Temporal Patterns of Photon Emissions Can Be Stored and Retrieved Several Days Later From the "Same Space": Experimental and Quantitative Evidence

Michael A. Persinger and Blake T. Dotta

Abstract

Photomultiplier tube measurements during simultaneous productions of nonlocal+ local photon emissions showed conspicuous doubling of the durations of the photon spikes from hydrogen peroxide-hypochlorite reactions if both loci were exposed to the same configurations of changing angular velocities of circular magnetic fields. Different experimentally manipulated temporal patterns of the photon emissions were evident as "spontaneous" spikes within 3 to 5 days after the actual injections when the same magnetic field configuration was present but no injections occurred. These results suggest that temporal patterns of entangled photon emissions were "stored" within space-time and could be retrieved long after the events had been generated.

Key Words: entanglement, photon emissions, information storage, retrieval, space-time

NeuroQuantology 2011; 4: 605-613

Introduction

The operation of non-locality (Stapp, 2009) is assumed if there is excess correlation of events between two spatial loci without the involvement of a classic mediating factor such as a propagating force or field (Dotta *et al.,* 2009; Persinger *et al.,* 2008a, b). Excess correlation, or entanglement (Arnesen *et al.,* 2001), may be directly involved with quantum information processing or representation. Information storage and retrieval through the manipulation of differences in quantum phase of two levels of the superposition (Aczel, 2002) that define entanglement has been reported (Ahn *et al.,* 2000).

One interpretation of Minkowski space-time, or the classic relationship $\sqrt{(x^2+y^2+z^2-c^2t^2)}$ where x, y, and z represent the three space dimensions and c and t reflect the velocity of light and the inverse of frequency, respectively, is that information that was present in a space is still present long after the stimulus event has ceased in local time and could be retrieved. Space and time, which have been assumed to converge at spatial resolutions in the order of 10^{-18} m and below the resolution of protons and electrons (10^{-15} m), is assumed to be real and applicable to any exact formulation of quantum mechanics (El Naschie, 2004). Whether or not one employs the mathematical construction of Hilbert space or Minkowski space, information from a

Corresponding author: Dr. M. A. Persinger
Address: Biomolecular Sciences and Behavioural Neuroscience Programs, Laurentian University, Sudbury, Ontario, Canada P3E 3C6.
e-mail: mpersinger@laurentian.ca
Thanks to Dr. W. E Bosarge, Jr, Chairman, Quantlab LLC for financial support.
Received Sept 13, 2011. Revised Oct 11, 2011.
Accepted Dec 12, 2011.

previous time should still be accessible within that locus. Stated alternatively space, itself, could have a representation of events, that is, memories.

In some forms of spatiotemporal communication with synchronized chaotic carrier waveforms in optic systems, the digital information (the message) to be encoded determines the output of the nonlinear transmitter. As a result the information and carrier become integrated in a nontrivial process (Garcia-Ojalvo and Roy, 2001). This output when re-integrated with the locus of the transmitter's convergence (the receiver) allows for recovery of the original signal when both the transmitter and receiver are synchronized. The process described by Garcia-Ojalvo and Roy involved two optical ring cavities coupled by a light beam extracted from one ring (the transmitter) and "injected" into the other.

During experiments with nonlocal+local (simultaneous) generation of singlet molecular oxygen and chemiluminescent reactions from injections of hydrogen peroxide into separate solutions of liquid hypochlorite housed in two locations (Dotta and Persinger, 2012) we found a reliable widening of the photon spike compared to a single local injection if both locations shared the same angularly accelerating and decelerating magnetic fields that rotated within a circular array of solenoids (see Figure 1).

