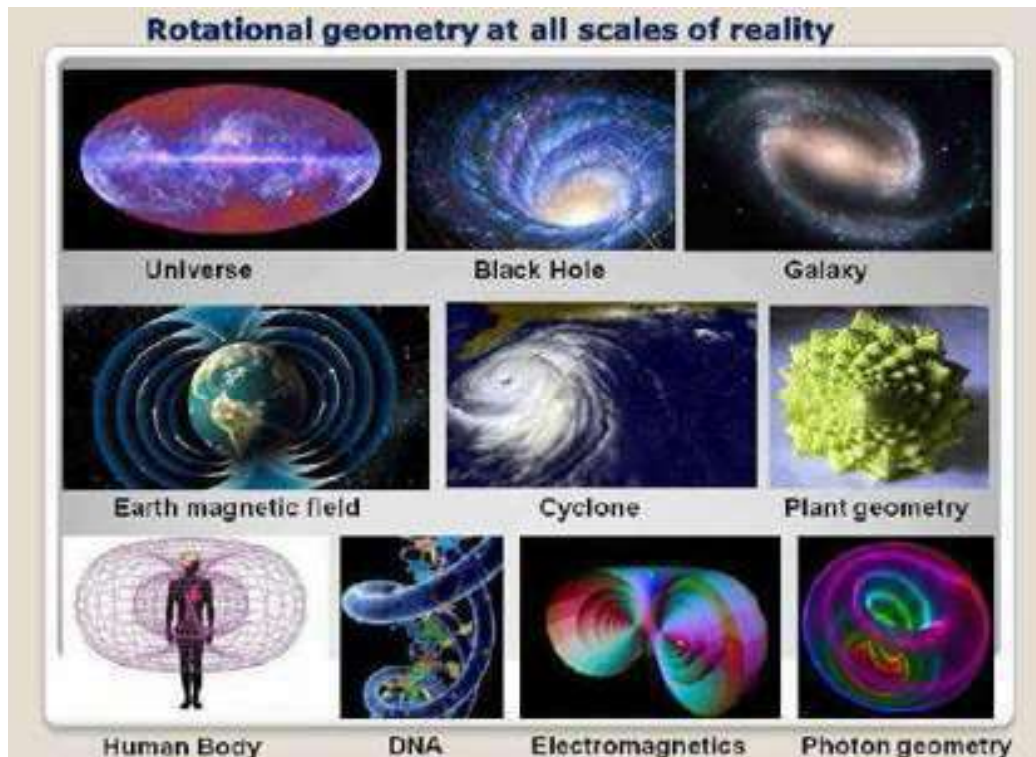


holographic communication (Pribram, 2004). The latter may not only explain the extremely rapid reactions of the nervous system (Meijer and Korf, 2013), but also the coupling of conscious knowledge to sub-consciously induced intuitive impulses, and mental states.

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* (Dunajzki *et al*, 2004). Recently, Haramain *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 been indicated by Melkikh 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* (Kepler, 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 4<sup>th</sup> 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 4<sup>th</sup> 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).

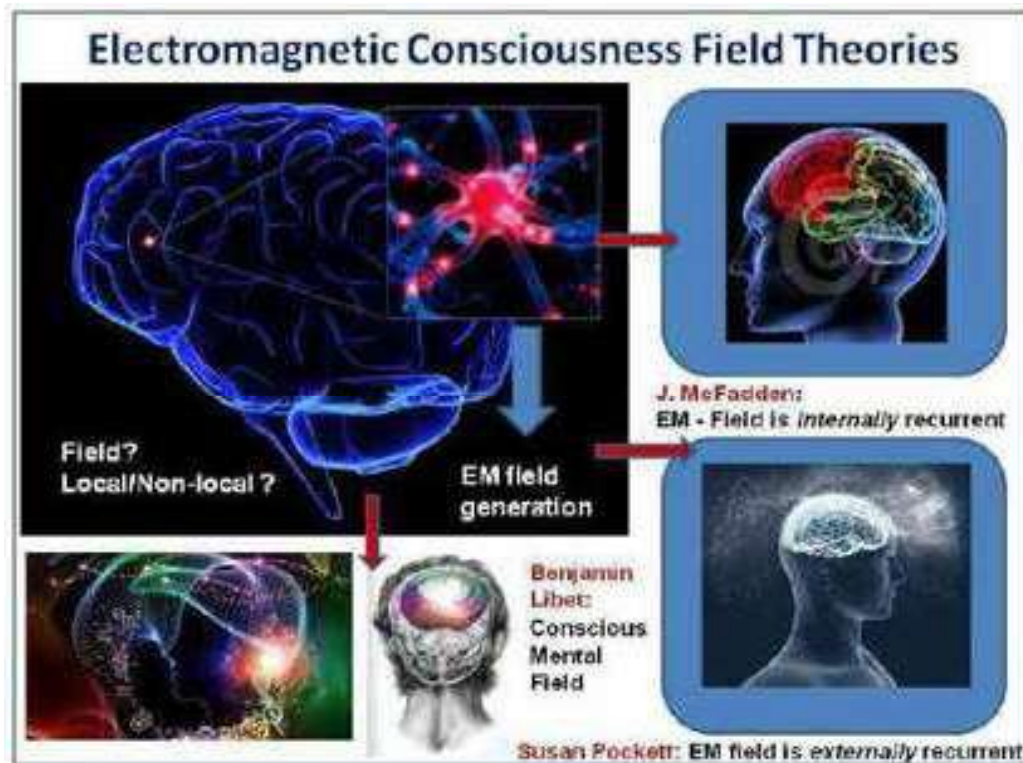
The collective field concepts may constitute an interpretation framework for poorly understood phenomena such as mental states such as intuition, telepathy, far distance observation as well as near death experiences (see Radin, 1997) as well as near death experiences (Beichler, 2012c; Bókkon *et al*, 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 Ca<sup>2+</sup> gradients and ion-oscillations may play a pivotal role since Ca<sup>2+</sup>, 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

