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Hidden Connections Between NanoTesla Magnetic Fields, Cosic Molecular Resonance, and Photonic Fields Within Living Systems

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ABSTRACT

The interfaces between molecules and the interactions between cells involve very small energies (~10^{-20} J) and photon flux densities (~10^{-12} W·m^{-2}) that ultimately control the dynamics and health of the human body. Within the environment there is an increment (± 3 nT) of weak magnetic field fluctuations whose energies within the volume of the human brain display the capacities to affect its properties through nuclear spins in neural membranes. There is a conservation of energy. Within the same volume when there are increases in photon flux densities from cells and human cerebrums there are decreases of interfacial geomagnetic field intensities within the nanoTesla range. The spectral power densities of the sequential quantifications of pseudopotentials of the amino acids that compose proteins and the nucleotides that construct DNA and RNA predict the functions of molecular pathways as electromagnetic resonances. They operate through these small energies, photon flux densities, and fluctuating magnetic fields. Whereas metabolic-level energies operate the mechanics of the multivariate molecular pathways for cell signaling the photon wavelengths predicted by the Cosic Resonant Recognition Model may be the templates and the initiators. The involvement of specific peaks of photon wavelengths that are the energetic equivalents of molecular structures containing intrinsic phase-modulations creates the conditions for excess correlations ("entanglement") and potential non-locality within the total human environment. This alternative perspective may facilitate developments of different strategies and technologies for solving the challenges of global public health in the 21st century.

***Keywords*: Cosic RRM; photon flux; nanoTesla magnetic fields; 10^{-20} Joules; Hu-Wu dipole-dipole effects; Bokkon photonic fields; ultraweak biophoton emissions, spectral power densities, geomagnetic activity, excess correlation

INTRODUCTION

Tesla-intensity magnetic fields are primarily employed in order to enhance resolution for imaging. However biological and chemical effects, that do not always involve Faradic currents from induced electric fields secondary to changing magnetic fields, have been reported to be responsive to very weak intensities within the nanoTesla (10^{-9} T) range [1,2]. This fundamental discrepancy between very large and very small magnitudes is not unique to magnetic fields. The pressure associated with the atmosphere is in the order of 100 kPa (10^5 Pa) while the pressures produced by the more complex processes associated with listening to a human whisper and responding to it are within the 0.1 mPa (10^{-4} Pa) range. This is also a difference in the order of 10^9. Normal people do not hear "the whisper" of static atmospheric pressure. Sometimes the critical factor is not the magnitude but the complexity of the information. In general smaller magnitudes support faster shifts (quicker fluctuations) in their polarity and hence more information capacity. One of the most frequently persistent ranges of intensities that could couple physical forces and energies with cellular, organ, and behavioral activity is between 1 nT to ~10 nT.

Although traditional approaches assume an implicit linearity between intensity of global geomagnetic activity (which can range from 1 nT to hundreds of nT) and the many forms of chemical, cellular, and organismic responses, the presence of "non-linearities" or "windows" of intensity that are most strongly correlated with a biological response or produces a response experimentally are well documented [3,4]. The phenomenon might be considered similar to the differential effects exhibited by high and low affinity receptor subtypes embedded within plasma membranes of cells. The gradual increase in the concentration of a ligand (the analogue of intensity) can result in qualitatively different effects that are mediated by completely different cellular mechanisms (e.g., primary and secondary messengers) depending upon which receptor subtypes that are being optimally stimulated by that specific concentration of chemical.

As reviewed by multiple researchers the strengths of the essential bivariate correlations between the typical range of intensity of geomagnetic activity and biological and behavioral correlates are between r~0.4 to r~0.6 [5,7]. These persistent strengths of association suggest the two sets of variables share ~20% to ~30% of their variance. That these correlational effects are actually associated with the magnetic field changes rather than confounding or third factors that were occurring simultaneously has been shown by experimental studies. Michon and Persinger [8] reported a mild to moderate strength correlation between spontaneous seizures in chronic epileptic rats and the global geomagnetic activity (in the nanoTesla range) at the time of the overt convulsion. Simulation of the range of the natural intensity by experimentally-applied magnetic fields with configurations modeled after geomagnetic activity also resulted in an increase in seizures. The effect sizes of the field and no field conditions were almost identical to the effect size (r^2) of the correlation studies with the same groups of rats.

Mulligan et al [9] verified the correlation between global geomagnetic activity and quantitative electroencephalographic activity involving very specific regions of the human cerebrum and frequency bands [10] by whole-body exposure of volunteers to a "simulated geomagnetic" perturbation. The largest effects were associated with the magnetic field strengths that were most proximal to natural intensities. Caswell and his colleagues [11], who employed a different measure (quantitative electrocardiographic profiles), demonstrated that the complex components of heart rate that had been reliably shown to be associated with increases in global geomagnetic activity [12] were also evoked when they applied whole body magnetic fields that most closely simulated the natural condition in both temporal pattern and intensity.