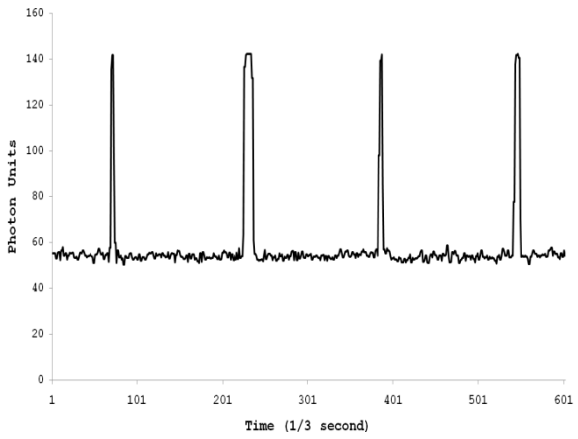

Figure 1. Photon spikes generated by local injections of hydrogen peroxide or the widening ("doubling") of the spike when non-local+local injections occurred simultaneously when both locations shared the same changing angular velocity circular magnetic fields.

Although this excess correlation between the photon emissions from two loci immersed in changing angular velocity magnetic fields within two circular arrays of solenoids was robust (equivalent to correlations of between 0.7 and 0.8) and qualitatively conspicuous, we found that during subsequent days, even *before* injections of H_2O_2, photon spikes with comparable energies "spontaneously" appeared. Here we present perhaps the first evidence that *temporal patterns* of photon emissions are stored, as inferred by their retrieval, in the space within which they had been generated for at least three to five days.

Our standard operating procedure to produce entanglement was derived from a series of systematic experiments with human subjects (Persinger *et al.,* 2010) and melanoma cells (Dotta *et al.,* 2011a) that we have examined over the last ten years. The metaphoric assumption is that if two loci of chemical reactions, which could be human brains or collections of cells in culture, share the same complex magnetic fields in two different loci with intensities of about 1 μT being generated within circular arrays of solenoids at varying angular velocities but containing phase-shifting components, the conditions are satisfied to produce the same space. In other words the two loci separated by distance become the same space. The concept is congruent with Sheldrake's (2009) morphogenic field theory.

Although stimulation of the brains of human subjects or cell cultures (Persinger *et al.,* 2010; Dotta *et al.,* 2011a, b) in one locus with light flashes resulted in the increase of photons emissions (as measured by a photomultiplier tube, PMT) from the brains of other human subjects or other cell cultures in the dark quite reliably, a chemical reaction that did not involve complex contributions from other processes was considered more optimal. We found that serial injections of 0.1 cc from a 1 cc syringe of hydrogen peroxide through 1 m of intramedic tubing into a dish of 6 cc of liquid sodium hypochlorite positioned directly over the aperture of a photomultiplier tube (both covered with several layers of cloth within a dark room) produced a clear and conspicuous spike in photon emission.

Methods and Results

Our standard protocol (Dotta and Persinger, 2012), once the dual magnetic fields had been initiated, was to inject 0.1 cc into the dish over the PMT (local injection) every odd minute and 0.1 cc into the dish over the PMT and 0.1 cc into the dish in the other room simultaneously (nonlocal+local) every even minute for about 18 min.

When both experimenters each simultaneously injected 0.1 cc of hydrogen peroxide into two separate dishes, one over the PMT (local) and one in a Faraday cage-acoustic chamber 10 m away (nonlocal, the duration of the photon spike doubled (Figure 1) as if twice as much peroxide had been injected in the local dish. This was verified by actually injecting locally into the dish over the PMT 0.2 cc of hydrogen peroxide. This widening did not occur if the two experimenters did not inject the reactant *simultaneously*. It also did not occur unless a very specific series of angular accelerations were presented.

The very specific exposure order was required to produce this "doubling" of the photon emission. Both dishes were exposed optimally for 6 minutes to a rotating magnetic field with an angular acceleration containing a decreasing phase modulating pattern (or a "decreasing phase velocity") during which time the duration of the photon spikes for the local and the nonlocal+local injections did not differ significantly, i.e., no excess correlation. However when both dishes were then exposed for and additional 12 to 14 minutes to a rotating magnetic field with decreasing angular acceleration but increasing phase-modulated field pattern ("increasing phase velocity"), the double photon effect emerged conspicuously. The duration of the widening of the photon emission after the initiation of the second field configuration was about 8 minutes after which the phenomenon ceased and any further nonlocal+local injections produced durations of photon emissions that did not differ from local single injections.

