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SCHUMANN RESONANCE

Excerpt from Nexus Magazine, Vol. 10, #3, April-May, 2003

by Iona Miller



Using the sound recording of Voyager (with special thanks to Dr. Frederick Scarf) we created this dark and ambient music to fit into the theme of our series Music of the Spheres. The music was composed using a 7.83 HZ frequency, the actual frequency of the earth's SR vibration.

Since life began, the Earth has been surrounding and protecting all living things with a natural frequency pulsation of 7.83 HZ—the ancient Indian Rishis called OM. "Schumann Resonance" refers to the frequency of the electromagnetic field of the earth. Whether by coincidence or not, it also happens to be a very powerful frequency to use with brainwave entrainment. The discovery, from 1954, has spurred much research. We incorporated subtle Isochronic tones in the music.

Isochronic tones are regular beats of a single tone used for brainwave entrainment. Similar to monaural beats, the interference pattern that produces the beat is outside the brain so headphones are not required for entrainment to be effective. They differ from monaural beats, which are constant sine wave pulses rather than entirely separate pulses of a single tone. As the contrast between noise and silence is more pronounced than the constant pulses of monaural beats, the stimulus is stronger and has a greater effect on brain entrainment.

This frequency has been associated with high levels of hypnotizability, meditation, increased HGH levels and cerebral blood flow levels seem to be much higher while this frequency is being stimulated. OM mantra was uttered

by the Vedic sages who stayed on the banks of the river Saraswati in 9000 BC. Vedic civilization of Saraswati flourished till 4000 BC, till the river became non-perennial due to tectonic shifts blocking the Himalayan Glacier mouth. The elite then migrated all over including Western coast of India, Mesopotamia, Europe and Russia.

Mankind depends on two subtle environmental signals, the Yin from below and the Yang from above. The Schumann wave surrounding our planet being YANG and the weaker geomagnetic waves coming from below, from within the planet, being the YIN signal. Alpha brain Frequency of 7.83 HZ on the EEG, is also known popularly as Schumann's Resonance . These frequencies start at 7.8 Hz and progress by approximately 5.9 Hz. (7.8, 13.7, 19.6, 25.5, 31.4, 37.3, and 43.2 Hz.).

<http://thomasschoenbergermusic.com>



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Miller, I., *Schumann Resonance, Psychophysical Regulation & Psi (Part I)*

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Article

Schumann Resonance, Psychophysical Regulation & Psi (Part I)

Iona Miller*

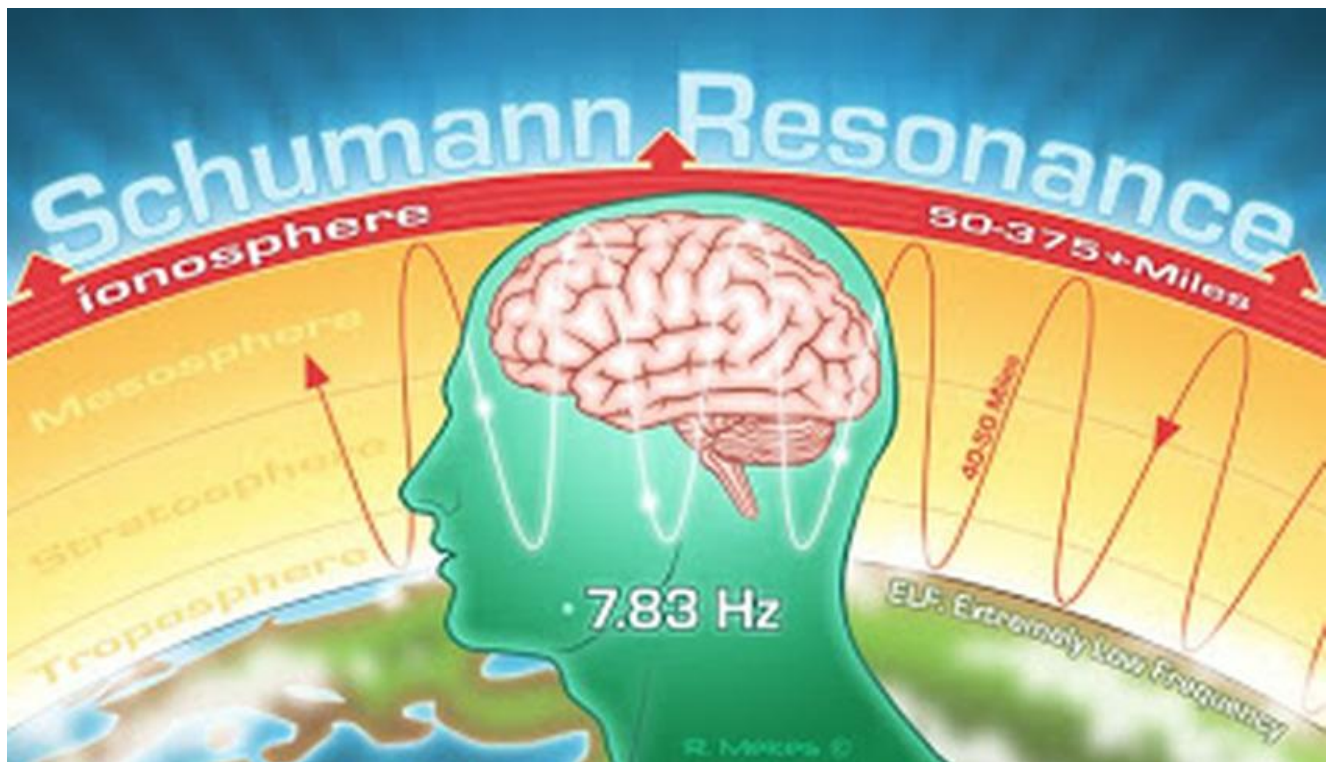
ABSTRACT

This article concurs with Hainsworth's pioneering research on the health correlates of Schumann Resonance ("SR") and postulates, along with Pitkanin and Sidorov, that SR may be the substrate for a radar-type extrasensory perception mechanism common to all organisms. SR forms a sort of global guidance system for life. Resonant absorption of an oscillating signal and reaction is presumed as most brainwaves fall within the first five SR modes (0-35 Hz). Frequency matching amplifies even weak signals, even in the presence of other strong static and oscillating fields. It is vital in brain-to-cell and cell-to-cell communication.

Part I of this two-part article contains: Introduction; Planetary Rhythms; Ducted Propagation; Physiological Frequencies, Coherent Resonance & Well-Being; EM Frequencies & Human Response; and Measuring Brain Waves by EEG.

Key Words: EMF, Schumann Resonance, psi, ionosphere, resonance, solar flares, ULF/ELF, diurnal cycles, endocrine hormones.

<http://www.jcer.com/index.php/jcj/article/view/316/341>



Geospace is the term that relates to the solar-terrestrial environment and the relevant space occupied by Earth and her fields. Schumann Resonances (SR), global electromagnetic resonances, excited by lightning, is one of the natural EM fields in our planetary environment. But resonances can be excited by any electromagnetic disturbance in the atmosphere.

The fundamental SR mode roughly corresponds to a wave with a wavelength equal to the circumference of the Earth. Transverse resonance is predominantly a local phenomenon containing information on the local height and conductivity of the lower ionosphere and on nearby thunderstorm activity. Waves in the ULF range (i.e., below the first Schumann Resonance), will have wavelengths much larger than the circumference of the Earth.

ULF waves, at approximately 1 mHz to 1 Hz, play a major role in propagating energy throughout the magnetospheric system. At the lowest end of this frequency band, the wavelength of ULF waves is comparable to the entire magnetosphere. In this frequency range, the global structure of the magnetosphere can lead to global cavity resonances and waveguide modes. The structure of these modes is determined by the gradients in the Alfvén and fast mode speeds in the magnetospheric system. (Lysak)

SR is *not* the internally-generated resonant frequency of the planet Earth, which is 10 Hz as Tesla discovered. It is electromagnetic oscillations -- the Earth's global electric circuit consisting of the frequencies that play through the ionospheric cavity (space between the ground and ionosphere) as waves

in a plasma. The ionosphere is a highly-conductive region of cosmic plasma.

The solar-terrestrial environment is modulated by solar cycles which affect the global climate and all organisms in the biosphere. Interference patterns are the transducers of energy, which at its most fundamental is described as information. Earth functions like a planet-sized electrical capacitor or condenser, storing electrical potential.

The space between Earth and the ionosphere is a dissipative closed cavity between 50-375 miles that can sustain quasi-standing waves at wave lengths of planetary dimension. Electrical conductivity in the atmosphere is driven largely by cosmic rays that generate a torsion field. Conductivity increases exponentially with altitude because the lower atmosphere buffers collision frequency.

The ionosphere begins about 50 miles out from the Earth's surface and extends out over 180 miles. It consists of charged particles. This highly dynamic region is constantly exposed to harsh ultraviolet radiation from the Sun. It breaks down molecules and atoms. Highly charged ions and free electrons therefore fill the ionospheric layers creating a "spectral power station".

Lightning radiates broadband EM fields that spread laterally into the cavity. Global thunderstorms excite the Schumann resonances, which can be observed around 7.8, 14, 20, 26, 33, 39 and 45 Hz. The resonant spectrum is a superposition of global lightning discharge. For these resonant values to change, the planet would have to change diameter.

The Schumann resonance modes, like other low-frequency modes, are able to leak into the ionosphere, particularly at night when the plasma density is lower. . . *Using measurements from the Communications/Navigation Outage Forecasting System (C/NOFS) satellite, we report, for the first time, Schumann resonance signatures detected well beyond the upper boundary of the cavity. These results offer new means for investigating atmospheric electricity, tropospheric-ionospheric coupling mechanisms related to lightning activity, and wave propagation in the ionosphere. The detection of Schumann resonances in the ionosphere calls for revisions to the existing models of extremely low frequency wave propagation in the surface-ionosphere cavity. (Simoes)*

Such frequencies have wrapped earth's life since its inception. Normal daily variation ranges ± 0.5 Hertz. Driven by lightning, this primal SR pulse calibrates us and enhances our physical and mental well-being. That natural resonance helps us achieve our optimal brainwave states, but this atmosphere to human linkage is disrupted by the electrosmog of today's technology.

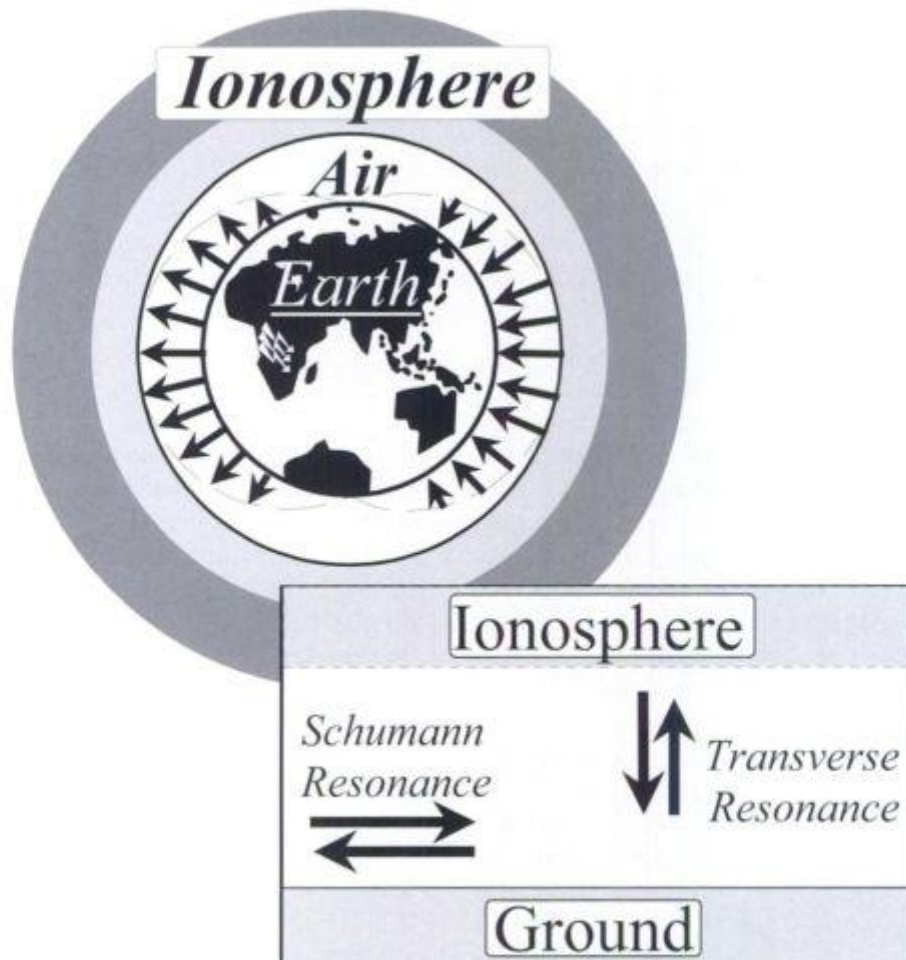


Fig. 1.1. Diagram of Earth–ionosphere cavity. The lower scheme demonstrates two kinds of electromagnetic resonance. (Adopted from *Bliokh and Nickolaenko, 1984*).