The role of very weak magnetic fields in human health and epidemiological phenomena that could affect millions of people over periods of months to years may be obscured because of implicit thresholds which are likely to be within the low nanoTesla range. As reviewed by Ossenkopp and Barbeito [13] the threshold in global geomagnetic activity for disruption of bird (pigeon) flight is a daily average of >~20 nT. Within controlled experimental settings Persinger and Richards [14] found that the increase in a specific cluster of subjective experiences that are often associated with weak magnetic field applications, such as dizziness, a sense of detachment, or a sensed presence [15], were more frequent above a threshold of >~20 nT to 25 nT. There was no linearity of effect after the onset. If the full range of intensities had not been considered, which often occurs for restricted range artifacts, there would have appeared to have been "no effect".

"Non-linearities" whereby a change of responding occurs within a narrow band of intensities or frequencies but not with values below or above that band can be obscured unless they are predicted by theory or discerned because of great precision during the systematic pursuit of a phenomenon. This important concept was elegantly demonstrated by W. Ross Adey [16] for calcium flux in cells. St-Pierre and her colleagues [17] were the first to demonstrate experimentally these effects for whole organisms. In the pursuit of isolating the potential geomagnetic factors that might contribute to Sudden Infant Deaths (SIDS) in human beings, she designed an experiment in which electrical sensitivity could be maintained in the brains of infant rats after they had been exposed perinatally to different intensities of 7 Hz magnetic fields. The electrical sensitivity, which resulted in terminal convulsions, was measured in the rats that had been exposed perinatally to either < 1 nT, 1-2 nT, 5 nT, 10-12 nT, 50 nT, 500 nT variations of these fields. She found a conspicuous almost maximum mortality only in the rats that had been exposed to the 5 nT variations. The fact that the mortality of those exposed to the 1-2 nT and 10-20 nT fields did not differ from either no field or the 50 nT and 500 nT exposures reflects the precision of the effect. Such precision often indicates tuning and resonance.

The precision and "narrow band" enhancement of weak magnetic field effects upon the human brain were shown experimentally by Persinger and Saroka [18]. In order to test the potential convergence and amplification of energy within the cerebral volume from fluctuations in the Gravitational Constant and experimentally generated, transcerebral, physiologically-patterned magnetic fields they applied discrete increments of intensities between 1 and 7000 nT. Quantitative electroencephalography (QEEG) and sLORETA (Low Resolution Electromagnetic Tomography) were measured. They found a marked enhancement of power within the 4 Hz to 20 Hz band within the right caudal hemisphere within the region of the cuneus when the applied intensities were within the 5 nT to 20 nT range. This effect was not discernable for the intensities below or above this increment.

THE PHYSICAL CORRELATES OF ~5 nT FLUCTUATIONS

The potential universal significance of this range of magnetic field intensity was first revealed by Vladimirskii [19]. He found that a small range in the variation (-8 to +8 nT) in interplanetary magnetic field strengths around the earth was associated with fluctuations of Newton's G which ranged from 6.6725 to $6.6756\cdot10^{-11}$ $kg^3\cdot m^{-1}\cdot s^{-2}$; this is equivalent to a perturbation of $\sim3.1\cdot10^{-3}$. Later Persinger and St-Pierre [20] employed data from Quinn et al [21] and showed that a change of 3 to 4 nT in aa (average antipodal) global geomagnetic activity was associated with this range in variation in G. Persinger and St-Pierre calculated the gravitational energy within the human cerebral volume, derived from:

$$J = G\cdot kg^2\cdot l \qquad (1)$$

where kg was the average mass of the adult human brain and l was its length. The solution was $3\cdot10^{-14}$ J. This is the same order of magnitude and coefficient of energy from magnetic flux lines from the critical intensities within the cerebral volume according to:

$$J = (B^2\cdot 2\mu^{-1})\cdot m^3 \qquad (2),$$

where B is the strength of the field, μ is the magnetic permeability constant ($4\pi\cdot10^{-7}$ $N\cdot A^{-2}$) and m^3 is the volume. For the human brain with an approximate volume of $1.3\cdot10^{-3}$ m^3 the energy associated with fluctuations in the order of 3-5 nT would be between ~0.9 and $8.2\cdot10^{-14}$ J. Depending upon the coefficient (1 to 3) for 10^8 $m\cdot s^{-1}$ for the velocity of light this quantity may exhibit the mass equivalence of an electron.

This magnitude of small changes in local magnetic field strength is also associated with shifts in the photon flux densities emitted from human brains. Dotta et al [22] had shown that when people engaged in imagery while sitting in very dark rooms there were increases in photon emissions from the right (but not the left) hemisphere that were clearly detectable at ~15 cm. The magnitude was in the order of 10^{-12} $W\cdot m^{-2}$ and was strongly correlated with fast beta activity over the left prefrontal region. Within the context of modern neuroscience this coupling is consistent with effect of 'intention' upon imagery and the emissions of ultraweak biophotons from the brain. Other experimenters [23] have found that the theta (4 to 7 Hz) activity from slices of hippocampal tissue (the "gateway" to memory) were phase locked with photon emissions within the same order of magnitude.