To be consistent with potential applications to the implications of the photon not being massless (Tu *et al.,* 2005), we designated the movement of the field around the circular array as the group velocity and the display of the complex pattern being carried by that sequence as the phase velocity. For the experiments presented here the accelerating group velocity was created by removing 2 msec from the generation of the magnetic pattern (counterclockwise direction from the top) at each of the 8 successive solenoids that comprised the circular array from an initial duration at solenoid 1 of 20 msec (Persinger *et al.,* 2008b).

Consequently the durations of the field at each successive solenoid changed from 20 ms to 6 ms (8th solenoid) before it shifted back to 20 ms (1st solenoid), continuously. The field pattern contained within this rotation had a "phase velocity" that was created by a decreasing frequency-modulated field (Figure 2A) that was generated by computer software from a series of numbers between 0 and 256 (transformed to -5 V to +5 V). The duration of each number (and hence voltage) was 1 ms.

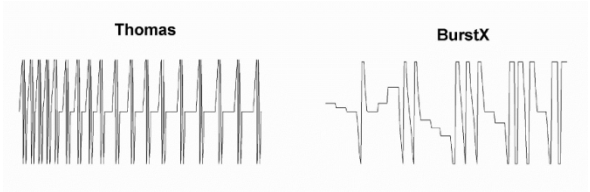

Figure 2. The two temporal patterns that composed the changing "phase velocity" fields that were rotated within the circular array of solenoids within which the chemiluminescence reactions were stimulated. The pattern on the left ("Thomas") is a decreasing phase velocity while the pattern on the right ("BurstX") is an accelerating phase velocity. The labels refer to names employed in various publications and their selection was based upon efficacy from previous research.

The decelerating group velocity field, which began after the 6 min of the accelerating group velocity field, started with the same duration of field generation at the first solenoid but then 2 ms was added (i.e., 20 ms to 34 ms) from each successive site around the circular array; the field being phase modulated was an increasing frequency modulated field (Figure 2B). These particular wave patterns were also selected because of their efficacy for altering affective experiences for human subjects (Richards *et al.,* 1993) and noiceptive thresholds in rodents (Martin *et al.,* 2004).

Each experiment involved 8 single (local) injections of 0.1 cc of reactant and 8

double (nonlocal+local) injections of 0.1 cc. The injections occurred once per minute with the single injections every odd minute and the double injection every even minute. After about a half dozen of these experiments over the same numbers of days (each experiment with fresh solutions) we decided to create the same conditions with fresh solutions and the first component of the magnetic field activated but to *not* inject anything in order to exam any background fluctuations in photon emission.

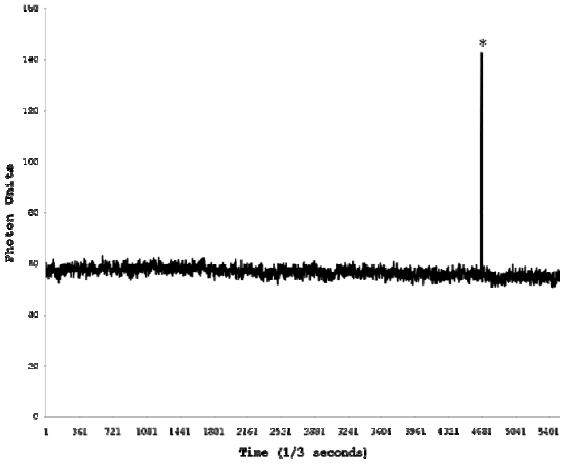

Figure 3. The typical background photon emission (1 unit is ~5 x 10^{-11} W/m^2) recorded by the PMT (vertical axis) as a function of time. The large spike (asterisk) is the photon emission from a local injection of 0.1 cc.

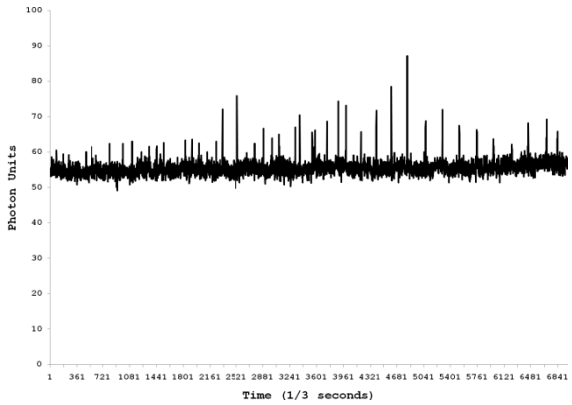

Figure 4. The occurrence of spontaneous spikes of photon emission on a day when no injections occurred although multiple photon spikes had been evoked the previous days.