The diagram in the lower part of figure separately depicts a cross–section of the cavity with two resonances feasible. A radio wave traveling along the ground surface (shown in the left part) circles the globe and returns to the starting point. The first, or basic, Schumann resonance occurs when the phase delay of the round the world wave is equal to 2π . When the wave bounces between the ground and ionosphere (as is shown in the right part), it may be trapped between two ‘mirrors’, and the transverse resonance takes place.

We are proposing, along with Pitkanin and Sidorov, that the Schumann resonance (SR) may be the substrate for a radar-type extrasensory perception mechanism common to all living beings. Like water bouncing off of rocks and other submerged objects, this non-specific frequency is absorbed and re-radiated in unique interference patterns by all objects it encounters. This interference pattern is a composite of external and internal properties, as the constituent atoms, molecules and their global assembly all re-transmit this energy according to their specific configurations. Not only that, but the “sounding waves” can be frequency and pattern modulated by conscious

intent in order to yield specific information (interference patterns). Decoded by the brain they return almost instantly on the “back” of the Schumann Resonance. Once recaptured, the patterns are then decoded by the brain.

In this Fourier-type transformation the information is translated into conscious data, much like other sensory processing. Conversely, specific effects may be imprinted as bioinformation and made to exercise a "mysterious action at a distance", once the signal wave reaches the target. That pattern, in turn, may, under the right ("pre-requisite") global conditions, avoid routine dissipation and become instead coupled to the dominating ("state-of-consciousness") standing wave that is picked up and carried by the Schumann resonance. Mental intent may function as a variable window of transmission/reception in the exchange of extrasensory information. Tuned into the Schumann resonance, it may carry such bio-regulating information to distant targets and act as a primitive, radar-type sensory interface.

Further research on these electromagnetic relationships is essential, perhaps even to our psychophysical survival as a species. They affect our minds, the cellular and genetic structure of our bodies, our sleep and dream cycles, our emotions, perhaps even our spirit. Monitoring and collating these effects of atmospheric tampering and their potential influence on the ionosphere and SR, therefore human brainwaves and health, should be continued. We are approaching the end of the current sunspot cycle, and should use an entire 11 year cycle to acquire accurate data results, as Hainsworth suggested (see last issue).

A team of researchers and physicists, including these authors, is pulling together some relevant data under the auspices of the *Journal of Non-Locality and Remote Mental Interactions (JNL RMI)* edited by physicist Lian Sidorov. A major hypothesis of this group is that EM fields outside of the body are crucial for our consciousness. Finnish physicist Matti Pitkanen has developed a model of physics, called *Topological Geometroynamics (TGD)*, highlighting the close relationship of human physiology with SR and other ELF and electromagnetic patterns.

Pitkanen believes that not only global, but interplanetary and interstellar magnetic fields are of great importance for conscious life. His explanations involve magnetic flux tubes, a dipole-like part of a field. A wide range of EM waves, in particular microwaves and radiowaves are likely key elements in homeostasis, remote mental interactions between cells and other structures, and sensory representation, as well as in remote mental interactions both within and outside of the body. He explains that the noise level of Earth's magnetic field must be low for anomalous cognition (also called psi or ESP) to occur. Alan Frey suggested similar field notions decades ago, speaking specifically of microwave range inputs.

These EM fields are only correlates of consciousness. Still, TGD allows the possibility of assigning someone's field body a topological field quanta identity. Pitkanen also suggests these fields and waves are influential when biological systems perform quantum computation-like processes. His biophysics suggests that neural circuits and molecules are bound by lock and

key mechanisms through this process of magnetic circulation (topologically quantized dipolar magnetic fields).

Pitkanen even sees Earth's magnetic field as a quantized dipolar magnetic field interaction of knotting, linking, and complex twisting. TGD views the brain and nervous system as a sensory organ for our extended, electromagnetic selves, which have a length scale at least the size of the Earth's diameter. He suggests further that psi phenomena and distant healing may involve transfer of specific electromagnetic frequencies through Planck-length wormholes and join-along boundaries postulated by TGD, which would allow for the near-instant transfer of information.

[T]he magnetic sensory canvas hypothesis provides a mechanism for "sharing qualia" associated with distant points on the geomagnetic sphere - essentially a form of cognitive entanglement between operator and target. One clear advantage of TGD over other models of subtle energy transmission is that the EM fields are not directly carried from sender to target, but are simultaneously generated at the two locations by a vacuum (geometrical) current: hence they remain coherent while bypassing the paradox of non-attenuation with distance. . .the illusion of our locality is perpetuated by the data fed to us by our senses - that is, those perceptions we are habituated to pay attention to. (Sidorov, JNLRMI) Other research suggests the fundamental interaction of internal and external fields is the right track. Joseph Jacobson (2002) at MIT, found a way to switch cells off and on with radio waves. His team also "unzipped" and manipulated DNA with a radio-frequency pulse. The same approach worked on proteins as well, and proteins orchestrate nearly all cellular chemical processes. Further, physicist Peter Gariaev has proposed a wave-based genome, whose main information channel is the same for both biophotons and radio waves (see www.emergentmind.org).

In 1973, Miller, Webb and Dickson described DNA as a holographic projector (see "Embryonic Holography"). In other words, genes encode and express themselves via light and radio waves, or acoustical holography (see "Quantum Bioholography", Miller, Miller and Webb, JNLRMI , 2002). Delocalized interference patterns create calibration fields (blueprints) for our bodies' space-time organization. The system works as a biocomputer -- a wave biocomputer. DNA can also function as a gel-like liquid crystal, emitting a weak laser-like light that can be converted into an electro-acoustic signal.

In conclusion, Miller and Miller postulate, along with others that,

- 1.The organization of all biological systems is established by complex electrodynamic fields. We are fundamentally electromagnetic, rather than chemical beings. Wave interaction is a key determinant of biological structure and optimal functioning. Biosystems are sensitive to natural and artificial electromagnetic fields. Perturbations in environmental fields can induce changes in organisms informed by those fields. Field frequencies and amplitudes affect our biodynamic state.

2. ELF frequencies of Schumann's Resonance are intimately linked with those

of human brainwaves. Natural or artificially induced changes in SR could affect subtle and perhaps gross brainwave generation. In particular, it could lead to changes in patterns and frequencies of resonance and resulting phenomena such as homeostasis, REM, psi, and healing.

For a decade, Robert Beck researched the brain wave activity of healers from all cultures and religious backgrounds (he enumerates psychics, shamans, dowzers, Christian healers, seers, ESP readers, kahuna, Santeria, wicca practitioners and others). Independent of their belief systems, each exhibited "nearly identical EEG signatures" during their "healing" moments: a 7.8-8Hz brainwave activity, which lasted from one to several seconds and which was "phase and frequency-synchronized with the earth's geoelectric micropulsations - the Schumann resonance". (Sidorov, JNLRMI)

Liquid crystals (DNA, brain ventricles, and cellular structures) in the human body may operate as antennae for detecting and decoding such global and local ELF signals. Beal (1996) proposes that liquid crystals (which are an intrinsic part of cell membranes) act as a detector/amplifier/memory storage device for ELF EM patterns in the environment. Proteins, tend to orient themselves in the 10-Hz resonant EMF, so would be extremely sensitive to ELF changes in the 10Hz region. A coherent wave-field may emerge from the body's own liquid crystal (LC) matrix.]

The very structure and organization of living tissues is, however, itself regulated by that master molecule, the DNA. The genetic system (consisting, to be more accurate, of an equidirectional translation function which may start equally well with DNA, RNA or protein) reveals itself as a complex, multidimensional code with both local (codon) and global (context), material (nucleotide) and field-like (EM hologram) parameters, all of which are mutually interdependent and at the same time subject to external, environmental influences. (Sidorov, JNLRMI)

3. There is a strong correlation between behavioral disturbances in humans and periods of solar and geomagnetic field turbulence. Conversely, studies show that subjects living in isolation from geomagnetic rhythms over long periods of time developed increasing irregularities and chaotic physiological rhythms - which were dramatically restored after the introduction of a very weak 10Hz electrical field. Early astronauts suffered until SR generators were installed in their spacecrafts.

4. Geomagnetic anomalies (tectonic strain, earthlights, geomagnetic field perturbations) can induce some forms of anomalous cognition - such as auditory and visual hallucinations, and TLTs (temporal lobe transients or small seizures). Also, one of the effects of meditation is to "quiet the mind" as a method of allowing the "free-run" (or silent thalamic periods) to become entrained by natural geophysical rhythms. This form of tuning or "magnetoreception" is mediated by the pineal gland, (30% of its cells are magnetically sensitive), and organic magnetite-containing tissues. Persinger (1989) points out that deep temporal lobe activity exists in equilibrium with the global geomagnetic condition. When there is a sudden decrease in geomagnetic activity, there appears to be an enhancement of processes that

facilitate psi reception, especially telepathy and clairvoyance. Increases in geomagnetic activity may suppress pineal melatonin levels and contribute to reductions of cortical seizure thresholds. Indeed, melatonin is correlated with temporal lobe-related disorders such as depression and seizures. (Krippner)

5. Optimal global ELF (calm night; low sunspot activity; low EM pollution) conditions can facilitate anomalous cognitions, including psi such as ESP, remote viewing, and remote healing. *[P]si is always present in space and time, waiting to be accessed by crisis, emotion, or by optimal laboratory stimulus parameters. Geomagnetic activity may affect the detection capacity of the brain for this information, especially the neural pathways that facilitate the consolidation and conscious access to this information. Without this geomagnetic activity, awareness of the psi stimulus might not be as likely and the brain's "latent reserve capacities" would not be utilized.* (Krippner)

Sidorov (2001) and others have suggested that human intent functions as a variable window of transmission/reception in the exchange of extrasensory information, possibly within the range of ELF electromagnetic frequencies. Brain synchronization with Schumann's Resonance of both sender and receiver facilitates psi, or "therapeutic entrainment," amplifying, re-radiating coherent waveforms derived from the environment, simulating the wave pattern of the environment. Sidorov further hypothesizes,

[B]rainwaves (particularly in the alpha range) can be transmitted along the perineural system (or via Frohlich excitation) to any distal parts of the body, and even to adjacent organisms, via ELF EM waves. These frequencies can be amplified by closely-related Schumann resonance waves, or by feedback mechanisms typical of the body's physiological pathways (akin to immunologic and neuroendocrinologic cascades). In turn, these basic frequencies can re-activate stalled healing processes, enhance growth, accelerate immune responses, and generally "jump-start" functions inherent to the body's tissues, by "rebalancing its energies" (according to Oriental medicine) or (in Beal's terminology) by re-configuring the liquid crystal orientation of cell membrane components and thus triggering specific intracellular responses.