The cerebral photon emissions were inversely related to shifts in the static intensity of the magnetic fields (i.e., the local geomagnetic field) that surrounded the human brain and within which it is immersed. Hunter et al [24] found that when one particularly gifted subject, Sean Harribance, generated increased photons from the right hemisphere during intense imaging there was a corresponding decrease in the intensity of the local geomagnetic field along the right side but not the left side of his head. Calculations indicated energy conservation; the quantity of energy from the decreased magnetic field within the sphere surrounding his head was equal to the energy estimated to be associated with the increased photon emissions. This experimental result complimented the brilliant insights of Bokkon

[25] who first conceptualized that dreams and visual imagery were not the subjective equivalents of patterns of action potentials but the occurrence of photonic fields within the cerebral volume. From this perspective the presence of a disproportionally large population of corpus callosal fibers between 0.4 and 0.8 μm (400 to 800 nm, the visible wavelength) might be the structural substrate through which interhemispheric photon communication might occur [26].

More detailed analyses of a second subject [27] verified that an increase in photon emissions ($\sim 10^{-11}$ to 10^{-12} $W \cdot m^{-2}$) from the right side of the head was associated with a diminishment of about 5 to 7 nT of the earth's magnetic field at a distance of ~15 cm. Spectral analyses indicated the source of the cerebral activity was primarily from the right parahippocampal region which shared phase modulations with the photon emissions and was equivalent to about 20 ms increments and is similar to the latency to include a base nucleotide within a expanding DNA molecule. This is the duration of repetition of transcerebral electromagnetic fields associated with consciousness and dreams [28]. The "beat" frequency in the spectral power densities of the photon emissions during episodes of imagining light in this study [27] was about 6 Hz. The sensitivity of the right hemisphere, specifically within the regions of the temporal lobe and parahippocampal gyrus, to weak, non-ionizing fluctuations of magnetic fields at the appropriate frequencies has been shown by many researchers [e.g., 29]. The concomitant subjective experiences are typically attributed to the left side of the body.

This powerful inverse relationship between weak magnetic fields and photon flux density was also demonstrated experimentally for cell cultures by Persinger et al [30]. They monitored the fluctuations in the static geomagnetic field over plates of melanoma cells while photons were also being measured. Over the time (a few min) of the experiments there was a conspicuous inverse correlation between the shift in the intensity of the field (1 to 15 nT) and photon numbers. Calculations indicated that for every 1 nT decrease in the ambient geomagnetic field there was an increase in 10^{-12} $W \cdot m^{-2}$ of photon emissions in the same area. Within a volume of 0.2 cc (the estimated volume of about 10 million cells and their interstitial distances), a 1 nT decrease would have been associated with an increase of 10^{-19} J which is the range of visible light. Together these data strongly suggest that small shifts in the order of 1 nT magnetic fields are coupled to photon emissions and both share a common source of variance.

More detailed calculations from the results of the enhanced power and current density (as inferred by LORETA quantification) within the cuneus regions of the right hemisphere for transcerebral intensities between 5 and 20 nT but not lower or higher values [18] supported the potential connection with photon flux density. To obtain the mass/charge ratio the value for a hydronium molecule or H_3O^+ ($3.5 \cdot 10^{-26}$ kg) was divided by the unit charge ($1.6 \cdot 10^{-19}$ $A \cdot s$) to obtain $1.97 \cdot 10^{-7}$ $kg \cdot A^{-1} \cdot s^{-1}$. When this value was divided by intensities between 2 and 4 nT ($kg \cdot A^{-1} \cdot s^{-2}$), the resulting frequency was within the range of the free oscillations of the earth [31-32]. The product of the average mass of the human cerebrum, the median amplitudes ($0.5 \cdot 10^{-11}$ $m \cdot s^{-2}$, about a nanoGal) of the fundamental spheroid modes of the earth-atmospheric interface and 25 mHz is $2.3 \cdot 10^{-13}$ $kg \cdot m \cdot s^{-3}$. When divided by the average length of the cerebrum (~0.1 m), the resulting flux density ($kg \cdot s^{-3}$, or Watts per meter squared) is $\sim 2 \cdot 10^{-12}$ $W \cdot m^{-2}$.

THE HU-WU DIPOLE-DIPOLE (J) COUPLING COMPONENT

The intricate relationship between nanoTesla magnetic fields and picoWatt per meter photon flux densities was predicted by Hu and Wu's [33] prescient interdisciplinary hypothesis that nuclear spin networks in neural membranes are associated with relatively robust fluctuating internal magnetic fields. They are modulated by action potentials through indirect dipole-to-dipole coupling. The process is considered an indirect scalar interaction between two nuclear spins which emerges from the discrete intercalation between local electrons and their associated nuclei. The intercalation has the potential to be mediated through delocalized electrons.

Because the energy associated with neuronal action potentials is the product of the net change in voltage (about 120 mV) and the unit charge ($1.6 \cdot 10^{-19}$ A·s), or $\sim 2 \cdot 10^{-20}$ J [34], the incremental energies are quite small. In fact they are almost identical to the second shell energies associated with the movement of a proton through the processes of the hydronium ion which is the primary physical bases for pH [35]. In addition it is not unusual for dipole-to-dipole coupling between protons to range between 5 Hz and 25 Hz which overlaps with the primary power density of cerebral activity as well as the amplitude fluctuations of photon flux densities from non-neural cells when exposed to weak (microTesla) magnetic fields [36].