Instead of the expected (Figure 3) background of photon emission (about 5 x 10^{-11} W/m^2), there were qualitatively conspicuous photon spikes (Figure 4) with durations between 1.5 and 2.5 s and with similar amplitudes to those produced by actual injection of 0.1 cc of hydrogen peroxide. This dense series of spikes occurred for about 30 min before they began to attenuate. A simple sum of the numbers of spikes and the area under the curves indicated that this could not be due to indirect leaking of the syringe. The total numbers of spikes far exceeded the amount of reactant contained within the 1 cc syringe and tubing.

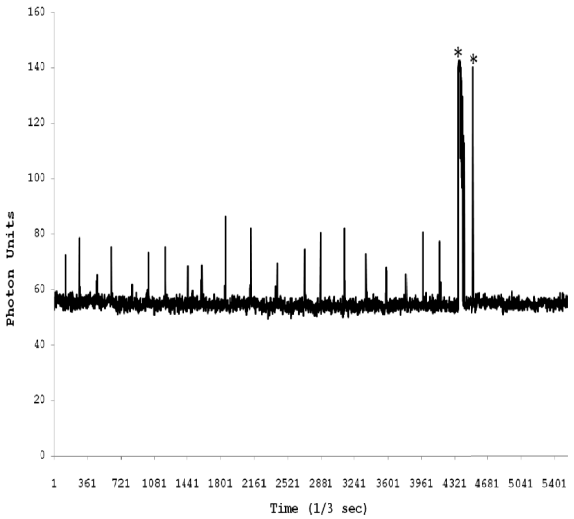

Figure 5. The occurrence of spontaneous spikes every approximately 60 s when there were no actual injections on the day following actual injections in the same space. The asterisks refer to photon emissions from actual injections of hydrogen peroxide.

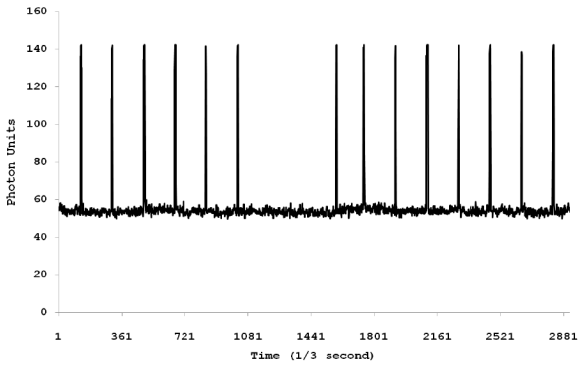

Figure 6. The pattern of spike emissions from actual injections of hydrogen peroxide into the hypochlorite once every 60 s (compare to Figure 5).

We recreated the conditions the following day and ran the PMT; however, there were no spikes. Assuming that the effect was analogous to quantum memory or storage where once the information has been read it is erased, the process was repeated after another two days of testing (about 16 x 2 injections) with injections separated by one min. The experimental conditions were then recreated, including the activation of the

field, but no peroxide was injected. This was called the *retrieval* or "read out" condition. Once again spontaneous spikes were evident for about 20 or 30 min before they dissipated.

As shown in Figure 5, the most conspicuous feature of the spontaneous spikes is that they occurred approximately every 1 min, which was equivalent to the temporal pattern of the actual injections during the previous days. Figure 6 shows the pattern of photon emissions from *actual* injections of reactant every 60 s the previous day. The mean (standard deviation in parentheses) for the interspike period during the retrieval day was 64.1 (9.2) s, which was remarkable similar to the actual one minute intervals on the days of the injections. If these spikes were related to random diffusion from the tubing, one would not expect the fixed periodicity. However one could argue that the 1 min interval was incidentally related to a fixed diffusion rate from the tubing.