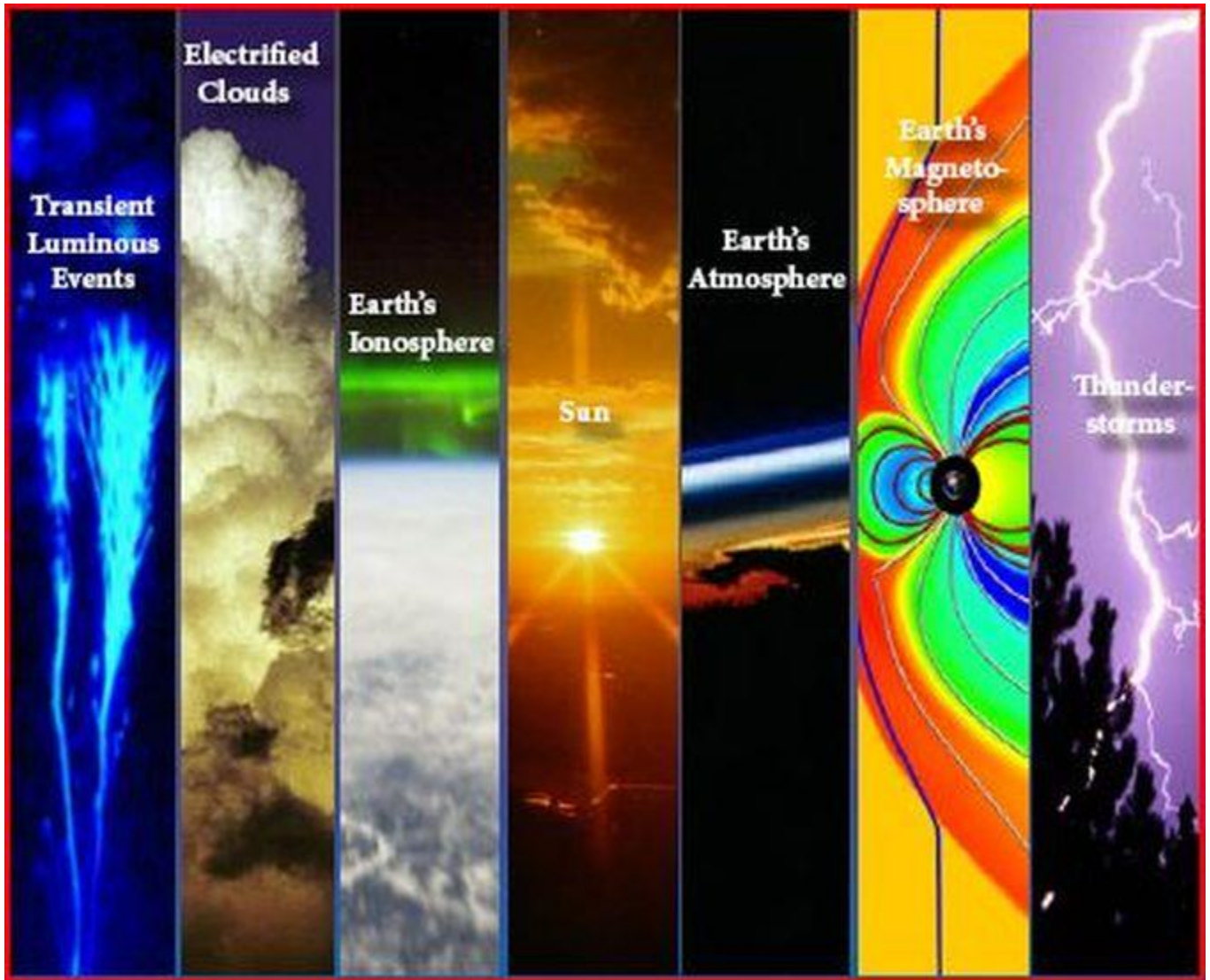
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like other sensory processing. Conversely, specific effects may be imprinted as bioinformation and made to exercise a "mysterious action at a distance", once the signal wave reaches the target. That pattern, in turn, may, under the right ("pre-requisite") global conditions, avoid routine dissipation and become instead coupled to the dominating ("state-of-consciousness") standing wave that is picked up and carried by the Schumann resonance. Mental intent may function as a variable window of transmission/reception in the exchange of extrasensory information. Tuned into the Schumann resonance, it may carry such bio-regulating information to distant targets and act as a primitive, radar-type sensory interface. All these and more mechanisms depend on the SR frequencies staying within their median range.

In a prior, "first-thoughts" essay discussing the presence of Schumann frequencies in the EEG during various healing practices we had proposed that mental intent might function as a variable window of transmission/ reception in the exchange of extrasensory information, which tuned into the Schumann resonance to carry such bio-regulating information to distant targets and acted as a primitive, radar-type sensory interface (Sidorov 2001). However, pursuing this line of thought soon lead to the landmark experiments of Robert Becker - who, it became evident, had not only reached somewhat similar conclusions based on his own body of evidence, but had gone beyond them to suggest that such subtle currents could reach far deeper into our genetic and consciousness control mechanisms. After nearly eight decades of EEG and other brain imaging studies, it is sobering to realize that we still can't tell with certainty where EEG voltages come from (Becker 1985, pp 88). It is conceivable that Becker's perineural system and/or the LC - liquid crystal matrix of the organism (including, but not limited to, connective tissues, cell membranes and DNA) might act as a full-body array of sensory receptors for Pitkanen's magnetic sensory canvas signals, with specific excitations patterns coding for different types of information.

[T]he body's ubiquitous liquid crystal arrays and their almost infinite configuration possibilities make them a top candidate for the primary sensory receptors parapsychology has been looking for. It is even conceivable that DNA phase-conjugation properties (see Popp and Chang, 1998) allow it to function as a multi-mode antenna, altering its function according to surrounding signal fields and possibly acting not just as a regulatory program, but also an element of "extrasensory" perception. Sidorov) As human beings we have extraordinary potentials we have hardly begun to study much less understand. Creative gifts, intuitions, and talents that are unpredictable or emergent may become stabilized in generations to come. Hopefully, we can learn to understand both our emergence from an essentially electromagnetic environment and facilitate our potential for healing, growth and non-local communication.

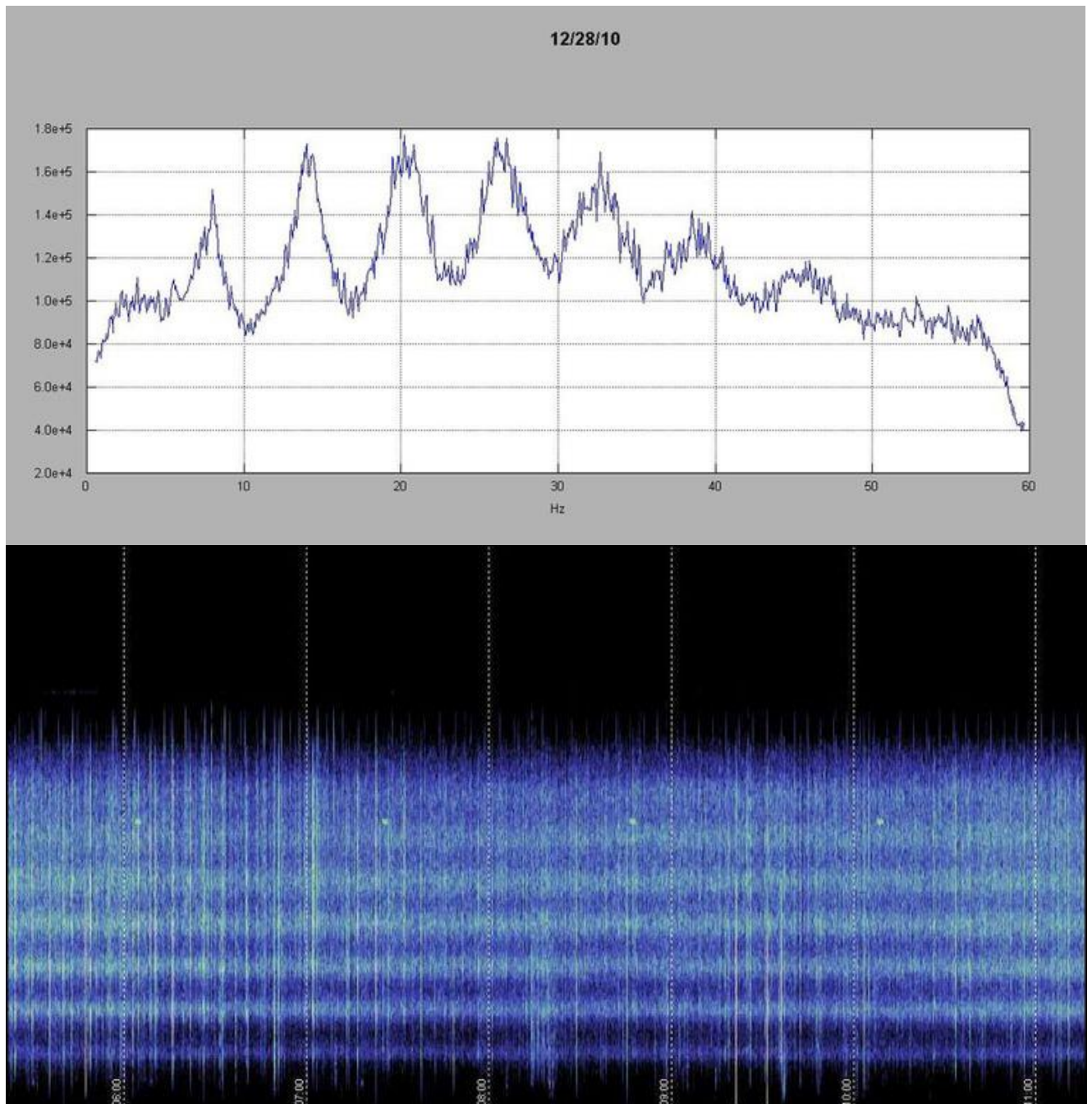


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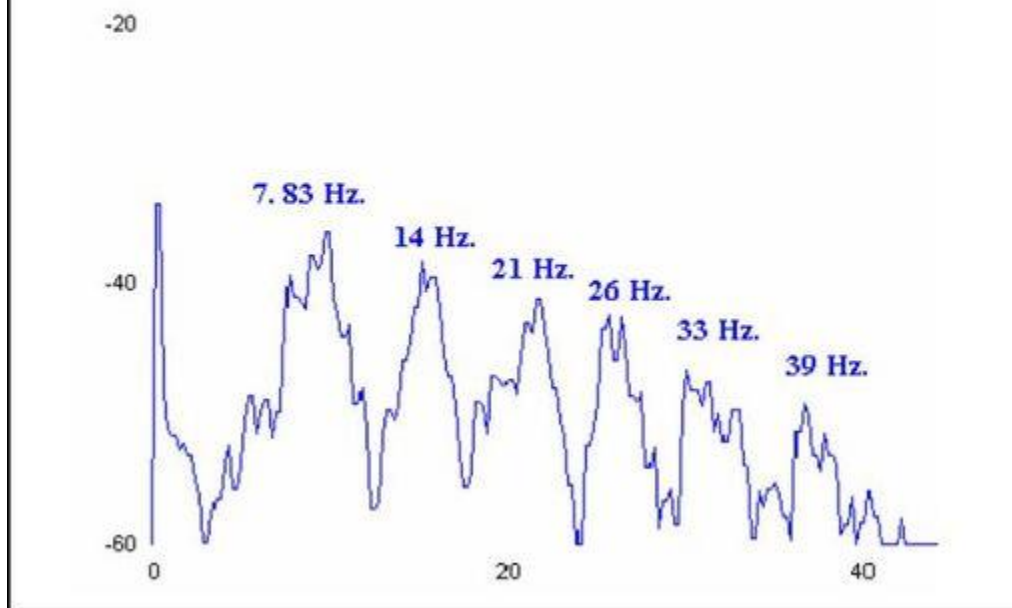
Schumann Resonance 12-11-2010: Lonetree shows evidence here that Schumann Resonance is *not* rising in frequency. He has monitored SR on a daily basis for decades; Including diurnal variation, SR remains steady.