The magnetic dipole strength between magnetic moments associated with spin can be described by:

$$B = (\mu_0 m) \cdot (4\pi r^3)^{-1} \qquad (3),$$

where μ_0 is the magnetic permeability ($1.26 \cdot 10^{-6}$ N·A^{-2}), m is the magnetic moment and r is the distance between the dipoles. The nuclear (proton) magneton displays a magnetic moment of $1.4 \cdot 10^{-26}$ A·m^{-2}. Across the cell's plasma membrane of 10 nm, the internal magnetic field strengths would be ~3 n T. This convergence between nT strength magnetic fields within the biological framework, the emission of 10^{-12} W·m^{-2} of photons, and the coupling to 10^{-20} J units of energy from action potentials of neurons reiterates some intrinsic relationship between these three values. The quantity is also the solution for the energy associated with the electric forces between the adjacent, single layer of potassium ions (each separated by ~10 to 11 nm), that is considered the primary source of the resting membrane potential of cells [34].

There is a relationship between 10^{-12} W·m^{-2} and 10^{-20} J that might reveal its universal prevalence [37]. To reiterate, this particularly flux density was considered because this is the median value emitted by all living systems [38]. This particular quantity of energy [34] emerges: a) when the force between two potassium ions is applied over that distance, b) as the increment associated with the neuronal action potential, c) with the second shell values for hydrogen in water, d) as the range associated with the sequestering energies for nucleotides or ligands-to-receptors, e) as the weaker bond (e.g., van der Wall forces) values, and, f) (most importantly) as the value contained with the fundamental physical properties of water [39]. When the magnetic moment of a proton ($1.4 \cdot 10^{-26}$ A·m^2) is divided by the unit charge ($1.6 \cdot 10^{-19}$ A·s) a diffusivity term of $0.88 \cdot 10^{-7}$ m^2·s^{-1} is obtained. Multiplied by the average viscosity of cellular water $6.3 \cdot 10^{-3}$ Pa·s, the resulting force is $7.87 \cdot 10^{-11}$ kg·m·s^{-2}. Applied between the distance of two O-H bonds in water ($1.92 \cdot 10^{-10}$ m) the intrinsic energy is 10^{-20} J.

The relationship between photon flux density and energy per unit time is optimally described by the aggregate of units:

$$kg \cdot s^3 = [(kg \cdot m^2 \cdot s^{-3}) \cdot (s \cdot m^{-2}) \cdot s^{-1}] \quad (4).$$

As aggregates this means: Watts per meter squared is equal to the product of energy per second, an inverse of a diffusivity term, and frequency. The most rational and universal values to obtain the diffusivity term were resistivity and magnetic permeability. Wave impedance (376.73 Ω) multiplied by the hydrogen line wavelength (21.16 cm) is $7.79 \cdot 10^1$ Ω·m. When divided by the magnetic permeability of a vacuum ($1.26 \cdot 10^{-6}$ $N \cdot A^{-2}$) the diffusivity is $6.33 \cdot 10^7$ $m^2 \cdot s^{-1}$ the inverse for which is $0.16 \cdot 10^{-7}$ $s \cdot m^{-2}$. The most parsimonious frequency would be the time for an electron to complete one orbit. The completion of one orbit, a closed loop, defines the properties of matter such the magnetic moment of the electron and the fundamental transformation unit of energy: Planck's constant. One representative value, the Bohr increment, is $6.59 \cdot 10^{15}$ s^{-1}. The product of $1.5 \cdot 10^{-20}$ J per s, the inverse diffusivity and the Bohr frequency is $1.6 \cdot 10^{-12}$ $W \cdot m^{-2}$. This is within the range of the radiant flux density of ultraweak, biophotons from cell membranes, bacteria, and the chemical reactions associated with signaling pathways [38, 40-41].

COSIC'S RESONANCE RECOGNITION MOLECULAR CONCEPT

The determination of the interface and quantitative transformation between energy and matter, the quintessential construct of duality, has been a primary goal of Natural Philosophy and Science. Irena Cosic's Resonant Recognition Model (RRM) that was published more than 20 years ago [42], reflects the perspicacious application of integrated knowledge and the type of insight and innovation that often defines the discoveries that shift scientific paradigms.

Assuming "structure dictates function" and implicitly that for every unit of matter there must be an energetic wave (a type of aggregate of de Broglie's matter-waves) Cosic quantified each component (the amino acids) of proteins with pseudopotential values. In her system each of the 20 amino acids are represented by the value of the electron-ion interaction potential. A similar process was applied to the nucleotides that compose RNA and DNA. Because the biologically active proteins, for example, can be composed of hundreds to thousands of amino acids the serial configurations are too complex for easy discernment of patterns by casual human perception. However when spectral analyses were applied to these spatial sequences spectral power densities (SPD) emerged that could describe every protein and every combination of DNA and RNA [43]. The extraordinary potential information within these configurations, analogous to that of a "voice print" when sonic patterns were spectral analyzed, offered an alternative approach to understanding the physical bases of molecular interactions in both living and non-living systems.