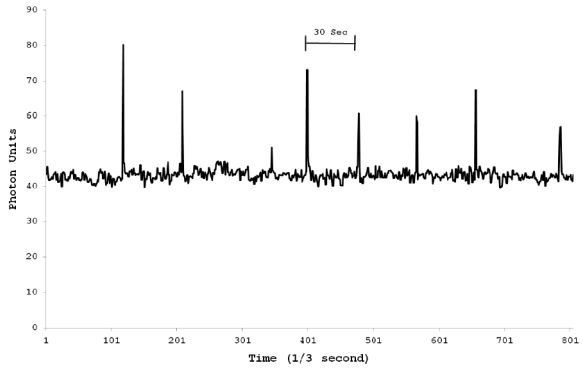

Figure 7. The occurrence of spontaneous photon spikes every approximately 30 s when there were no injections two days after actual injections of hydrogen peroxide in the same space.

To differentiate the two explanations for the spontaneous spikes we completed three experiments where the local and nonlocal+local injections did not occur every minute but every 30 s. The double photon effect was still evident during only the nonlocal+local injections during the usual 9 to 16 minute period of the second component of magnetic field configuration. During the following day when the retrieval procedure was initiated spontaneous spikes emerged once the first field was activated. However the interspike time averaged 30 sec (Figure 7) which was similar to the actual time interval of the original hydrogen peroxide-evoked photon emissions the previous day. The mean (standard deviation in parentheses) for the interspike intervals was 34.5 (7.5) s.

As an additional test, which approached the limits of injection rates and recovery, the local and nonlocal+local injections were completed every 15 s towards the end of the first magnetic field component and the middle of the second field component. In order to maintain the number of injections this meant that the 6 injections during the first phase and 8 to 10 injections of the second phase were clustered within a brief time with no additional injections. The double photon effect was noted during the second phase as expected. The next day when the retrieval procedure was initiated the spontaneous photon spikes occurred with a mean interspike interval of 15.1 (4.1) s.

In some experiments we controlled the duration, i.e., numbers of days, between the injections of the reactant to produce the photon spikes and the time to test the retrieval of the "spontaneous" photonic spike temporal patterns. The most reliable effects for a total of 8 experiments occurred if the duration between the stimulus or input phase and the retrieval or "downloading" phase was less than 3 or 5 days.

In separate experiments (Dotta and Persinger, 2012) we manipulated the parameters of the changing angular velocity circular magnetic fields. All of the other combinations of the components of the standard order of presentation: accelerating angular group velocity with decreasing phase modulation followed by decelerating angular group velocity with increasing phase modulation did not produce the effect. Presentation of either one of these two conditions only did not produce the double photon effect. Presentation of the usual of order of angular group velocities but a fixed phase modulation also did not generate the double photon effect.

Discussion

The results of these experiments suggest that *temporal patterns of photon emissions* can be retrieved from space which has been entangled by a specific temporal sequence of

circularly accelerating and decelerating magnetic fields containing opposite "phase velocities". This is an important observation if photons display the nonzero rest mass, in the order of ~10^{-52} kg, as reported by Tu et al (2005). The consequence of a finite photon mass is the creation of dispersions of light or dissociation between phase and group velocities. Dispersion and interference from different phases are involved with optical holograms (Ahn *et al.,* 2000) where information is stored as phases. Holographic information can be reconstructed when the original conditions associated with the "storage" are recreated in a specific and precise manner.

In the present experiment the re-exposure of the same space to the same configuration of magnetic fields that had produced the entanglement, might be considered analogous to chaotic synchronization between the space-time of the transmitter (the magnetic field on the day of the injections) and the receiver (the magnetic field reactivation on the day of the spontaneous spikes). In Garcia-Ojalvo and Roy's (2001) system based upon nonlinear optical ring cavities (rather than phase-modulating time varying magnetic fields in this study) spatial temporal chaos was a central operator to allow "message" recovery through chaotic synchronization between the transmitter and receiver.

