Article

Geomagnetics & Consciousness: Geomagnetic Field Effects & Human Psychophysiology (Part I)

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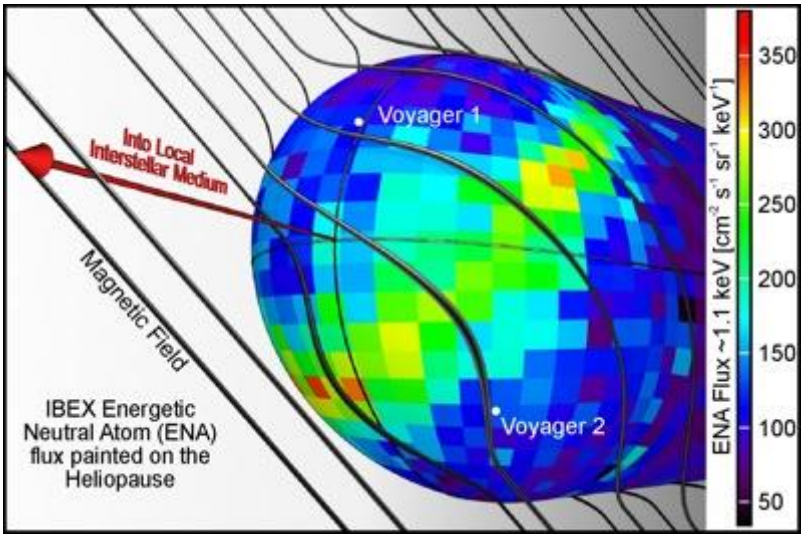
ABSTRACT

Anomalies during geomagnetic storms have potential psychophysical effects on human populations, as well as our technologies. Energetic events and ejections of plasma from the Sun cause dramatic changes in the radiation belts and magnetic field of Earth, as well as fluctuations in Schumann Resonance. Ben Lonetree has conducted numerous experiments correlating local geophysical anomalies in earth's magnetic field with EEG brainwaves of many subjects, and anecdotal reports of changes in consciousness. This article covers some basics of geophysics, electromagnetic effects on human psychophysiology, with some theories of psi and anomalous experience related to geomagnetics.

Part I of this two-part article contains: Introduction; & I. Geophysics.

Key Words: geomagnetic field effects, geophysics, magnetosphere, space weather, paranormal potential, biophysics, anomalous experience, solar wind, brainwaves, EEG.



(Source: IBEX Magnetic Field Influence; Southwest Research Institute, "Heliosphere", Wikipedia)

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Introduction

Research has proven that changes in solar/geomagnetic activity can affect our emotions and collective behavior. Every cell in your body is bathed in an environment of magnetic forces which are invisible to the human eye. Numerous rhythms within your body can synchronize with solar and geomagnetic activity. The earth's magnetic resonances vibrate at the same frequency as human heart rhythms and brainwaves. The earth's constantly changing electromagnetic fields may be affecting your day-to-day health, feelings and behavior. When the sun's emission of a 2.8-gigahertz radiowave frequency is increased we tend to feel better. Geomagnetic field disturbance is associated with lowered heart rate variability, indicating our nervous system is not functioning as well. Earth's magnetic fields can affect your health and daily life. Heart coherence helps reduce emotional reactions during solar flares. Solar flares can disrupt your sleep. Migraines may correlate with geomagnetic disturbances. You can feel more mentally fogged during solar flares. We are more intuitive during full-moon periods. --Heartmath

Even a single cell has its characteristic shape and anatomy, all parts of which are in constant activity; its electrical potentials and mechanical properties similarly, are subject to cyclic and non-cyclic changes as it responds to and counteracts environmental fluctuations. --Mae-Wan Ho

Twenty times more solar particles cross the Earth's leaky magnetic shield when the sun's magnetic field is aligned with that of the Earth compared to when the two magnetic fields are oppositely directed." --Marit Oieroset on THEMIS spacecraft data

This article covers some basics of geophysics, electromagnetic effects on human psychophysiology, with some theories of psi and anomalous experience related to geomagnetics. Geophysics uses quantitative means to describe the physics of the Earth and its environment in space. This vast magnetic cocoon is a force-field that has sheltered our journey through space for billions of years. Sometimes strengthening and weakening over long periods, the magnetosphere protects us against the bombardment of particles continuously streaming from the sun (solar wind). Because the solar particles (ions and electrons) are electrically charged, they feed magnetic forces. Most are deflected by our planet's magnetic field. However, our magnetic field is a leaky shield and the number of particles breaching this shield depends on the orientation of the sun's magnetic field.