The RRM revealed that specific periodicities within the distributions of de-localized electrons along a protein molecule were critical for the biological functions of proteins. This was particularly evident for interactions between sequences of molecules that constitute the "signaling pathways" that currently define modern biomolecular sciences. The recruitment of "delocalized" electrons into the model was fundamental. For example the movement of π electrons, when not restricted to the space between two neighboring atoms such that an electron cloud cannot be assigned to one bond between a given pair of electrons [44], creates the condition for an emergent field or state that can be juxtaposed, transposed and superposed over distances that could include non-locality. The velocity of the electron motion was calculated to be < $7.87 \cdot 10^5$ $m \cdot s^{-1}$. The spectral characteristics of these fields when real distances and widths for amino acids (~0.38 nm) and the Cosic constant were combined produced wavelengths that define the visible and para-visible (near UV and near IR) band of light.

As aptly stated by Cosic [42], “a charge moving through the protein backbone could produce electromagnetic radiation or absorption with spectral characteristics corresponding to the energy distribution along the protein”. This “resulting correlation between the amplitude spectrum of numerical representation of genetic sequences and the corresponding biological function” allowed a new approach to protein dynamics. In fact, many of the contradictions of molecular function based upon shared similarities of molecular structure were reconciled within the Cosic system when the Cosic configurations of the disparate molecules were employed rather than their traditional spatial (molecular) organization.

The validity of Cosic’s assumptions and model was first demonstrated by Dotta et al [45]. That research group reasoned that if the model was accurate than either increasing or decreasing the activity of specific proteins that composed specific components of the molecular pathways of cells should be associated with complimentary increases in emission of Cosic wavelengths associated with that specific molecule. When different filters that matched these predicted wavelengths (within ± 10 nm bands) were applied over apertures of photomultiplier units, Cosic’s predictions were confirmed. As cultures of melanoma cells removed from incubation and maintained at room temperature proceeded through shifts in wavelengths of primary photon emissions through the near-infrared, visible, and near-ultraviolet band during the subsequent hours, application of specific agonists or antagonists of the associated molecular pathways facilitated or inhibited the predicted Cosic wavelengths.

CONTRIBUTION OF THE PHOTON-MAGNETIC FIELD COMPONENT TO THE COSIC EFFECT

Phase-modulation contains the potential to include maximum information. Within the visible and paravisible wavelengths associated with most Cosic wavelengths for proteins and nucleotide-composed polymers phase-modulations could occur as the energies associated with the differences in the Cosic peaks. There has been potential confirmation of this effect. Karbowski et al [46] who “Cosicized” the JAK-STAT cellular signaling pathway showed that the weighted combinations of resonance standing waves, reflected as a convergence of spectral density profiles, predicted the molecular configurations of the components of the pathway.

The actual wavelengths were 441 nm, 430 nm and 416 nm according to the Cosic formula. The differences between the energies of these wavelengths were between 1.6 and $2.2 \cdot 10^{-20}$ J, which are also within the range of hydrogen bonds. The relevance to the average cell is conspicuous. The standing wavelength of $2 \cdot 10^{-20}$ J with respect to the velocity of light, is 10 μm. This is the median width of mammalian cell. This is also the solution for the wavelength from Wien’s relation with absolute temperature of 310 °K or 37°C (the homeotherm) and for the upper limit of length whose locality can accommodate the Boltzmann’s entropy and the Loschmidt echo across universal time [47].

The importance of this increment of energy was also shown for the more ubiquitous ERK-MAP pathway [48]. When the proteins that composed this pathway were transformed to Cosic's serial pseduopotentials, multiple regressions of the spectral densities for the components that preceded (the precursors) the final molecule showed that the weighted combination of these values were strongly correlated (0.8). This was interpreted to be consistent with a mechanism where the information applied to the membrane was communicated as components of standing waves (resonances) that when combined near the nucleus represented the molecular structures that performed those functions. The differences in energy between the peak visible wavelengths for this pathway ranged between 2.4 and $1.6 \cdot 10^{-20}$ J.

The central involvement of $\sim 10^{-20}$ J in the phase differences in energies between the Cosic solutions may be the integrator between the particulate and wave functions within the cell. It may be the macroscopic manifestation of what occurs during a single orbit of an electron that can exhibit both particle and wave properties [49]. Congruence in time (1 ms) and energy (10^{-20} J) between the neuronal action potential and the values required to stack a "base" on a RNA sequence has been known for decades [50]. The additional convergence with the movement of protons within water allowed the potential for a specific mechanism. The inclusion of 10^{-20} J as the phase modulation from the spectral peaks of visible light, the parallel of the molecular structure, produces the conditions for appropriate combinations of wavelengths to simulate and direct the powerful pathways presently allocated exclusively to the massive metabolic energies associated with molecular signaling.

The intrinsic structure and energy of physiological water as the source for the 10^{-20} J is evident by the quantitative solution for the ratios of proton magnetic moment to its charge, viscosity and the distance between O-H bonds. Del Giudice and Preparta's [51] sagacious calculations have shown that weak magnetic fields can become trapped within the "flickering" clusters of coherent domains of water molecules. Karbowski et al [52] demonstrated conclusively that when time-varying (temporally structured) weak magnetic fields are coupled with specific (LED-generated) wavelengths within the Cosic range photonic energy were maintained within cells for more than an hour after the applications of the fields and light pulses were terminated. The re-emitted light, as shown by flourospectrometry, was the same wavelength that had been applied. The total energy emitted by the photons during this duration before attenuation occurred was equivalent to the strengths of the magnetic fields that had been applied with the light during the previous hour. Murugan et al [53] also demonstrated the capacity for small volumes of spring water exposed to circular (changing angular velocity) magnetic fields to "hold" a specific pH despite successive addition of protons until the potential within the cohesive domains were saturated. At this point there was a "catastrophic" shift (increased acidity) in pH. The latency before this shift occurred was directly related to the intensity of the applied fields.