Frequency is shown on the right hand side of the chart and SR is the broadband lighter coloration you see.

Schumann Resonances & Human Physiology

by Iona Miller & Richard Alan Miller, 2003

Seven Subtle Vibrations



Excerpt from Nexus Magazine, Vol. 10, #3, April-May, 2003

PLANETARY RHYTHMS AND HUMAN HEALTH

Lewis B. Hainsworth of Western Australia is arguably the first researcher to recognize the relationship of brain-wave frequencies to the naturally circulating rhythmic signals, known as Schumann's resonances (SR), in the space between the surface of the Earth and the ionosphere. Hainsworth imparted this awareness to Dr Robert O. Becker, noted electromagnetics pollution expert, and to Harvard neurologists as early as 1975.

In 1977, this phenomenon--the relationship between brain-wave rhythms and the spectrum of the natural Earth ELF (extremely low frequency) signals--became the basis for Itzhak Bentov's *Stalking the Wild Pendulum* (Dutton, 1977). Later research confirmed a relationship to human health and well-being and even to ESP or psi phenomena.

Hainsworth sent up a clarion cry against hazardous EM (electromagnetic) pollution, whose dangers pale in comparison to the threat of technologies such as HAARP [High-frequency Active Auroral Research Program], which sends violent pulsations into the Earth's ionosphere, potentially disrupting the entire electromagnetic shield of the planet and certainly affecting the whole biosphere and thus human welfare in general.

Some research (Braden) has suggested that the frequency of the basic Schumann's resonance has recently been rising in value, possibly threatening

the whole biosphere, human welfare and our evolutionary future. But this is totally unsubstantiated fallacious disinformation. There is no evidence whatsoever of rising SR.

All biological processes are a function of electromagnetic field interactions. EM fields are the connecting link between the world of form and resonant patterns. They store gestalts or patterns of information. The bridge connecting solar system resonances and brain frequencies resides in our human DNA helix, which co-evolved in the Earth's environment.

Electrical engineer Lewis B. Hainsworth, MA, was among the first to suggest that human health is linked with geophysical parameters by way of the naturally occurring Schumann's ELF. His hypothesis identified naturally occurring features which determine the frequency spectrum of human brain-wave rhythms: *The frequencies of naturally occurring electromagnetic signals, circulating in the electrically resonant cavity bounded by the Earth and the ionosphere, have governed or determined the 'evolution' or development of the frequencies of operation of the principal human brain-wave signals. In particular, the alpha rhythm is so placed that it can in no circumstances suffer an extensive interference from naturally occurring signals.*

Hainsworth concluded that the frequencies of human brain-waves evolved in response to these signals. If his hypothesis is correct, conditions for evolutionary changes in human brain-wave patterns have now been established. Furthermore, variations in these patterns can produce mild to disastrous health and behavioural changes.

The nature of the applied stimulus makes it difficult to identify the responses directly, as they are most likely to occur in the form of stress-related conditions. They will therefore show up as drastic increases in mental disturbance, antisocial behaviour, psychosomatic conditions and neurological disturbances. Some electrical field phenomena have already been linked with abnormal cell growth and a decrease in immunocompetency.

All these factors could be expected to lead to the appearance of "new" diseases, probably accompanied by a decline in resistance to many minor infections, an increase in conditions related to abnormal cell development, including cancer, birth defects and infertility, and an increase in psychological disturbance problems, e.g., drug addiction and suicide. These existing psychobiological problems could be expected to increase in scale, but could be studied for deviations from "normal" alpha cycles of 10.4 Hz, with detectable changes in psychological characteristics and mental abilities.

Hainsworth therefore strongly urged that research into widespread measurements of the natural SR signals' frequency variations and field strengths be carried out and compared with statistics for the incidence of heart attacks, suicide attempts, road accidents, social violence, domestic accidents, crimes, etc. Studies are often conducted in this inferential way (such as those by Krippner and Persinger), searching correlations between the

phenomena of Earth lights and tectonic strain and reports of UFO sightings, abduction reports and other anomalous psychophysical experiences for an electromagnetic connection to temporal lobe seizures.

We strongly suggest that correlations of broad changes in the modulations of SR be studied in relationship to microwave radiation, ELF signals and HAARP for both immediate and long-term consequences. We have discussed elsewhere the obvious ramifications of such EM pollution and 10-50 Hz modulations on the human system (Miller & Miller, "Synthetic Telepathy", 2001).

We have also discussed the benefits for human well-being and relaxation from entraining with these natural rhythms (*The Diamond Body*, 1981). When a person is deeply relaxed, slow rhythmic sine-wave patterns can be detected in both the EEG and the heart/aorta resonating oscillator in the 7-8 Hz range. Resonance occurs when the natural vibration frequency of a body is greatly amplified by vibrations at the same frequency from another body.

Oscillators alter the environment in a periodic manner. Thus, standing waves in the body, whether during meditation/relaxation or not, can be driven by a larger signal. Progressively amplified wave-forms, created by resonance, result in large oscillations entraining other circuits in the body tuned to those frequencies. A hierarchy of frequencies thus couples our psychophysical selves to the harmonic frequency of the electrical charge of the Earth, which naturally pulses at the same frequencies. This is hardly a coincidence, as we are adaptive products of our environment.

Our planet is surrounded by a layer of electrically charged particles called the *ionosphere*. The lower layer of the ionosphere is roughly 60-80 kilometres (40-50 miles) from the crust, and this charged layer is known to reflect radio waves. Bombardment by HAARP signals "pushes" out this boundary layer, thus altering the natural, pulsating rhythm. Natural fluctuations in frequency occur daily, by the lunar month, and in response to solar flares.

Since the ionosphere is a highly charged layer, it forms a so-called capacitor with the Earth. This means that there is a difference in electrical potential between the two, the Earth being negatively charged and the ionosphere being positively charged. This potential varies somewhat, but is around 200 volts per metre. This is a fundamental type of electrical generator. The solar winds, interacting with the upper atmosphere rotation, act as the collector and brushes of a generator. The lower atmosphere can be seen as a storage battery for this gradient potential.

This electromagnetic field around the Earth can be viewed as a stiff jelly. When our bodies move and vibrate, these movements are transmitted to the environment, and vice versa. These fields not only impinge on our bodies, they also affect the charges inside our bodies. When we are standing on the ground, under normal conditions, we are grounded. Our body then acts as a sink for the electrostatic field and actually distorts the force-lines somewhat. The human body also has its own electrostatic field about itself.

These field lines are the result of the various biochemical reactions in the

body. This resultant bio-field couples us to the iso-electric field of the planet (Miller & Miller, 1981).

In 1957, German physicist Dr W. O. Schumann calculated the Earth/ionosphere cavity resonance frequencies (which were named after him). He fixed the most predominant standing wave at about 7.83 Hz.

A "tuned system" consists of at least two oscillators of identical resonant frequencies. If one oscillator starts emitting, the other will be activated by the signal very shortly, in the process of resonance, entrainment or kindling (igniting the resonance phenomenon among the neurons). It becomes obvious that in deep meditation, when waves of alpha and theta rhythms cascade across the entire brain, a resonance is possible between the human being and the planet. Energy and information which are embedded in a field are transferred. Perhaps the planet communicates with us in this primal language of frequencies.

According to Hainsworth, the influence of naturally occurring Schumann's resonance signals on brain-wave pattern evolution is formally stated to show that low-power electrical fields could produce evolutionary change. The electrical fields produced by modern electro-technology are then possible sources of evolutionary change. The characteristics of some forms which might result should be considered. Some fields might inhibit survival of existing forms. Because of lack of available data, precise measurements are lacking and must therefore be quantitatively valueless. Technology not only will change, but is changing, human evolution. Only extensive investigation of the naturally occurring signals will give any lead in showing what results might occur.

The possibility exists that human health is linked with geophysical parameters by way of the naturally occurring Schumann's resonances. A number of attempts have been made to discover the correlation through geomagnetic and ionospheric storms. The correlation comes through the biological fact that the human system is apparently sensitive to such low-power ELF signals. We don't know what the range of such a correlation might be.

The frequency values of the SR signals are determined by the effective dimensions of the cavity between the Earth and ionosphere. Thus, any events which change these dimensions will change the resonant frequencies. As Hainsworth warned, "such events could be ionospheric storms, and could even result from a *man-made ionospheric disturbance*" (emphasis added).

Geomagnetic storms are the magnetic changes produced by ionospheric storms, and are thus associated with conditions capable of changing the SR signals. However, although such storms can produce these changes, measurement of these parameters cannot give any indication of whether the resonance signals have changed to a value outside their normal range or not. Since the undisturbed state of the ionosphere corresponds to the normal SR patterns, then ionospheric disturbances are likely to produce abnormal patterns, but will not necessarily do so in all cases. If biological response is linked to Schumann's resonance signals, this will reduce any apparent link with geomagnetic or ionospheric data.

Trying to determine the relationships between geophysical and biological conditions can become extremely complex. The frequencies of the SR signals change with ionospheric conditions. These conditions change diurnally, seasonally and with variations in solar activity, which, in turn, varies with the 11-year sunspot cycle and also with the 27-29-day lunar cycle, mainly during sunspot minimum periods. Lunar tidal changes in the height and thickness of the layers could also sometimes affect the cavity dimensions and hence the Schumann's frequencies. So can powerful ELF signals from HAARP.

It should be borne in mind that if some signal conditions are harmful, then other conditions might be beneficial. This means that if, for example, seasonal and tidal conditions have resulted in the signals being in a biologically disturbing state, then the advent of a solar flare could result in changes in the signals, bringing them into a biologically beneficial state. The converse could also occur.

If we are sensitive to ELF signals, then when these factors are considered we would expect to get confusion if we try to link any effect with geophysical changes. For instance, there could be incidences of classic states of "lunacy" in some years if damaging signals coincided with full moons, then in other years the observations and analyses would show that the effects were not lunar.

An analysis of the correlation between the incidence of ionospheric disturbance and rate of admission to Heathcote Hospital (Perth, Western Australia) for about a three-year total indicated that when a disturbance occurred then the admission rate changed. The probability of the association being random was of the order of 2000:1 against. However, the fact that sometimes the rate went up and sometimes down showed that ionospheric storms changed the rate of incidence of mental disturbance in a way that is consistent with that change being dependent on the actual causes being linked to variations in the Schumann's resonance signals. At that point, Hainsworth decided to concentrate on trying to get some observational work going on measuring the SR signals.

Hainsworth's set-up used a 2,000-turn, 1-metre-square antenna, and another of 1/3-metre square, plus amplifiers to handle signals from 0 to 30 Hz. His amplified Schumann's signals were analyzed in a laboratory. On one occasion the signal dropped to zero amplitude when a solar flare occurred, and did not start recovering for about an hour and a half afterwards. It was originally just under 7 Hz and came back at only just over 6 Hz. His next step would have been to develop a wave analyser to try to pick out individual signals. But the failing health of both himself and his wife prevented this.