A storm of mantle plumes is brewing deep within the Earth (NOVA transcript), threatening to weaken this crucial magnetic defense, increasing levels of space radiation. Another vector is the 2013 peak of Solar Cycle 24. NASA suggests the intensity of geomagnetic storms during Solar Cycle 24 may be elevated in some areas where the Earth's magnetic field is weaker than expected. Such field anomalies have potential psychophysical effects on human populations, as well as our technologies. Energetic events and ejections of plasma from the Sun cause dramatic changes in the radiation belts and magnetic field of Earth, as well as fluctuations in Schumann Resonance. Alpha brain rhythm (8-12 Hz) overlaps the Earth's background frequency of 7-10 Hz, suggesting as many researchers have that our awareness is related to the rhythms of our host planet, and perhaps a coupling of individual and universal consciousness. Such oscillations are quantum time-keepers and bioregulators.

Electrical engineer, Ben Lonetree has continuously monitored several geophysical parameters over decades. His highly sensitive custom equipment outperforms government stations. He says, "There is a reason why my system responds to many things other magnetometers do not. Most are fluxgate mags that sample a collapsing field at a very slow sample rate. My system is simply a very large induction coil that after the amplifier and filter stages couples into an analog to digital converter. I have the converter programmed to use a sample rate of 240 times per second. So the system sees every little blip there is out there."

He has conducted numerous experiments correlating local geophysical anomalies in earth's magnetic field with EEG brainwaves of many subjects, and anecdotal reports of changes in consciousness. Preliminary experiments were done as proof of concept with intent to investigate the possibilities more deeply. Mentioned here, the results are covered in another article, "The Sedona Effect". The sun inductively couples to the earth and to humans. And human energy fields inductively couple to other human fields. First we need an understanding of induction. We can connect our bodies' energy field to Earth's field which in turn connects to the sun and other planets fields, which in turn can connect to the galaxy's core and beyond.

I. Geophysics

Introduction to Geophysics

A multidisciplinary science, Geophysics describes the physics of the Earth with quantitative means, including gravity, heat flow, vibrations, electricity, magnetism, electromagnetic waves, radioactivity, fluid dynamics, mineral physics, and its environment in space. Heliophysics is the study of the Sun-Earth connection, commonly known as "space weather". We are learning more about how space weather affects life on Earth

The Sun is a massive electromagnetic broadcaster which floods the planets of the solar system with heat, light, UV radiation and electrically charged particles. The Sun itself has a magnetic field that creates an "egg" around the solar system -- the heliosphere. The solar magnetic field polarity (solar dipole magnetic field) reverses in 11-year cycles associated with sunspot activity, peaking at solar maximum, in this Cycle 24 in 2013.

The Sun continues crackling with magnetic storms that may or may not spawn more Coronal Mass Ejections (CMEs) aimed toward our fragile globe. Streams of high-energy, charged particles rush from the sun to batter the Earth with protons and/or X-rays, and disrupt the magnetosphere. The length of that disruption varies until the magnetosphere is drained of its storm-time energy. Proton pulse events create spectacular *aurora borealis* displays as the particles pass through Earth's orbit, concentrating their energy on the northern parts of our planet.

NASA (Phillips) describes magnetic portals connecting the Earth and Sun as active and passive "flux transfer events" (FTEs). The Earth-Sun connection is unsteady, often escalating to dynamic bursts of energy. Magnetic fields in the magnetic cylinder twist and coil as the solar and earth

fields merge approximately every eight minutes. Computer simulations help us understand how they work. Active FTEs let particles flow through conduits into Earth's magnetosphere. Passive FTEs offer more resistance to flowing particles and fields.