"Where" the information, defined here as fixed temporal patterns of photon emissions, is "stored" may be less important than "when-where" in space-time it is represented and the boundaries of this representation. If we assume the dispersion of light within the visible to GHz range as the relative difference of velocity ($\Delta c/c$) to be in the order of 10^{-7} (Tu *et al.,* 2005) the temporal distortion according the Lorenz classical $\Delta t=t/\sqrt{(1-(v^2/c^2)}$ would be about 10^3 s per 1 reference second. Because the peak of the duration of the double photon effect (Dotta and Persinger, 2011a) was about 5 min (300 s) this means the cumulative duration would be 3.0 x 10^5 s or about 3 days, although the pattern should be discernable (given the 8 min of the "double photon" phenomena) as long as about 5 days. A similar estimation has been suggested by Dotta and Persinger (2009).

If the mass equivalence of ~10^{-43} kg calculated by Tuo *et al.,* (2005) is applied for the visible wavelengths of electromagnetic fields, the energy transform would be ~10^{-26} J. With about 10^{14} photons emitted per 0.1 cc of injected reactant (assuming 1% to 10% quantum efficiency) the summed energy per spike (for a quantum of 10^{-26} J) would be ~10^{-12} J. This is within the same order of magnitude of the energy outputs of our spikes when the duration is integrated with the peak amplitude and the sampling time of the computer is accommodated. Obviously this is not an exact value but a value derived from estimated quantities.

The quantum values of photons emitted during the direct injection of reactant and the spontaneous emission of photons is also with the range expected for the mass of the exotic transfinite particle or solitonic extended particle that exits as a quantum gravity event within Hilbert space (El Naschie, 2004). By applying the gravitational instanton formula for determining the mass equivalent of exotic particles the mass equivalent of the particle was calculated to be ~1.8 MeV or under standard unit conditions about 2.9 x 10^{-13} J. This is within the range of the photon energy generated by the chemical reactions but even closer to the averaged attenuated peaks observed during the "retrieval" process.

There has been a long and rich history in many cultures of re-experiences of "perceptions" of past events as if they were being "replayed". About 10% of phenomena classified as "haunt apparitions" or "retrocognitions" have been compared to a short sequence of a film that is replayed (Persinger, 1974). A single event is brief, in the order of 10s of seconds, but can occur in temporal clusters followed by periods of no occurrences.

In unpublished research many years ago the first author had shown the global geomagnetic activity was remarkably similar on the days that specific "*retrocognitions*" of stereotyped historical events in a particular locality occurred compared to randomly selected days in which no experiences had been reported. The hologram model (Bentov, 1977) suggested that if a distinct pattern of geomagnetic activity had occurred during a physiologically traumatic event (such as

death or crisis) associated with maximum steady potential (d.c.) shifts as well as extreme or "infrequent" electroencephalographic configurations in cerebral activity, interference patterns would be produced. Later reoccurrence of the same or similar pattern of geomagnetic activity could reconstitute the "image" in the same place.

In the classic formation of the holographic image a homogeneous column of light is split and one component (the working beam) passes around a three dimensional object before it reaches the photographic plate or recording medium. The second reference beam converges onto the same area of the plate. The recombination of the two beams produces interference patterns that are then represented (stored) in the medium. Later application of the reference beam only through the plate or the "storing medium" elicits the three dimensional image of the original object.

Like the polarity of general electromagnetic fields removing parts of the plate or medium that contain interference patterns does not fragment the image. Instead the image becomes weaker in a manner similar to sectioning a bar magnet at the midline. The two smaller magnets still display a N and S pole, except that the intensity is less. In other words although the acuity or brightness of the image is less the intrinsic spatial and temporal *patterns* that compose the information and the image remain.

In the original unpublished model the unique geomagnetic activity in the area of an extremely physiologically distressed human being was considered the working beam while the reference beam was the geomagnetic field around this person. The limiting steps at that time for this model had been the requirement for a functional relationship between geomagnetic intensity and light emission and the "medium" or equivalent of the photographic plate. Previous candidates for the latter had been the quartz crystals within adjacent bedrock or the sand of the mortar or cement that composed the walls of dwellings, the "memory" of patterns with local aggregates of water molecules, or the cellulose within dense plants such as trees. These materials contain the degrees of freedom and specific molecular structure to maintain electromagnetic patterns.