The value of proceeding with his seminal work has now increased many-fold due to the threat from the proposed US Missile Defense Shield. This is the offspring of the United States' HAARP program in Alaska, whose *raison d'être*, or mission statement, allegedly dealing with national security, is vague if not purposefully misleading.

EM FREQUENCIES AND HUMAN RESPONSE

Hainsworth posed a series of questions, all of which are answered with a resounding "yes". This should lead us in the direction of extreme caution towards introducing new EM or ELF sources and ionospheric changes in our environment. He presented his data in two papers based on the following questions:

1. Does the human biological system contain, use or generate any forms of electrical signal?
2. Does it respond to any of these signals?
3. Does it respond to audible signals at these frequencies?
4. Does it respond to optical signals at these frequencies?
5. Do human signals change with psychological or mental states, such as stress or problem solving?
6. Does the human system respond to any very, very low-power electromagnetic signals?

Brain waves have only been studied since about the mid-1920s, and the signal form that is apparently most widely known and identified is the alpha rhythm. The frequency of this signal varies from individual to individual, but it lies between about 7-8 Hz and 12 Hz, with an average value of 10.5 Hz. Theta and beta rhythm signals also occur, and are identifiable by EEG below the 8 Hz and above the 12 Hz frequencies. Since the discovery and measurement of these signals, a great deal of effort has been devoted to trying to work out how they originated in the first place and what determines their frequencies of operation.

In the early to mid-1950s, Schumann (a geophysicist almost certainly uninterested in neurology) suggested that electromagnetic signals might circulate at extremely low frequencies in the electrically resonant cavity between the Earth and the ionosphere. He was right. The signals came to be called "Schumann's resonances". One major component was originally predicated at a frequency of about 10 Hz. In 1959 it was measured to be slightly different. Meanwhile, the military co-opted the discovery for using ELF signals for submarine communications.

In fact, the first mode of these circulating signals has an average value of 7.8 Hz, with a typical diurnal range of from 7.2 to 8.8 Hz, and the second mode has an average value of 14.1 Hz and a range of from 13.2 to 15.8 Hz. These match the brain-wave theta rhythm and beta rhythm nicely. The blank range between the two modes is a very reasonable match with the normal frequency range of the human alpha rhythm, between 8 to 12 Hz or cycles.

Additionally, it was found that there is minimum (zero) power circulating in the Earth/ionosphere cavity at 10.4 Hz--which is virtually an exact match for the average value of the alpha rhythm. Hainsworth points out that the existence of these natural signals and the close relationship of their frequencies of oscillation were facts unknown to senior neurologists and mental health specialists as late as 1975.

Hainsworth argued that up to the end of 1979, no long-term systematic measurements of any great value were being made of the Schumann's

resonance signals. Measurements were being made only intermittently for the purpose of obtaining research data for use by post-graduate geophysicists in constructing esoteric mathematical models of the ionosphere. It follows from this that, until long after the end of 1979, no figures on these signals were available. Consequently, no "expert" can produce numerical evidence to support an objection to Hainsworth's original hypothesis, since the only numerical values available are those favouring it.

However, Hainsworth left us with some open-ended questions:

7. Has any evidence ever been obtained to indicate that the human system is totally unaffected by externally applied electromagnetic fields?
8. Have any measurement programs ever been attempted to show whether the human system is (a) totally unaffected, (b) always affected, or (c) sometimes affected by naturally [or artificially] occurring electromagnetic signals?
9. Has the existence of such signals, having a close relationship with human biological signal frequencies, been known for many years?
10. Have those relationships been studied with adequate protocols in any detail?

Schumann's resonances are actually observed, by experiment, occurring at several harmonic frequencies between 6 and 50 cycles per second (one cycle equals one hertz). Specifically they are found at 7.8, 14, 20, 26, 33, 39 and 45 Hz, with a daily variation of around ± 0.5 Hz.

Only as long as the properties of Earth's electromagnetic cavity remain about the same do these frequencies remain the same. Cycles may vary somewhat due to ionospheric response to solar cycle activity and properties of the atmosphere and magnetosphere. Projects, such as HAARP, which heat up or blast out the ionosphere pose a potential threat of catastrophic proportions to this interactive system.

MEASURING BRAIN WAVES BY EEG

The resonant cavity formed between the ionosphere and the Earth produces rhythmic waves capable of entraining and phase-locking with brain waves.

Even at the turn of this millennium, Hainsworth (now deceased) seems to have been unfamiliar with extensive work in brain-wave research in neurology, hypnotherapy, biofeedback and neural feedback. This research includes extensive experiments in frequency-following response (FFR) and relating brain waves and brain-wave deficiencies to psychobiological states.

The brain is a massive source of ELF signals that get transmitted throughout the body through the nervous system, which is sensitive to magnetic fields. Brain waves and natural biorhythms can be entrained by strong external ELF signals, such as stationary waves at Schumann's resonances. Entrainment, synchronisation and amplification promote coherent large-scale activity rather than typical flurries of transient brain waves. Thus, resonant standing waves emerge from the brain, which under the right conditions facilitates internal and external bio-information transfer via ELF electromagnetic waves. These SR waves exhibit non-local character and nearly instant communication

capability.

The EEG (*electroencephalograph*) measures brain waves of different frequencies within the brain. *Rhythmicity* in the EEG is a key variable in the coordination of cortical activity. Electrodes are placed on specific sites on the scalp to detect and record the electrical impulses within the brain. *FrequencyAmplitude* represents the power of electrical impulses generated by the brain. *Volume* or *intensity* of brain-wave activity is measured in microvolts. is the number of times a wave repeats itself within a second. It can be compared to the frequencies on a radio.

Raw EEG frequency bands include *gamma* (25-60 Hz); *beta* (12-25 Hz); *alpha* (7-12 Hz); *theta* (4-7 Hz); and *delta* (less than 4 Hz). Their ranges overlap one another along the frequency spectrum by 0.5 Hz or more. These frequencies are linked to behaviours, subjective feeling states, physiological correlates, etc. Clinical improvement with EEG biofeedback is traceable to improved neuroregulation in basic functions by appeal to their underlying rhythmic mechanisms.

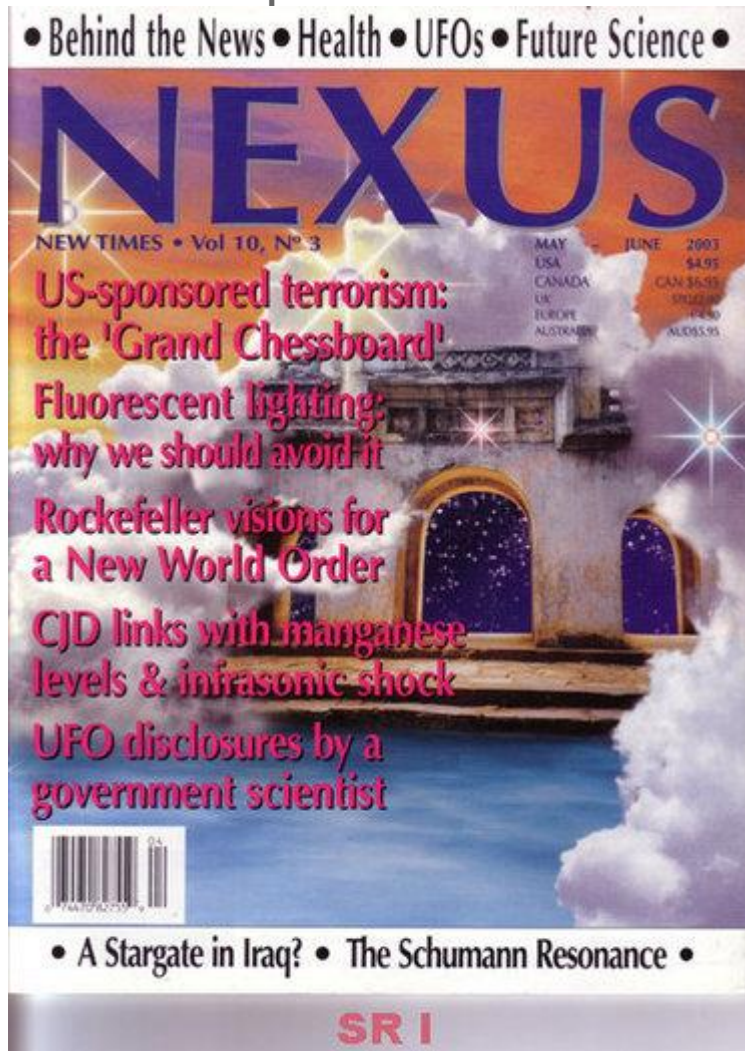
Schumann's resonance forms a natural feedback loop with the human mind/body. The human brain and body developed in the biosphere, the EM environment conditioned by this cyclic pulse. Conversely, this pulse acts as a "driver" of our brains and can also potentially carry information. Functional processes may be altered and new patterns of behaviour facilitated through the brain's web of inhibitory and excitatory feedback networks. Functional processes may be altered and new patterns of behaviour facilitated through the brain's web of inhibitory and excitatory feedback networks.

The brain has its own set of vibrations it uses to communicate with itself and the rest of the body. EEG equipment distinguishes these waves by measuring the speed with which neurons fire in cycles per second. At their boundaries these waves can overlap somewhat, merging seamlessly into one another--so different researchers may give slightly different readings for the range of cycles per second (Hz). The rate of cycling determines the type of activity, kindling wave after wave over the whole surface of the brain by igniting more neurons.



Schumann Resonance Brainwave Entrainment Music

Brainwave Frequencies



The frequency bands and wave characteristics are described as follows:

Gamma waves (25-60 Hz) appear to relate to simultaneous processing of information from different brain areas, e.g., involving memory, learning abilities, integrated thoughts or information-rich task processing. Gamma rhythms modulate perception and consciousness, which disappear with anaesthesia. Synchronous activity at about 40 Hz appears involved in binding sensory inputs into the single, unitary objects we perceive.

Beta waves (12-25 Hz) dominate our normal waking state of consciousness when attention is directed towards cognitive tasks and the outside world. Beta is a "fast" activity, present when we are alert or even anxious, or when engaged in problem solving, judgement, decision making, information processing, mental activity and focus. Nobel Prize winner Sir Francis Crick and other scientists believe the 40 Hz beta frequency may be key to the act of cognition.

Alpha waves (7-12 Hz) are present during dreaming and light meditation when the eyes are closed. As more and more neurons are recruited to this frequency, alpha waves cycle globally across the whole cortex. This induces deep relaxation, but not quite meditation. In alpha, we begin to access the wealth of creativity that lies just below our conscious awareness. It is the gateway, the entry point that leads into deeper states of consciousness. Alpha waves aid overall mental coordination, calmness, alertness, inner awareness, mind/body integration and learning.

Alpha is also the home of the window frequency known as the SR, which propagates with little attenuation around the planet. When we intentionally generate alpha waves and go into resonance with that Earth frequency, we naturally feel better, refreshed, in tune, in synch. It is, in fact, environmental synchronization.

Theta waves (4-7 Hz) occur most often in sleep but are also dominant in the deepest states of meditation (body asleep/mind awake) and thought (gateway to learning, memory). In theta, our senses are withdrawn from the external world and focused on the mindscape -- internally originating signals. Theta waves are associated with mystery, an elusive and extraordinary realm we can explore. It is that twilight state which we normally only experience fleetingly as we rise from the depths of delta upon waking or drifting off to sleep. In theta, we are in a waking dream; vivid imagery flashes before the mind's eye and we are receptive to information beyond our normal conscious awareness. Theta meditation increases creativity, enhances learning, reduces stress and awakens intuition and other extrasensory perception skills.

Delta waves (0-4 Hz) are the slowest but highest in amplitude. They are generated in deepest meditation and dreamless sleep. Delta waves confer a suspension of external existence and provide the most profound feelings of peace. In addition, certain frequencies within the delta range trigger the release of a growth hormone which is beneficial for healing and regeneration. This is why sleep, deep restorative sleep, is so essential to the healing process.