When physiological water (containing ions) is maintained undisturbed in the dark (defined by 10^{-12} $W \cdot m^{-2}$) the viscosity increases and the vacuoles or coherent domains increase in size [54]. The potential bases for this thixotropy includes the proton [55] as well as the potential conversion of energies that reflect the zero point vacuum fluctuation energies from which virtual particles become real particles [56]. The phenomena are closely related to the differences between interfacial water and bulk water that have been systematically examined by the resourceful Gerald Pollack and his colleagues [57-59]. Interfacial water, which occurs within narrow boundaries along cellular (membrane) surfaces as well as inorganic planes, exhibits enhanced viscosities, intrinsic molecular organization and a potential difference due to creations of narrow bands of protons that are in the order of 100 mV. This is the same order of magnitude as the resting membrane potentials of mammalian cells that are usually attributed to differential concentrations of potassium or chloride across the membrane. It may not be spurious that the Born self energy cost of an ion permeating a pure lipid bilayer for the hydronium ion (H_3O^+) is almost identical to the energy equivalence of an electron moving at the upper limit of the Cosic velocity along a protein backbone. In most stable reactions where parity is present, balance, manifested as some variant of Newton's third law, must be manifested.

Murugan et al [60] exposed spring water to weak, time varying magnetic fields with 3 ms pulse durations for more than two weeks in darkness. The numbers of photons emitted from small aliquots of water were then measured by fluorescent spectrophotometer. They found that a definitive shift (that explained 82% of the variance) within the 410 nm to 465 nm range in the very weak field-exposed water compared to control or higher intensity conditions. The weak field exposed water emitted about 150 counts per unit more than the reference water. The peak for the former was about 409 nm while the peaks in the latter were between 381 to 399 nm.

The difference between the weak intensity and higher intensity fields was ~10 nm and was equivalent to about $1.4 \cdot 10^{-20}$ J. The mixture of ions was critical for the effect to occur. This phenomenon was not observed in double-distilled water. Spectral power densities of the intrinsic fluctuations within the 355 to 465 nm range revealed in intrinsic peak that was equivalent to ~10 nm, the width of cellular membranes. These results suggest that within the darkness of the cell when exposed to appropriate intensity magnetic fields the intrinsic structure of water can provide the energy and substrate for the shift in wavelength of emitted photons that could compliment and augment Cosic's Resonant Recognition in molecules.

The remarkably low intensity and narrow band (3 to 5 nanoTesla) of convergence between geomagnetic activity (or shift in the local geomagnetic field static intensity), the photon flux densities from cells (10^{-12} $W \cdot m^{-2}$), and the quantity of energy (10^{-20} J) associated with molecular interfaces and phase-modulations of peak wavelengths within Cosic configurations for functional proteins may appear contradictory to the usual positive (linear) correlation between increased geomagnetic activity and the perturbations in blood pressure, epileptic displays, and social behaviors that contribute to global health. However most of these biological effects are lagged by 3 or more days after the enhanced geomagnetic activity. There are two potential explanations. First, the enhanced geomagnetic activity generates interference patterns within the narrow-band connections (of 10^{-12} $W \cdot m^{-2}$, 10^{-20} J. and 2 to 5 nT) which subsequently contribute to the health anomalies. Second, the health anomalies, initiated by the information within the enhanced geomagnetic activity, are delayed until it is "consolidated" once the ambient values attenuated to within the effective band.

THE POTENTIAL FOR ENTANGLEMENT OF PHOTONS

The intercalation between the critical band of magnetic intensity and photons that are presumed to mediate the primary Cosic effect is particularly compelling when a single photon is assumed to have an upper rest mass > 0. According to Tu et al [61] "A non-zero rest mass of the photon as described by the Proca equations would result in a third polarization state in which the vector of the electric field points along the line of motion". The particle is called a 'longitudinal photon". If this construct is a variant manifestation of the electron that displays both its particle and wave properties, then one parsimonious geometry would be a cylinder with the classical radius ($2.8 \cdot 10^{-15}$ m) of an electron and a longitudinal axis equivalent to the Compton wavelength of an electron ($2.4 \cdot 10^{-12}$ m). The resulting volume is $\sim 5.9 \cdot 10^{-41}$ m^3.

The energy (equation 2) associated with the applied magnetic field strength of 3 nT ($9 \cdot 10^{-18}$ T^2) within this volume is $\sim 2 \cdot 10^{-52}$ J. This quantity may not be coincidence. It is the energy associated with the upper boundary of the rest mass of a photon ($\sim 2 \cdot 10^{-52}$ kg, [61]) when c (the velocity of light in a vacuum) approaches unity. The continuance of this quantity might be inferred by dividing into Planck's constant ($6.67 \cdot 10^{-34}$ J·s). The resulting duration is $\sim 10^{18}$ s which is the estimated latency before the final epoch of the universe is approached [62]. Although considerations of large-scale space and time are often not considered in contemporary concepts of biological systems and their interactions with photonic fields, the reflections of universal properties within the matter that compose biological systems would not be unexpected.