Earth has had a variable magnetic field for at least 3.5 billion years, which NASA characterizes as being in a "constant state of change". It is produced by convection currents of an electrically conducting iron-nickel alloy in the liquid core, about 3,000 kilometers below Earth's surface. It can be modified by emissions from the Sun, cosmic debris, and heat convection in the core of the planet. In recent years the magnetic pole has been wandering more quickly. Compass needles are drifting and the global magnetic field has weakened 10% since the 19th century.

At irregular intervals, averaging 300,000 years, the poles flip completely, but that is beyond the scope of this paper. The magnetosphere is a generally a highly stable field, which can be periodically inconstant, perpetually bombarded by energetically charged solar particles (solar wind). A mass of charged particles can slam into our planet's magnetic field, sending jolts of electromagnetic energy shooting in all directions, causing what's known as a geomagnetic storm. For sensitive people in the right [or wrong] locales it may also lead to "brainstorms".

Powerful fountains spew away from the sun as solar flares or coronal mass ejections (CME). If aimed at us, within hours they can bombard Earth with a shower of positively-charged hydrogen atoms, called protons. Proton bombardment can cause scientific and communications satellites to short-circuit. Highly sensitive people report dysphorias. Chemical reactions in the atmosphere can drastically diminish the upper-most areas of the ozone layer that blocks life-threatening ultraviolet radiation from reaching the Earth.

The Earth's magnetic field extends about 36,000 miles (58,000 km) into space. It can be treated mathematically as a dipole field with a number of non-dipole elements. Generated from the spinning effect of the electrically conductive core, it acts like a giant electromagnet. In geologically ancient times, the field was 20 times stronger, but it has also been periodically weaker or even absent. Movement of the liquid and the solid parts of the Earth's core generate an electric potential, making the planet an electric generator. Regular daily and monthly fluctuations in the GMF are affected by weather, the Moon, and sunspots.

Magnetism is a property of the atom itself. Ultimately, the magnetic properties of matter are determined by the collective behavior of the negatively charged electrons that orbit the nuclei of atoms. The magnetic dipole moment (or magnetic field) of an individual electron has two components, one resulting from the spin of the electron about its own axis, the other from its orbital motion about the nucleus. Both kinds of motion may be considered as tiny circular currents (moving charges), thus linking electricity and magnetism at an atomic level.

Accelerator Mass Spectrometry (AMS) is a new ultra-sensitive single atom counting method that reads the concentrations of the most relevant long-lived cosmogenic radionuclides. Forming an archive of our earth, chronological deposits of such isotopes are found in trees, polar ice, lake and deep sea sediments. AMS is virtually the only way to measure their concentrations. Information about long term interval changes on solar activity, geomagnetic field and earth climate can be obtained and collated.

Turbulence & Polarity Transitions

The GMF is influenced by currents in the mantle on a time scale of tens to hundreds of millions of years. Temperature patterns within the lower mantle influence both the stability and intensity of the field. Massive changes in or on the Earth, including extinction events, follow a 26.6 million to 30 million year cycle over the last 250 million years. The solar system crosses the relatively dense galactic plane every 30 million years. GMFs are implicated in some mass extinction events.

Unexpected escalation of climate change demonstrates that perturbing natural cycles can lead to cascades of cataclysmic change related by complex dynamics. Our climate is degrading much faster than most of us thought. One small change can disrupt a system already in motion, ultimately leading to cataclysmic results.

As early as 1906, changes in the magnetization of some rocks opposite to that of the present day made it clear that some time ago it was different from the modern time. But, long before pole reversal -- or more accurately, geomagnetic reversal -- we could expect escalating experiential effects, based on effects we see during solar storms.

All kinds of mental and physical phenomena might fluctuate long before any 'tipping point'. If ecological cataclysm looms (Lovelock, 2009), geomagnetic cataclysm is also a possibility. The Sun is also heating the interior of the earth, which increases volcanism and tectonic plate shift. It is heating the whole solar system.

Many land and underwater volcanoes are located on or near subduction zones, rifts, and trenches, associated with an increase of mantle plumes -- core heat rising to the surface. Large mantle plumes build islands, even continents. The land is built, stretched and destroyed on volcanic rift margins.