Rhythm & Harmonic Resonance *There is a harmonic relationship between the*

Earth and our mind/body. Earth's low-frequency iso-electric field, the magnetic field of the Earth and the electrostatic field which emerges from our body are closely interwoven. Our internal rhythms interact with external rhythms, affecting our balance, REM patterns, health, and mental focus. SR waves probably help regulate our bodies' internal clocks, affecting sleep/dream patterns, arousal patterns and hormonal secretion (such as melatonin).

The rhythms and pulsations of the human brain mirror those of the resonant properties of the terrestrial cavity, which functions as a waveguide. This natural frequency pulsation is not a fixed number, but an average of global readings, much like the EEG gives an average of brain-wave readings. SR actually fluctuates, like brain waves, due to geographical location, lightning, solar flares, atmospheric ionisation and daily cycles.

The most important slow rhythm is the daily rhythm sensed directly as the change in light. Rhythms connected with the daily rhythm are called *circadian* (an example is pineal gland melatonin secretion). Some experiments in the absence of natural light have shown that the basic human "clock" is actually slightly longer than one day (24 hours), and closer to one lunar day (24 hours 50 minutes).

On a slower scale, a strong influence on the Earth is its geomagnetic field, which is influenced by the following periods: the Moon's rotation (29.5 days); the Earth's rotation (365.25 days); sunspot cycles (11 or 22 years); the nutation cycle (18.6 years); the rotation of the planets (88 days to 247.7 years); and the galaxy's rotation cycle (250 million years). Very important rhythms, like hormone secretion and dominant nostril exchange, are in the order of 1-2 hours. In the range of human EEG, we have the Sun's electromagnetic oscillation of 10 Hz, while the Earth/ionosphere system is resonant at frequencies in the theta, alpha, beta-1 (low or slow) and beta-2 (high or fast) bands.

Different species often have internal generators of environmental rhythms, which can be extremely precise, up to 10⁻⁴. The frequency of these oscillators is then phase-locked-loop (PLL) synchronised with the natural rhythms. Environmental synchronization sources are often called *zeitgebers*. The mechanism of optical synchronization can be shown. The presented rhythms should inspire a better understanding of the interaction of internal and external rhythms during specific states of consciousness.

The bioelectrical domain is geared to thalamocortical generation of rhythmic activity. In neurofeedback, what is being trained is the degree of rhythmicity of the thalamocortical regulatory circuitry. Rhythmicity manages the entire range of activation and arousal in the bio-electrical domain. One role advocated for rhythmic activity is that of *time binding*: the need for harnessing brain electrical activity, which is spatially distributed, while maintaining it as a single entity.

Brain waves indicate the arousal dimension, and arousal mediates a number of conditions. Changes in sympathetic and parasympathetic arousal "tune" the

nervous system. Underarousal leads towards unipolar or reactive depression, attention deficit disorder, chronic pain and insomnia. Overarousal is linked with anxiety disorders, sleep onset problems, nightmares, hypervigilance, impulsive behaviour, anger/aggression, agitated depression, chronic nerve pain and spasticity. A combination of underarousal and overarousal causes anxiety and depression as well as ADHD.

Instabilities in certain rhythms can be correlated with tics, obsessive-compulsive disorder, aggressive behaviour, rage, bruxism, panic attacks, bipolar disorder, migraines, narcolepsy, epilepsy, sleep apnoea, vertigo, tinnitus, norexia/bulimia, suicidal ideation and behaviour, PMS, multiple chemical sensitivities, diabetes, hypoglycaemia and explosive behaviour.

The brain responds to inputs at a certain frequency or frequencies. The computer can create wave-form patterns or certain frequencies that compare with the mind's neural signals in terms of mind patterns. If people can control their mind patterns, they can enter different states of being (mental relaxation, study, etc.).

So what happens when the mind is entrained with a sound or vibration that reflects the thought patterns? When the mind responds to certain frequencies and behaves as a resonator, is there a harmonic frequency that the mind vibrates to or can attune to? What does the study of harmonic resonance, sound or vibration have to do with the brain's frequency waves?

Sound waves are examples of periodicity, of rhythm. Sound is measured in cycles per second (hertz or Hz). Each cycle of a wave is, in reality, a single pulse of sound. The average range of hearing for the human ear is somewhere between 16 Hz and 20,000 Hz. We cannot hear extremely low frequencies, but we can perceive them as rhythmic.

Entrainment is the process of synchronisation, where vibrations of one object will cause the vibrations of another object to oscillate at the same rate. External rhythms can have a direct effect on the psychology and physiology of the listener. Slower tempos from 48 to 70 BPMs have been proven to decrease heart and respiratory rates, thereby altering the predominant brain-wave patterns.

Binaural beats are continuous tones of subtly different frequencies, delivered to each ear independently in stereo via headphones. If the left channel's pitch is 100 cycles per second and the right channel's pitch is 108 cycles per second, the difference between the two equals 8 cycles per second. When these sounds are combined, they produce a pulsing tone that waxes and wanes in a "wah wah" rhythm.

Binaural beats are not an external sound; rather, they are *subsonic* frequencies heard within the brain itself. These frequencies are created as both hemispheres work simultaneously to hear sounds that are pitch-differed by key mathematical intervals (*window frequencies*). The brain waves respond to these oscillating tones by following them (*entrainment*), and

both hemispheres begin to work together. Communication between the two sides of the brain is associated with flashes of creativity, insight and wisdom.

Alpha-wave biofeedback is considered a consciousness self-regulation technique, while alpha-frequency binaural beat stimulation (frequency-following response) is a passive management technique where cortical potentials entrain to or resonate at the frequency of an external stimulus. Through the self-regulation of specific cortical rhythms, we begin to control those aspects of consciousness associated with that rhythm. When the goal is alpha, either in meditation or in biofeedback, it means entraining with the primary SR.

MEASURING CHANGES IN SCHUMANN'S RESONANCES

Earth's background base frequency, or "heartbeat" (Schumann's resonances), fluctuates BUT IS *NOT RISING* dramatically, despite a New Age meme that alleges it. The authors have been unable to substantiate a rising SR in the literature and Ben Lonetree's readings directly contradict it. SR is stable; it is *NOT* rising. Though it varies between geographical regions, for decades the overall measurement has remained 7.8 cycles per second.

Earth behaves like an enormous electrical circuit. The atmosphere is actually a weak conductor; and if there were no sources of charge, its existing electrical charge would diffuse away in about 10 minutes. There is a "cavity" defined by the surface of the Earth and the inner edge of the ionosphere, whose height fluctuates somewhat. It's been calculated that at any moment, the total charge residing in this cavity is 500,000 coulombs.

There is a vertical current flow between the ground and the ionosphere of 1 - 3 x 10¹² amperes per square metre. The resistance of the atmosphere is 200 ohms. The voltage potential is 200,000 volts. There are about 2,000 lightning storms at any given moment worldwide. Each produces 0.5 to 1 ampere, and these collectively account for the measured current flow in the Earth's "electromagnetic" cavity.

Schumann's resonances are quasi standing-wave electromagnetic waves that exist in this cavity. Like waves on a string, they must be potentiated or "excited" in order to be observed. They are not caused by internal terrestrial factors or Earth's crustal movements or the core, which does produce magnetic fields. They seem to be related to electrical activity in the atmosphere, particularly during times of intense lightning activity. So long as the properties of Earth's electromagnetic cavity remain about the same, these frequencies remain the same. Presumably there is some change due to the solar sunspot cycle, as the Earth's ionosphere changes in response to flares and mass ejections during the 11-year cycle of solar activity. High-energy charges coming off the Sun brush across the upper atmosphere, ionising there.

Since the Earth's atmosphere carries a charge, a current and a voltage, it is not surprising to find such electromagnetic waves. The resonant properties of this terrestrial cavity were first predicted by W. O. Schumann in 1952 and 1957, and first detected by Schumann and König in 1954.

Much of the research in the last 20 years has been conducted by the US Department of the Navy, which uses ELF signals for communication with submarines. However, little attention is given by the military and defence contractors to issues of psychobiological health and well-being.

Between the nearly perfectly conducting terrestrial surface and ionosphere, a resonating cavity is formed. Broadband electromagnetic impulses, like those from lightning flashes, fill this cavity and create globally the so-called Schumann's resonances at frequencies in the range of 5-50 Hz (Schumann, 1952; Bliokh et al., 1980; Sentman, 1987). The nominal average frequencies observed are 7.8, 14, 20, 26, 33, 39 and 45 Hz, with slight diurnal variation (Sentman and Fraser, 1991).

Standard magnetometers are not able to measure Schumann's resonances, and even the search coil (i.e., pulsation) magnetometers, which most often sample at about 0.1 Hz, do not allow such studies. Special equipment is thus needed (see, for example, Sentman and Fraser, 1991).

Current findings suggest:

1. Schumann's resonances emerge at several frequencies related to brain waves. They range between 6 and 50 cycles per second, specifically 7.8 (alpha), 14 (low beta), 20 (mid beta), 26 (high beta), 33 (low gamma), 39 (gamma) and 45 Hz (gamma), with daily variation of about ± 0.5 Hz.
2. The strongest of the seven resonances is 7.83 Hz, in the alpha brain-wave range.
3. The amplitude (i.e., intensity) of the Schumann's resonances is not constant, and appears to be extremely dependent upon tropical (hence global) temperature.

SR AND GLOBAL TEMPERATURE CHANGES

One of the most crucial questions in science today centers on whether or not the planetary temperature is rising, falling or remaining unchanged. Recently global warming has been acknowledged by most in the field, and human interference (technology) is implicated. Yet, there is evidence the whole solar system is heating with the solar cycle.

On one hand, analyses of thermometer measurements of near-surface global (land and sea) air temperatures suggest the planet has been warming in recent decades. But satellite measurements of the planet's lower atmospheric temperature show no warming from 1979 to 1998.

Temperature data from weather balloons launched throughout the world reveal

variations and trends in global temperatures that correspond to those found in the satellite-based measurements. Analysis of pressure thickness measurements from these same balloons also shows no warming in recent decades. It's no wonder we have such an ongoing "heated debate" about the recent temperature history of the Earth! Yet most people recognize that their local weather is markedly different than in past decades.

Scientists have suggested lately that another method may exist to monitor planetary temperature accurately. The idea is simple, though the underlying physics of the processes is complex. The method is based on the well-known fact that thunderstorms and lightning strikes in many parts of the world are directly related to lower-atmospheric air temperatures. Higher temperatures produce more lightning strikes, while lower temperatures tend to depress lightning activity.

Lightning discharges occurring anywhere in the world produce electromagnetic pulses that spread away from the source. Much of the energy is quickly degraded, but some of the energy the lightning produces falls in the extremely low frequency/long-wavelength domain of the electromagnetic spectrum. At these long wavelengths, the energy from a lightning strike is able to circumnavigate the Earth without serious degradation. This low-frequency/long-wavelength energy creates SR signals which can be detected throughout the world.

Understanding SR waves requires a basic appreciation of the vertical structure of the atmosphere. In the upper reaches of the ionosphere, incoming ultraviolet radiation and soft X-rays affect atoms or bonded groups of atoms, causing gains or losses of negatively charged electrons. This interaction creates an environment of positively and negatively charged particles of the high atmosphere that, among other interesting qualities, can readily conduct electricity.

The bulk of our insulating atmosphere lies between two conducting layers of the Earth's surface and the lower boundary of the ionosphere. This spherically concentric cavity, the Earth/ionosphere cavity, is bounded by those electrically conducting walls. Again, lightning discharges within the cavity produce electromagnetic pulses that spread away from the source in the extremely low frequency domain, and the conductive walls of the cavity produce some interesting effects for the low-frequency energy.