If the importance of ~3 nT is prevalent and ubiquitous the quantity within biological and non-biological space should be related to variables associated with excess correlation (entanglement) and fundamental properties of the electron. Persinger and Koren [63], in the pursuit of understanding large-scale structures of the universe, related the product of the four spatial and temporal features of a symmetrical closed boundary (a circle) to the four fundamental properties of the universal set: G (gravity), M(mass), D(diameter) and T (duration). The product of the circumference, area, volume and 2πrf (the representation of the fourth dimension: time), which was $21.3\pi^4$ m^7 s^{-1}, when set equal to typical values for G, and the mass, diameter and final age of the universe, resulted in a diffusivity term that was $\sim 2.4 \cdot 10^{23}$ $m \cdot s^{-1}$.

For convenience this value was designated as ψ, the lower case value of Schrodinger's wave indicator. This diffusivity term was the same order of magnitude when the ratio of the total energy of the universe expressed as V m^{-1} and magnetic field strength was calculated. The order of magnitude is same as the "jiffy" velocity, often employed in quantum considerations, which is the time required for light at c to traverse the width of the classic electron divided into the most ubiquitous distance (λ) in the universe: the 21 cm hydrogen wavelength. The consideration of an "entanglement velocity" can accommodate the anomalous excess correlations between solar activity and aqueous solutions involving the 10^{-12} s life time of the hydronium ion as well as the shifting ("dragging") inertial frames ($\sim 10^{-16}$ s) now measured in orbiting satellites [64]. However it also represents the photon as a hybrid process such that the product of $2 \cdot 10^{-52}$ kg, the velocity of light ($3 \cdot 10^8$ $m \cdot s^{-1}$) and the excess correlation velocity ($2.4 \cdot 10^{23}$ $m \cdot s^{-1}$) is $\sim 1.4 \cdot 10^{-20}$ J. This is within the range of the hydrogen bond energies, proton mobility in water, and the phase shifts in complex Cosic light emissions.

The product of 3 nT, the electric dipole potential of an electron according to the most recent measurements of $8.7 \cdot 10^{-31}$ A·s·m [65] and the excess correlation velocity ψ ($2.4 \cdot 10^{23}$ $m \cdot s^{-1}$) is $3.2 \cdot 10^{-10}$ m. For comparison the circumference of the orbit for the Bohr magneton is $3.3 \cdot 10^{-10}$ m. If the convergence was exact, considering the estimates of the universal values from which ψ was obtained, then the critical magnetic field intensity, the property of all electrons with intrinsic spin and a factor that integrates all electrons result in a distance which is one orbit. The completion of one orbit of an electron determines the properties of matter such as the magnetic moment of the electron and the fundamental value of Planck's constant.

The completion of single orbits is coupled to the emissions or absorptions of photon quanta across the various electronic shells.

Considering the convergence between gravitational energy (equation 1) and magnetic energy (equation 2) within a volume that overlaps with the human cerebrum, the potential for excess correlation might be expected. In fact Rouleau and Persinger [66] demonstrated experimentally that the shift of 1 to 5 nT in the east-west direction of the earth's magnetic field due to the activation of toroids during the experimental demonstration of excess correlation between the inverse-coupled alterations in pH within two volumes of water separated by non-traditional distances required this magnitude. They calculated that assuming the earth's mass to be $5.98 \cdot 10^{24}$ kg and its rotational velocity within the range of their experiments to be $4.63 \cdot 10^{2}$ $m \cdot s^{-1}$, the total energy for the system would be $1.27 \cdot 10^{30}$ J. When applied to the area of the classic electron ($6.15 \cdot 10^{-36}$ m^2) the average energy would be $1.5 \cdot 10^{-14}$ J per electron. This is within experimental range of error for the energy equivalent for the rest mass of an electron. It is also the solution for energy within the human cerebrum from magnetic field fluctuations of ~3 nT and from the gravitational energy associated with the fluctuation of G.

Rouleau and Persinger's demonstration of "excess correlation" occurred during a specific time when the changing angular velocities of frequency (or phase) modulated magnetic fields were being applied to the two volume of spring water. Injecting small aliquots [67] of protons into the volume (producing increased acidity) was associated with a small increase in alkalinity in the other volume of water even though no injections were made. The effect was evident at 1 m, 100 m and 10 km. Comparable demonstrations of excess correlations were shown by Dotta et al employing other types of equipment [68]. Dotta and Persinger [64] demonstrated excess correlations between photochemical reactions that occurred simultaneously within two non-traditional loci separated by either 10 m or 3 km. The photon emissions were produced by injecting small, fixed quantities of hydrogen peroxide into a hypochlorite solution. The doubling of the photon emissions behaved as if the two loci had been juxtaposed and superposed, that is, they were the same space. This experimental manifestation of the classic "Schrödinger's cat" appearing two places simultaneously as if they two spaces were juxtaposed has been shown recently within more precise physical systems [70].