Compound dynamic forces have many effects:

Climate Change: Unexpected escalation of climate change demonstrates that perturbations in natural cycles can lead to cascades of cataclysmic change related to complex dynamics. Likewise for the ocean-conveyor, methane traps, and other threats to human survival. One small change, such as mantle-held flux, can disrupt a system already in motion, ultimately leading to cataclysmic results. Very little is known about the behavior of the magnetic field during the transition from a superchron (long periods without reversal) to a mixed polarity state, though we can imagine intense auroras surrounding the globe. Supernova gamma ray events, galactic superwaves (Laviolette, 1986) and cometary showers have been linked with geomagnetic excursions. Complex cycles of climate migration and Earth crust instability share 1) the sun-earth relationship, embedded in the solar system, 2) solar heliopsphere and bow shock of geomagnetic field, 3) Earth's connection to our galactic center plasma fields.

Polarity Intervals: Long before pole reversal -- or more accurately, geomagnetic reversal -- we might plausibly expect an amplification of human experiential effects. Geomagnetic cataclysm is only a possibility. In Australia around 28,000 B.P., a wandering di-pole event signaled sudden 3x

expansion of the magnetic field. Some postulate a geomagnetic excursion around 12,500 B.P. that sent tribal villagers in the Levant back to nomadic life. (Mithen, 2004)

Paleomagnetosphere: Anomalous inclinations in the South Pacific are also recorded in the geological record for 2,500 and 12,500 years ago. (Lund, et al) There is also evidence of high-energy particle bombardment at the same time, associated with extinction events. 12,000, 32,000, 43,000 and 70,000 yrs ago the reduced magnetic field rendered Earth especially vulnerable to cosmic rays. Whether geomagnetic excursions admit cosmic radiation or the gamma blasts cause the excursions is uncertain. There have been some indications that geomagnetic reversals may occur astonishingly fast-- even within only a matter of months, according to one location of 16 million year old lava flows.

Magnetic Cataclysmic Variable: Geomagnetic reversal is chaotic in nature. Large oscillations of directions precede or follow reversals, showing waveforms with amplitude amplified by the decrease of the dipole. There is no apparent preferred location for the virtual geomagnetic poles (VGP). Asymmetry between pre- and post-reversal phases is a dominant characteristic, indicating the importance of field regeneration to initiate a new stable polarity interval. Virtual Dipole Moments show as reversed (R) polarity, intermediate-normal-reversed (I-N-R) change and subsequent normal (N) periods. There is no way we can predict it. Yet, it is a normal pursuit of science to identify and extrapolate future scenarios, including geomorphology. The goal is to anticipate and mitigate effects on humanity and the biosphere. We are challenged not by single alterations but a complex confluence of unstable systems. This is not to say, "The End is coming," but to identify phenomena, which might arise along the way to major earth changes. It is permissible to ask, "What if..."

Chaotic Dynamics: Geomorphological systems containing bifurcations have both deterministic (universal and necessary) and probabilistic (historical happenstance) elements. They have more than one solution (configuration) and this fact calls into question notions of process domains leading to the development of characteristic forms. They possess varying degrees of susceptibility to change induced by fluctuations. They respond differently to local, regional, and global fluctuations. Geomagnetic Field (GMF) is one of these parameters. When meteor impact occurs there may be a time lag from initiating event to actual field reversal of many thousands of years. During part of the interim the field may measurably weaken down to a certain plateau. Then, after perhaps more thousands of years have passed at or near the plateau, a relatively sudden reversal may take place. Some evidence indicates extraordinarily rapid change of the geomagnetic field during a reversal.

Intense Heat & High Pressure

Geomagnetic reversal is chaotic in nature. There is no way we can predict it. Polarity reversal is connected heat convection in the mantle. The latest theory is that changes in heat flow from the Earth's core into the base of the overlying mantle leads to pole shifts. Heat-loss in the core-mantle boundary drives the reversal. The mantle exerts a reciprocal control on the core.

Pole flip starts with short distance wandering of the north pole, to the extreme where magnetic north dips below the equator, ending in full magnetic reversal. Dr. Andrew Biggin suspects that True Polar Wander (TPW) changes the pattern of heat flowing out of the core.