The results of the present study suggest that space itself may maintain the information in a type of "electromagnetic, state-dependent" manner such that recreation of the electromagnetic condition that occurred when the initial light patterns were being emitted would reconfigure the same or similar pattern of light emissions. This association would also require a functional relationship between the intensity or power density of incident photons and geomagnetic intensity.

In the laboratory we have observed a consistent inverse relationship between background photon emissions from the ambient environment (about 5×10^{-11} W/m^2) around the PMT sensor and the intensity of the local geomagnetic field as measured by a magnetometer. For comparison the power density for cosmic ray incidence and release of natural radioactivity of the ground have almost identical values of ~10^{-13} W/m^2 or about 0.1 roentgen per year (Koenig *et al.,* 1981). In general for every 10 nT decrease in the local geomagnetic field adjacent to the PMT, there is ~10^{-11} W/m^2 increase in photon emission energies.

The human body is a semiconductor whose presence modifies the local geomagnetic field. The 1.5 kg mass of the human brain, as a function of its activity, can modify the intensities within the 10 nT range. The geomagnetic field around the brain of Sean Harribance decreased up to 1 m away during periods when, associated with his intense mystical and visual imagery, there was increased photon emission from his right hemisphere while he sat in the dark. The energies within the volume of that geomagnetic field that was modified around his head and the total photon emissions were equivalent, about 10^{-11} J/s (Hunter *et al.,* 2010). More recently an experienced meditator, engaging in intense mystical imagery also displayed at about 20 cm from the right side of her head the inverse relationship between photon emission and intensity changes in the geomagnetic field. The slope of the relationship indicated that for every 10 nT decrease in the intensity of

the geomagnetic field adjacent to her head there had been an increase of about $0.5x10^{-11}$ W/m^2 in photon emissions (Saroka *et al.,* 2011).

It is not clear whether or not the information is stored within the geomagnetic field, the space it occupies or as some yet to be described interaction between geomagnetic energy and space. If space itself stores the information extracted from temporal patterns of light emission that can be retrieved, in a manner similar to our experimental demonstration, then one would expect a scaled increase in energy if larger spaces than the cell culture dishes containing the source of light emission employed here were involved. At the spatial level of the mass and space of a person, the total output could be discernable visually.

The human body, when time is ignored, is a three dimensional mass through which geomagnetic fields penetrate. Cells that are in a state of disequilibrium (such as when they are dying) display continuous photon emissions of at least $\sim 10^{-19}$ J/s (Dotta *et al.,* 2011c). With approximately 10^{13} (10 trillion) cells of the body each generating this quantum a continuous output of at least 10^{-6} J/s of photons would occur as the geomagnetic field penetrated the body. For comparison the total energy "storage" within the magnetic field (with the intensity of the earth) for a volume of the approximate mass of a human being immersed within that field would be $(25 \times 10^{-10}\ T^2/\sim 25 \times 10^{-6}\ N/A^2) \cdot 5 \times 10^{-2}\ m^2$, or, about 5×10^{-6} J.

If the pattern of output, which would reflect the spatial organization of the tissue from which the photons were generated (the body) was stored within the geomagnetic space, as we posited as the explanation for our experimental observations, then subsequent activation of this space by a similar geomagnetic pattern would "retrieve" the original temporal pattern of photon emissions. It may be relevant that 10^{-6} J/s, if distributed over a square meter would be within the range of the intensity on a moonless clear night and would be quite discernable by the dark-adapted eye and recordable with specialized cameras. The dark adapted human eye through rod vision displays a threshold of about 10^{-17} J and this threshold can be altered by experimental attenuations of the earth's static magnetic field (Thoss, 2007).

References

Aczel AD. Entanglement: the greatest mystery in physics. Vancouver: Raincoast, 2002.

Ahn J, Weinacht TC, Bucksbaum PH. Information storage and retrieval through quantum phase. Science 2000; 287: 463-465.

Arnesen MC, Bose S, Vedral V. Natural thermal and magnetic entanglement in the 1D Heisenberg model. Physical Review Letters 2001; 87: 017901-1/017901-4.