The direct connections between photon emissions, which are considered the most optimal units to engage in entanglement, and changes in nanoTesla magnetic fields, were shown experimentally by Dotta et al [36]. A similar precision of narrow-band intensity, which is reminiscent of resonance phenomena, was shown for entanglement for parity shifts in pH between two volumes of water one of which was injected with small aliquots of protons [71]. The effect was only demonstrated if both areas containing the volumes of spring water shared changing angular velocity, circular magnetic fields. Dotta et al [36] assumed that the cell displayed a "membrane magnetic moment" (analogous to the electron's magnetic moment) because of the lateral diffusion of proteins within this fluid, liquid crystal matrix. If this calculation was valid then the application of a weak, appropriate intensity magnetic field to the "membrane magnetic moment" ($A \cdot m^{-2}$, $J \cdot T^{-1}$) would produce a discrete amount of energy whose equivalent frequency (wavelength) was within the visible range. Direct measurement with photomultiplier units verified the prediction.

The production of Cosic configurations of spectral densities of light would also be capable of excess correlations and non-local effects because of the involvement of photons. Our experimental paradigm whereby excess correlations were created between two spaces separated by non-traditional distances that shared circularly rotating, changing angular velocity magnetic fields may have multiple natural equivalents. Each of these could produce the non-local effects that define “entanglement”. There are three levels at which this could occur. The first is between the circular movements of constituents (lateral diffusion) that occur in both the plasma membrane of the cell and the membrane of the nucleus within the cell. Essentially there are only three processes that define cellular activity: the boundary of the cell (its membrane), the boundary of the nucleus (its membrane), and the interface between the two (molecular signaling pathways). If the rotating electromagnetic fields within the plasma and nuclear membranes were the “two loci” then the molecular signaling would be a local material (particulate) representation of the process of the excess correlation mediated by photons and the Cosic configurations.

The second level would occur between cells. If each cell displays its own rotating magnetic field at its boundary, then any condition that produces the specific timing that facilitates excess correlation would encourage non-local effects. The information of these non-local effects would be the spectral density resonances of the photon wavelengths predicted by the Cosic formula. Unlike chemical mediation, the information transformed through the excess correlation would not be limited by diffusivity, the medium, or the concentration of the reaction and would display the properties of non-locality. However the manifestation of the excess correlation within each cell would be reflected as local molecular phenomena whose dynamics and directions would be determined by cause-effect. The energy associated with these extensive, molecular-based processes (that define the signaling pathways) would be derived from the matter within the cell. The excess correlations mediated by the photonic patterns of the Cosic configurations would initiate or influence the bifurcations points within the pathways.

That cells stimulated in culture by powerful compounds emit photons has been shown experimentally. Injections of physiological concentrations of morphine (but not saline) into melanoma cells generated spikes of photon flux densities that were between 10 to 100 times greater than baseline values [72]. Non-locality indicates cells with shared rotational fields could interact through Cosic configurations at any distance without involving traditional methods of connection such as vascularity or lymphatic portals. Consequently physical mechanisms with nearly unlimited permeability such as tuned, temporally patterned magnetic fields coupled to specific photon wavelengths could be employed to generate information anywhere within the volume of the body [52]. Several researchers such as Trushin [73] and Fels [74] have developed parallel concepts that crucial and determinant information controlling the behavior of cells and bacteria is mediated through photon emissions.

The third level would occur between organisms such as human beings or between human beings and the environment. The dynamics of the human cerebrum is implicitly closed [28]. The electromagnetic processes that are associated with consciousness involve reiterative rostral-to-caudal, large scale intercorrelated cortical cerebral fields [28, 75]. They are regenerated every approximately 20 to 25 ms (40 Hz). The completion of the closed path, which can be described mathematically as the topological equivalent of a circle, is mediated through the medial components of the cerebrum. It includes most of the structures that define the default mode network for subjective experiences [76]. The spectral densities and amplitude fluctuations associated with this correlate of consciousness is reflected in the SPD of the photons emitted from the cerebrum during ideation [27]. If these aggregates reflect Cosic patterns then excess correlations between different individuals through non-local processes would occur during optimal conditions. A similar conclusion, based upon different models and assumptions, has been imaginatively articulated by Pitkanen [77].

CONCLUSIONS

Global health reflects the interactive consequences of large aggregates of human beings as well as other species that contribute to the dynamics. The current models of disease and contagion emphasize the predominantly metabolic energies mediated through signaling pathways and kinetics within and between cells. These processes are determined by molecular (spatial) structure and the particulate properties of matter. The creation by Irena Cosic of the Resonant Recognition Model and its experimental verification indicates there are electromagnetic equivalents to molecular interactions that emerge as spectral power densities (temporal patterns) within the visible and near-visible wavelengths. The RRM may be one solution to the matter-wave dichotomy. Experimental and correlational data indicate that the functions of proteins and nucleic acid sequences in the human body predicted by Cosic's model involve interactions between photon flux densities of $\sim 10^{-12}$ $W \cdot m^{-2}$, discrete energies of $\sim 10^{-20}$ J, and magnetic variations within the 1 to 10 nT range which occur prominently within the human body and the environment. The primary role of light (photons) creates the conditions for potential non-local effects and excess correlations that might affect local deterministic chemical reactions. Even its low probability manifestation would change interpretations and perspectives for global public health.

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CONFLICTS OF INTEREST

The author declares that he has no conflict of interest.

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