TPW is caused by the changing density distribution in the mantle. It changes the pattern of heat flowing out of the core causing the magnetic field to first become less stable, with lots of reversals, and then become much more stable – and stop reversing. It stabilizes when there are less magma outpourings from the core.

South Atlantic Anomaly

The magnetic field occasionally flips over in its normal cycle. Reversals are random events. But they are preceded by marked field fluctuations such as the South Atlantic Anomaly (magnetic field intensity 60% of predicted value).

The South Atlantic Anomaly (SSA) is above South America, about 200 - 300 kilometers off the coast of Brazil, extending over much of South America and the nearby portion of the Van Allen Belt. It is a weak spot in the GMF, Earth's protective bubble. The envelope here is 1/3 of normal. As this field continues to weaken, the inner Van Allen belt gets closer to the Earth and proton bombardment increases. There is an increased flux in this region.

Sudden fluid motions within the Earth's core can alter the magnetic envelope around our planet. Researchers have just begun to detect such rapid magnetic field changes taking place over just a few months.

The last major reversal in the field took place about 780,000 years ago. A flip in the north and south poles typically involves a weakening in the magnetic field, followed by a period of rapid recovery and reorganization of opposite polarity.

Some studies in recent years have suggested the next reversal might be imminent, but the jury is still out. Weakening of Earth's overall magnetic field by 10 percent over the past 150 years might also point to an upcoming field reversal. But it only happens about once in a million years.

Earth is a Dynamo

When the sun reaches deep into the earth, it "talks" to her and modifies the generator within her. The ionosphere is one poorly understood channel. The sun interacts magnetically with the solid Earth, reaching down into the crust, generating forces that can trigger earthquakes that either rupture or slide.

Before major earthquakes, the crust "talks" back to the ionosphere, causing perturbations. Magnetic field maxima and minima move around over the surface of the earth. The total amount of coupling changes over time. Electrochemical loops cross, increasing quake likelihood.

Earth itself acts as a magnet. Minerals in the earth's crust contain dormant electronic charge carriers. They act like electronic crystals when energized. Squeezing, heating or stressing such rocks activates them so they can travel through the earth for kilometers changing conductivity, generating Lorenz force interacting with tectonic force vectors, pushing the system over the edge. Rapid magnetic field variations lead to ULF emissions. They ionize the plasma in the atmosphere, measurably perturbing the ionosphere, the coupling mechanism.

Earth constantly generates ULF emissions. Life evolved in this ULF field. The fundamental Schumann Resonance is a standing wave in the atmosphere around 8 Hz. The human brain emits frequencies in the same region. Up to 12-14 days before a quake, broadband ULF emissions before major earthquakes can swamp the whole ULF spectrum, affecting the brains and circadian rhythms of animals and humans. Currents may be higher in highly mineralized areas with crystalline basement rock, such as Sedona, Arizona.

Stressed rocks are active charge carriers which turns them into batteries. The driving force is deep magma and tectonic strain. Electric currents, up to millions of amperes, start to flow like in a semiconductor battery, perturbing earthquakes. Currents up to millions of amperes flow along stress gradients, fluctuating and emitting EM radiation. Therefore, Earth emits powerful broadband EM waves prior to quakes, in microhertz to about 20 hz. extremely low frequencies (ULF).

Paleomagnetic records show that the dipole polarity of the geomagnetic field reversed many times in the past. Convection in the fluid outer core is continually trying to reverse the field. However, the solid inner core inhibits magnetic reversals because the field in the inner core can only change on the much longer time scale of diffusion. Only once in many attempts is a reversal successful. This is probably the reason the times between reversals of the Earth's field are long and randomly distributed.

Geophysics

Scientists from the Institute for Geomagnetism at the Russian Academy of Sciences say the magnet poles are gradually drifting towards the Equator, reaching zero point in about 2,000 years, which would be a disaster for living organisms. The rate of change in the planet's liquid core, however, means that the shift could happen much sooner.