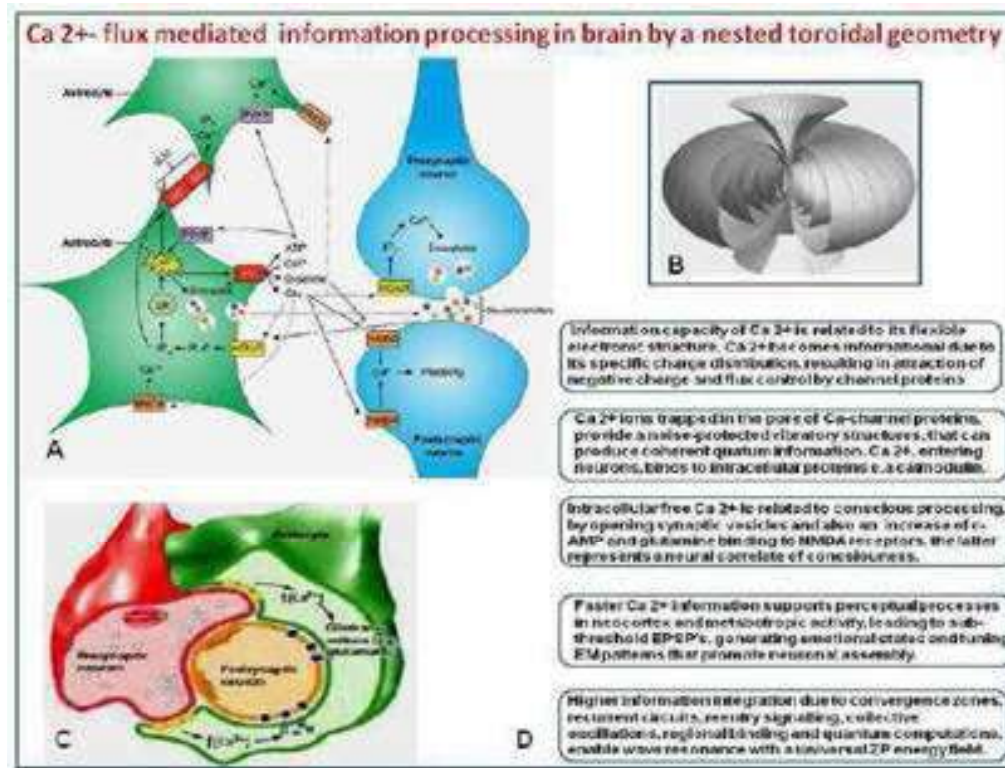
that are normally rather refractory for external EM wave modalities, become very sensitive to such radiation via perturbation of cytosolic Ca<sup>2+</sup> oscillations. Rotating spiral Ca<sup>2+</sup> waves have been reported in many studies (see for references Zioutas, 1996) and photon energy is transformed in kinetic energy of the gyrating ion (gyro-resonance).

The pivotal role of Ca<sup>2+</sup> 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 Ca<sup>2+</sup> 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 Ca<sup>2+</sup> 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.** Ca<sup>2+</sup>-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<sup>-1</sup>, 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.