For example, energy with a frequency near 7.5 Hz would have a wavelength of about 40,000 km (recall that wavelength = speed of light / frequency). Because this wavelength equals the circumference of the Earth, the energy is able to circumnavigate the Earth/ionosphere cavity without serious degradation. The 100 or so lightning bolts occurring each second in the 1,000 lightning storms around the world contribute to the energy in the 7.5 Hz portion of the spectrum, which can be measured anywhere on the planet. It is these resonance properties of this global spherical capacitor or resonator) that Schumann predicted over 40 years ago.

In an article published in *Science*, MIT scientist Earle Williams (1992) constructed a powerful argument that links Schumann's resonances to convection and ultimately to widespread tropical and/or global temperature. Williams concluded that a 1°C warming in the tropics should result in a fourfold increase in lightning activity, and he presented empirical data from several locations to support his conclusion. He noted that any measurable parameter nonlinearly related to temperature could be extremely useful in assessing the most subtle changes in global temperature.

Others have presented different sensitivities: Price (1993) concluded that a 1°C warming would increase global lightning activity by 7%; Price and Rind (1994) found a 5-6% increase per 1°C sensitivity; while Reeve and Toumi (1998) found the sensitivity to be near 40% per 1°C. Regardless of the exact sensitivity, all these scientists conclude that lightning increases with even moderate amounts of warming worldwide. More lightning would generate a stronger SR, which may be useful in monitoring planetary temperatures.

The link between SR and the number of lightning strikes is supported by a mean day/night temperature fluctuation pattern. A diurnal pattern of worldwide lightning exists with three maxima recorded regularly due to the large number of mid- to late-afternoon thunderstorms in land areas of Africa, South America, and Southeast Asia and Australia. (Storms are first generated in Asia; later they form in Africa; and later each day they arise in South America.)

Global warming has been linked to the suspected rise in SR, and is a threat to its synchronization with our brain waves. Small changes in temperature pump up into large signals in extremely low frequency (ELF) resonances. Long-term monitoring and study of global climate changes via measurements of ELF electromagnetic waves needs to be conducted more closely. Monitoring the intensity and frequencies of the lightning-induced ELF SR could help monitor changes in the Earth's climate over time.

One Israeli program proposed setting up two or three widely separated ELF field sites. A suggested site for a permanent SR monitoring station was in the Negev Desert in Israel. Members of this proposal want to develop, test and install the appropriate software for the automatic electromagnetic monitoring and preliminary processing of the incoming data. They suggested that simultaneous measurements could be made in Russia and Sweden to test the global nature of the ELF signals measured in Israel. The continuous ELF data measured in Israel could be compared with other ELF data sets from other locations around the world, such as Hungary, USA or Japan. Furthermore, the relevant global climate data sets - such as surface temperature, satellite observations of the global distribution of deep convection, and global atmospheric water vapour measurements - could be used for comparisons with SR data to check the reliability of the "global thermometer" hypothesis.

A systematic study of SR parameters during high-energy particle precipitation events has shown that protons and electrons with energies above 1 MeV ionise the upper boundary of the Earth/ionosphere cavity. This leads to an increase in the resonance frequency and a decrease in the damping of the first

Schumann's resonance, as derived from measurements at Arrival Heights, Antarctica. The study used the nine strongest solar proton events of the past Solar Cycle 22 and high-energy electrons emitted periodically from co-rotating interaction regions in the solar wind during 1994-95. The variation of the SR parameters is in qualitative agreement with current SR theories. The study also showed that high-energy particle precipitation (solar ejecta) is not the only relevant source affecting SR parameters. The findings constitute a so far little-explored aspect of solar/terrestrial interaction.

FACILITATING OUR POTENTIAL

In conclusion, we postulate that: (1) *we are complex electrodynamic, rather than merely chemical beings, sensitive to natural and artificial EM fields;* (2) *SR frequencies coincide with human brain waves, affecting subtle and gross brain-wave generation, regulating homoeostasis, healing and psi;* (3) *there is strong correlation between human behavioural disturbance and geomagnetic field turbulence or isolation from SR frequencies.*

As human beings we have extraordinary potentials we have hardly begun to study, much less understand. Creative gifts, intuitions and talents that are unpredictable or emergent may become stabilised in generations to come. Hopefully, we can learn to understand both our emergence from an essentially electromagnetic environment and facilitate our potential for healing, growth and non-local communication.

Notes and References:

- The authors give special thanks to Betty Daly-King of Western Australia for getting them started on the completion of Lewis B. Hainsworth's original works on this subject.
- Two background papers by Hainsworth are appended to the article "On the Possible Effects of Changes in Schumann's Resonances on Human Psychobiology"
- Appendix 1: The Effect of Geophysical Phenomena on Human Health (first published in *Speculations in Science and Technology*, vol. 6, no. 5, December 1983);
- Appendix 2: Electrical Technology and Human Evolution (*Speculations in Science and Technology*, vol. 11, no. 2, 1987)

Appendix 1

THE EFFECT OF GEOPHYSICAL PHENOMENA ON HUMAN HEALTH

L. B. Hainsworth Copyright:

Speculations in Science and Technology, Vol. 6, No. 5
(pp 439-444; Dec. 1983); used by permission of author's estate
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Abstract: *The possibility that human health is linked with geophysical parameters by way of the naturally occurring Schumann ELF resonant signals is discussed. It is concluded that the frequencies of the human brain-waves, especially that of the alpha-rhythm, evolved in response to these signals, and hence that variations in them can produce health changes. Because of the relationship between these signals and ionospheric, and other, conditions it is also deduced that, unless massive amount of data are used, attempts to establish a relationship between biological effects and ionospheric or geomagnetic parameters will produce confusingly contradictory results, as has happened. As the human system is apparently sensitive to such low-power ELF signals, it is also considered that these links need to be examined closely before any damage is caused by present-day technology.*

1. INTRODUCTION:

A number of attempts have been made to discover if there is any correlation between health and geophysical parameters such as geo-magnetic and ionospheric storms. However, such studies have paid little attention to the mechanism whereby such correlation could be produced, and this has almost certainly been responsible for producing confusingly conflicting results. As an illustration of this conflict, one such study which showed a very positive correlation was carried out by Malin and Srivastava (1), while another study of a similar kind by Lipa, Sturrock, and Rogot (2) showed no correlation of any significance at all. Between these two extremes lie a range of observations or results indicating varying degrees of correlation, and there are typical examples of such reports. (3), (4), (5), (6), (7), (8).

Two interesting points are made in the opening paragraph of the paper by Malin and Srivastava. Firstly, that most papers on the subject "conclude that there is such a correlation", and secondly, that "there is widespread skepticism concerning the reality of the correlation." A third point, that is not explicitly mentioned, is that results obtained by one group can often not be duplicated by another, although this is partially implied by the reference to the work of Lipa et al. As an illustration of this third point: a study for the year 1978 has been made of the admissions to the cardiac unit at the City General Hospital, Stoke-on-Trent, U.K., and no significant relationship has been found between the daily admissions and the planetary geomagnetic index, Kp-sum, published by the International Union of Geodesy and Geophysics.

The contrast between these results and those obtained by Malin and Srivastava must lead to skepticism of the results of the latter work, unless valid reasons can be found to account for the difference. Some possible reasons will be discussed later. The purpose of the present discussion, therefore, is to consider: Firstly, the reasons why a correlation might be expected to be found between health and geophysical parameters; secondly, what the possible range of such a correlation might be; and, thirdly, possible reasons for there being such large discrepancies between the results of

studies that have already been made. One set of geophysical factors which might have biological effects, and which do not seem to have been considered in this connection, are the Schumann resonant signals, and this study will examine the possibility of them being such a causal factor, They are linked with geophysical parameters that have been considered in other studies; and in such a way as may account for many anomalies already found.

2. SUMMARY OF DATA

There are sixteen items of data or information which seem to be concerned in forming the basis of the possible relationship. These are enumerated as follow, in related blocks, and will be referred to by [number] in the subsequent discussions:

- 2.1 Light flicker in the range of 3 - 30 Hz has biological effects.
- 2.2 Auditory signals in the range of 3 - 30 Hz have biological effects.
- 2.3 The dominant brain-wave rhythm, known as the alpha-rhythm, has an average signal frequency of about 10.5 Hz.
- 2.4 Mental disturbance is often considered as "stress-induced."
- 2.5 Heart attacks are often thought to be "stress-induced."
- 2.6 The cavity between the earth and the ionosphere resonates electrically so that electromagnetic waves, know as Schumann resonant signals, circulate in the cavity at frequencies down to the order of 6 Hz. The lowest four of these resonant electromagnetic signal modes lie between 6 and 30 Hz.
- 2.7 The Schumann resonant frequencies change with ionospheric changes.
- 2.8 The average frequency of the first Schumann mode is 7.8 Hz.
- 2.9 The average frequency of the second Schumann mode is 14.1 Hz.
- 2.10 The average frequency at which there is minimum power circulating in the earth/ionosphere cavity is 10.5 Hz.
- 2.11 Large ionsopheric changes occur during ionospheric storms.
- 2.12 Geomagnetic storms are associated with ionospheric storms.
- 2.13 Geomagnetic activity has been linked with heart attacks.
- 2.14 Geomagnetic activity has been linked with mental disturbance.
- 2.15 Ionospheric storms have been linked with mental disturbance.
- 2.16 The three last points have been regarded as "suspect."

3. DISCUSSION 3.1

Brainwave Frequencies and Schumann Resonances.

Since both visual and auditory stimulation at frequencies in the brain-wave spectrum produce biological effects [2.1 & 2.2], then electromagnetic signals in the same frequency range may also be expected to have biological effects, and there is already indirect evidence that this is so [2.13, 2.14 & 2.15]. Additionally, the frequencies of the first and second Schumann modes lie in the theta- and beta-rhythm regions respectively of the brain-wave spectrum [2.8 & 2.9], and the average value of the alpha-rhythm frequency coincides with the average frequency at which the power of the naturally occurring circulating electromagnetic signals is at a minimum [2.3 & 2.10].

Now while the association of the first and second Schumann modes with the theta- and beta-rhythms may be coincidence, the association of the alpha-

rhythm in relation to these modes is almost incredibly fortuitous if it is to be accidental. This is because if the alpha-rhythm frequency is accidentally related to the Schumann odes in the way that it is, then the evolutionary process, in which the basic frequencies of the biological rhythms were developed in response to the action of external factors, must have accidentally located the dominant, or alpha-rhythm frequency, at the precise point where there will be minimum interference from naturally occurring external signal sources. In parenthesis it might be mentioned that, in constructing any comparably complex communication, control, and computer system, this freedom from interference would be a prime requirement for any signal basic to that system operation, and would be designed into the system but not by accident.

Assuming that the relationship between the alpha-rhythm and the Schumann signals is accidental it is then necessary to consider what other factors, almost certainly of global extent, could have caused this evolution. The first alternative explanation for the development of the alpha-rhythm at this frequency is that in fact the development was truly accidental, and no evolutionary process or externally operating factors were involved. However, this requires that variations in the alpha-rhythm frequency should be much wider than have so far been observed, and at the same time casts grave doubts of evolution generally. The second alternative is that the physical size of the organism determines the basic frequency of resonance. So far as is known, no evidence is available to this effect.

The third alternative is that the alpha-rhythm frequency evolved in response to the existence of oscillatory signals other than the Schumann resonances. These could only be one of three kind, subsonic acoustic signals, optical flicker, or electromagnetic signals (which, of course, are the same type as the Schumann signals). Subsonic acoustic signals could occur naturally, but would be severely localized in their intensity, frequency and incidence; thus a general global effect at one frequency would be a virtual impossibility. Optical flicker on the required global scale seems to be equally unlikely, and finally, in this subset, if the chosen alternative is the electromagnetic signal, then this must accept the Schumann signals as being biologically influential, and they are already known to be significantly linked to the alpha-rhythm at least.