Bentov I. Stalking the wild pendulum: on the mechanics of consciousness. N.Y.: EP Dutton, 1977.

Dotta BT, Mulligan BP, Hunter MD, Persinger MA. Evidence of macroscopic quantum entanglement during double quantitative electroencephalographic (QEEG) measurements of friends vs strangers. NeuroQuantology 2009; 7: 548-551.

Dotta BT, Persinger MA. Dreams, time distortions and the experience of future events: a relativistic neuroquantal perspective. Sleep and Hypnosis 2009; 11: 29-39.

Dotta BT, Persinger MA. Doubling of local photon emissions when two simultaneous, spatially-separated, chemiluminescent reactions share the same magnetic field configurations. Journal of Biophysical Chemistry 2012; In press.

Dotta BT, Buckner CA, Lafrenie RM, Persinger MA. Photon emissions from human brain and cell culture exposed to distally rotating magnetic fields shared b separate light-stimulated brains and cells. Brain Research 2011a; 388: 77-88.

Dotta BT, Buckner CA, Cameron D, Lafrenie RF, Persinger MA. Biophoton emission from cell cultures: biochemical evidence for the plasma membrane as the primary source. General Physiology and Biophysics 2011b; 30: 301-309.

El Naschie MS. Gravitational instanton in Hilbert space and the mass of high energy elementary particles. Chaos, Solitons & Fractals 2004; 20:917-923.

Hunter MD, Mulligan BP, Dotta BT, Saroka KS, Lavallee CF, Koren SA, Persinger MA. Cerebral dynamics and discrete energy changes in the personal physical environment during intuitive-like states and perceptions. Journal of Consciousness Exploration & Research 2010; 1: 1179-1197.

Garcia-Ojavlo J, Roy R. Spatiotemporal communication with synchronized optical chaos. Physical Review Letters 2001; 86: 5204-5207.

Koenig HL, Krueger AP, Lang S, Soennig W. Biologic effects of environmental electromagnetism. N.Y.:Springer-Verlag, 1981.

Martin LJ, Koren SA, Persinger MA. Thermal analgesic effects from weak, complex magnetic fields and pharmacological interactions. Pharmacology, Biochemistry and Behavior 2004; 78: 217-227.

Persinger MA. The paranormal: the patterns. N.Y.: MSS Information, 1974.

Persinger MA, Koren SA, Lafreniere GF. A neuroquantologic approach to how human thought might affect the universe. NeuroQuantology 2008a; 6: 262-271.

Persinger MA, Tsang EW, Booth JN, Koren SA. Enhanced power within a predicted narrow band of theta activity during stimulation of another by circumcerebral weak magnetic fields after weekly spatial proximity: evidence of macro quantum entanglement? NeuroQuantology 2008b; 6: 7-21.

Persinger MA, Saroka KS, Lavallee CF, Booth JM, Hunter MD, Mulligan BP, Koren SA, Wu

HP, Gang N. Correlated cerebral events between physically and sensory isolated pairs of subjects exposed to yoked circumcerebral magnetic fields. Neuroscience Letters 2010; 486: 231-234.

Richards R, Persinger MA, Koren SA. Modification of activation and evaluation properties of narratives by weak complex magnetic field patterns that simulate limbic burst firing. International Journal of Neuroscience 1993; 71: 71-85.

Saroka KS, Dotta BT, Persinger MA. Concurrent photon emission and changes in quantitative brain activity over the right hemisphere while concentrating on inner light. Journal of Chinese Medicine 2011; in submission

Sheldrake R. Morphic resonance. Toronto: Park Street Press, 2009.

Stapp H. Nonlocality, in D. Greenberger, K. Hentschel, F. Weinert (Eds). Compendium of Quantum Mechanics, New York: Springer, 2009, pp. 405-410.

Thoss F, Bartsch B. The geomagnetic field influences the sensitivity of eyes. Vision Research 1995;47: 1036-1041.

Tu L-C, Luo J, Gilles GT. The mass of the photon. Reports on Progress in Physics 2005; 68: 77-130.