3.2 Geophysical Parameter Interrelations. Because other studies so far made have taken no account of the possible effects of Schumann resonances then, in attempting to deduce a possible relationship between geophysical changes and biological effects, it is necessary to consider the inter-relationship between the geophysical parameters that have been or may be used as a measure of geophysical activity. The frequency values of the Schumann resonant signals are determined by the effective dimensions of the cavity between the earth and the ionosphere. Thus any events which change these dimensions will change the resonant frequencies [2.7]. Such events could be ionospheric storms [2.11], and could even result from a man-made ionospheric disturbance as described by Balser and Wagner (9). Any such variation will be superimposed on normal diurnal variations that also occur.

Geomagnetic storms [2.12] are the magnetic changes produced by

ionospheric storms, and are thus associated with conditions capable of changing the Schumann signals. However, although such storms can produce these changes, measurement of these parameters can not give any indication of whether the resonant signals have changed to value outside their normal range or not. Since the undisturbed state of the ionosphere corresponds to normal Schumann resonance patterns, then ionospheric disturbances are likely to produce abnormal patterns, but will not necessarily do so in all cases. If biological response is linked to the Schumann signals, this will reduce any apparent link with geomagnetic ionospheric data.

3.3 Biological Response to ELF Stimulus Since a signal pattern already exists normally, it may be expected that the general response of the central nervous system to most electromagnetic signals conforming to this pattern will be neutral. However, if the earth/ionosphere cavity resonances shift outside of their normal pattern variations, then the central nervous system will be subjected to abnormal signals. The response may then be analogous to that produced by oscillatory optical and auditory stimuli, and, since the incident stimulus an abnormality, the most likely reaction will be the development of stress symptoms, which would link with mental disturbance and heart attacks [2.4 & 2.5].

A lower level of response is likely to include increases in irritability and absent-mindedness, and a consequent rise in accident rates. Although the general response of the biological system to abnormal patterns will be that which would result from an inimical situation, there will almost certainly be a limited number of abnormal frequency and field-strength combinations to which there may be a neutral or even beneficial response. There will also be a variation in the level of response of individuals, and in some few cases a variation in the type of response. Such variations can be expected because of the wide range of other conditions of which the individual such as the state of general health, factors which may have produced a preconditioning effect, etc. Thus, although the general biological response to abnormal conditions of the Schumann resonant signals is likely to be harmful, it will not necessarily be universal, and in some cases it may be beneficial.

4. CONCLUSIONS

Section 3.1 shows that the frequency of the human alpha-rhythm is related to ELF electromagnetic signals occurring naturally in the form of the Schumann resonant signals which circulate in the earth/ionospheric cavity, and hence indicates that the central nervous system is responsive to such ELF electromagnetic signals. Section 3.2 shows that, while there is a connection between ionospheric and magnetic storms and the Schumann frequencies, this connection can not be quantified to show when abnormality is present in the Schumann resonant frequency values. Section 3.3 shows that the response of the central nervous system to naturally occurring abnormalities in the Schumann resonant signals will not be completely uniform or universal.

If these results are taken into account, then the results of attempting to link biological effects with geophysical parameters consisting of measures of ionospheric or geomagnetic disturbance can be assessed, and would be

expected to be as follows. For small amounts of data, some studies would show a positive correlation with a high degree of significance, while others would show less significant or insignificant correlation. A few could even show a negative correlation, as some ELF electromagnetic signals could quite probably have beneficial effects. When massive amounts of data are used statistically significant correlation would be expected, but with a very much lower degree of significance than would have been desired, and such quantities of data should really extend over a period of not less than one full sunspot cycle. [Therefore, any future research project would do well to begin toward the end of a sunspot cycle and continue through the end of another, 11 years later--ed.].

Two other factors that could affect the apparent connection between geophysical parameters and biological effects are links with geographical considerations. Firstly, wind eddies carrying ionized air can produce oscillatory signals in the range of 3 - 6 Hz. These could be associated with thunderstorm activity, or with winds such as the Fohn wind in Austria, and could have biological effects which would be quite localized. And secondly, because of the high background level of electromagnetic noise in technologically advanced areas, then, in general, studies made in these areas will probably have much lower significance than studies made elsewhere. This deduced pattern of results, that could be expected for attempts to find a correlation between biological effects and the geophysical parameters usually considered, is precisely the pattern that has occurred in practice, which suggests that the present analysis is correct; i.e. the human biological system is responsive to very-low-power ELF electromagnetic signals, which are tenuously linked with geomagnetic and ionospheric conditions. As these effects include both heart attacks and mental and emotional instability, and can be seen to have links with the Schumann resonant signals, there is an urgent need to determine the exact extent of such links as quickly as possible. Advances in technology increase the amount of electromagnetic pollution daily, and comparatively recent developments have already produced a significant increase in the ELF component of this, and will produce more. For instance, most of the world is now subjected to electromagnetic signals which contain a component at about 10Hz. If the alpha-rhythm evolved in response to the absence of signals at this frequency, then continued exposure to such signals could be interesting - to an external observer. The best approach would probably involve continuous automatic hourly monitoring of the Schumann signals, and subsequent comparison with cardiological, psychiatric, and neurological records. It is anticipated that significant results would be obtained much more quickly than has been the case with other geophysical parameters. The results could then be of clinical benefit in a comparatively short time, to say nothing of avoiding the possibility of unexpected evolutionary changes.

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Appendix 2

Electrical Technology and Human Evolution

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Abstract: The influence of naturally occurring Schumann resonant signals on brain-wave pattern evolution is formally stated to show that low-power electrical fields could produce evolutionary change. The electrical fields produced by modern electro-technology are then considered briefly, as possible sources of evolutionary change. The characteristics of some forms which might result are considered, and some of the factors that might inhibit survival of existing forms.

The extent of research work being done in this area is assessed in relation to the lack of data available, showing that any expert opinion asserting that there is no danger from these fields is not based on measurements, and must therefore be quantitatively valueless. The final conclusion is that modern technology will change human evolution, and only extensive investigation of the naturally occurring signals will give any lead to show what results might occur. Brain-wave pattern evolution An analysis of factors that might affect the evolution or development of the human brain-wave frequency spectrum

showed that naturally occurring, extra-low frequency, electromagnetic fields were the only physical quantities that could have been responsible for that spectrum.

This conclusion, although attracting reasonable interest worldwide, has remained totally undisputed since its publication four years ago. (1) This leads to the further conclusion that, in the absence of any reasonable alternative, that hypothesis should be formally stated as: *"Factors determining frequencies of brain-wave signals The evolution or development of the frequencies of operation of the principal human brain-wave signals has been governed or determined by the frequencies of naturally occurring electromagnetic signals circulating in the electrically resonant cavity bounded by the Earth and the ionosphere. In particular, the alph-rhythm frequency has so developed that it is impossible for it to suffer any extensive interference from, or confusion with, naturally occurring signals."*

Corollaries to the Hypothesis

(1) The human biological system is sensitive to the existence of extra-low frequency electromagnetic fields. (2) Exposure of the human population to extra-low frequency electromagnetic signals, at frequencies which differ from those of the naturally occurring ones but in the same range, will evoke biological responses. (3) The responses will be such that, by further processes of natural selection, they will cause a change in the "natural" brain-wave frequency spectrum, i.e. they will produce a form of evolutionary change in the human species.

Additional Consequences

Further possible consequences could include the following: (1) The evolutionary change in the operational mode of the human central nervous system could cause drastic changes in human characteristics. (2) If the human system is sensitive to electromagnetic fields at extra-low frequencies, then it could also be expected to be sensitive to similar fields at other frequencies, in which case, exposure to electric fields associated with any power usage or any radio or television transmissions may also be hazardous. (3) Other species could also undergo evolutionary change as a result of exposure to unnatural oscillatory electromagnetic fields. (4) In the absence of careful and continuous measurements and observations, changes produced may escape notice until it is too late to alter them, or to prevent their spread.

Present-Day Electromagnetic Fields

Modern electro-technology subjects the whole world to artificially generated electromagnetic fields, at frequencies from the lowest brain-wave rhythm values up into the microwave spectrum. Much of this exposure in industrialized countries is linked to domestic use of electrical power. This spreads exposure into non-industrial areas by wave of power transmission lines, power transformers, radiation from domestic appliances and light industrial applications occurring in what are substantially non-industrial areas. Further sources of exposure, even more widespread and potentially dangerous, are modulated radio signals. These completely envelope the entire

world, and, even if there is no biological response to the radio-frequency component of such signals, there is no guarantee that demodulation of such signals cannot occur in a biological circuit, and hence inject signals at damaging low frequencies into that system. A particularly interesting type of modulated radio signal is the kind known as "over-the-horizon radar", in which the repetition frequency of the modulated pulses is very often in the brain-wave frequency range.

Perhaps the best known of these "facilities" is the Russian system known as "Woodpecker" radar, which blankets North America and Europe. However, there are many other installations of the same kind all over the world, including one said to be directed from Pine Gap, Australia towards South-east Asia for detecting possible drug runners, etc., one on Fylingdales Moor in North Yorkshire, UK, and one on Mormond Hill in North-east Scotland, UK. Thus, since there is no evidence of any error in the conclusions set out above, it seems that conditions for evolutionary changes in the human brain-wave patterns have apparently now been established.

In light of this, the present usage of electrical technology may be presenting one of the greatest environmental hazards that mankind has ever faced.

Change Mechanism

Such changes could be potentially disastrous, and will continue to affect our descendants until the present technology either collapses or is abandoned. Even then repercussions must occur as further evolutionary changes return the brain-wave rhythms to patterns compatible with natural conditions. Of course, the end product of such an evolutionary change need not be significantly different from the present product. Unfortunately, the history of technological side effects does not seem to include any that are not, at least, undesirable.

For example: the Eastern Mediterranean and the Great Lakes in North America are often regarded as ecological disasters, acid rain is creating havoc in Northern Europe, and heavy-metal pollution in restricted waters has made eating some fish dangerous in many areas, and even deadly in Japan. To assume that the end effects of present electromagnetic pollution may be less deadly would thus be the height of criminal irresponsibility, unless some extensive attempts have been made to assess what those effects might be.

In any event, the change-over process will be a painful one, governed by the principle of survival of the fittest, and extending over a timescale which could possibly be as short as two to ten generations: i.e. 80 to 400 years. While natural selection will determine what form of the species will survive, it is still only possible to speculate on precisely what those forms may be like, and on what processes might inhibit the survival of other forms.

Possible Survival Forms

Accepting that changed electromagnetic field conditions will result in changed brain-wave patterns, there is still not enough known about their operation to

say what effect this may produce in either the mental or physical characteristics of the organism. The possibilities seem to include: A drop in the intelligence of the surviving species. That is, the development of a moronic species, which would almost certainly be disastrous. *or* A rise in intelligence, which seems rather improbable.

or The development of a psychopathic species.

or The development of a species with the faculty of telepath or other unusual mental ability.

or The development of a species of telepathic psychopaths.

or The development of a species of telepathic genius.

or A mix of some of the above, *e.g.* some telepathic geniuses and some moronic psychopaths.

or No significant change, which is a condition that could really only be assessed by an independent observer in a few hundred years' time, if it was then certain that none of the foregoing changes had occurred. These are just some of the possible changes in the human species that could result from the changes in brain-wave patterns that will follow from exposure to our continued thoughtless use of electrical systems.

Factors Inhibiting Survival of Other Forms

For the principle of natural selection to apply, those forms adaptable to the changed environment must be more likely to breed than those who are not, and there are various possibilities as to how this may happen. However, the most likely factor for bringing this about is the elimination of the less adaptable forms before breeding can occur, *i.e.* at a comparatively early age.