In 2001, an international polar expedition revealed that in seven years the North magnetic pole shifted around 300 km (186.4 miles). Currently, it is drifting 40 km (24.85 miles) a year from the Canadian Arctic shelf towards Russia's Severnaya Zemlya Islands. Scientists predict the North Pole could eventually be found in the South Atlantic.

Russian scientists say dangers include anti-radiation protection falling, with space flights becoming impossible and energy-dependent systems, including mobile phones and satellites, failing. Then, solar and space radiation would affect the genome of the organisms inhabiting the Earth, causing some of them to become extinct, while others mutate at a higher rate. With extremely powerful electrojet currents, life may become impossible on Earth before the full magnetic field collapses.

In the last 90 million years, the magnetic poles changed around every 500,000 years, with no total extinction or mass genetic mutations of living organisms taking place. The atmosphere remained a reliable steward of Earth's biosphere.

Pole Reversal

We know about pole shift from an examination of the geological record -- the magnetic poles reverse without the axis of the Earth flipping in any way. We can read the evidence of many magnetic reversals in the relentless march of the seabed floor. Valkovic links massive faunal extinctions with polarity reversals in earth's geomagnetic field. He assumed that the concentration factor for essential trace elements is dependent on the magnetic field.

When lavas are deposited on the Earth's surface, and subsequently freeze, and when sediments are deposited on ocean and lake bottoms, and subsequently solidify, they often preserve a signature of the ambient magnetic field at the time of deposition. This type of magnetization is known as 'paleomagnetism'. Sediment samples from Chalco Lake, Mexico "shows low frequency components with characteristic periods of 10,500, 3200–3400, 2900–3000, 1400–1500 and 800–900 years. In phase oscillations of inclination and intensity records point to drifting non dipole field anomalies." (B. Ortega-Guerrero and J. Urrutia-Fucugauchi, 1997)

Careful measurements of oriented samples of faintly magnetized rocks taken from many geographical sites allow scientists to work out the geological history of the magnetic field. We can tell, for example, that the Earth has had a magnetic field for at least 3.5 billion years, and that the field has always exhibited a certain amount of time-dependence, part of which is normal variation. An occasional reversal of polarity also occurs spontaneously in 3D computer models of the Geomagnetic Field. A similar reversal happens to the Sun every 11 years.

The geomagnetic poles are currently roughly coincident with the geographic poles, because the rotation of the Earth is an important dynamical force in the core, where the main part of the field is generated. Occasionally, however, the variation becomes sufficiently large so the magnetic poles end up being located rather distantly from the geographic poles. The poles have undergone an 'excursion' from their preferred state.

We know from physics that the Earth's dynamo is just as capable of generating a magnetic field with a polarity like that which we have today, as it is capable of generating a field with the opposite polarity. The dynamo has no preference for a particular polarity. Therefore, after an excursional period, the magnetic field, upon returning to its usual state of rough alignment with the Earth's rotational axis, could just as easily have one polarity as another.

The consequences of polarity reversals for the compass are dramatic. Nowadays, the compass points roughly north, or, more precisely, the north end of the compass points roughly north at most geographical locations. However 780,000 years ago, the polarity was reversed, so a hypothetical compass pointed roughly south. Before that reversed state the polarity was like that which we have today, and the compass would have pointed roughly north, and so on. The timings of reversals forms the so-called 'geomagnetic polarity timescale'.

During a reversal the geometry of the magnetic field is much more complicated than it is now. A compass could point in almost any direction depending on one's location on the Earth and the exact form of the mid-transitional magnetic field. There is no apparent periodicity to reversals. They are random events, happening as often as every 10 thousand years or so, and as infrequently as every 50 million years or more.

Antimatter

NASA discovered in 2003 that solar explosions produce antimatter that is projected in CMEs exploding from the sun's surface. Antimatter is created in flares when the fast-moving particles accelerated during the flare collide with slower particles in the Sun's atmosphere, producing it in one location and destroying it in another. (NASA)

In a private letter (June 10, 2011), engineer Tom Bearden does not assume a connection between solar radiation and potential pole reversal: *The earth's magnetic field, as any EM field energy, originates directly in the virtual state vacuum because of the proven broken symmetry of the earth's magnetic dipolarity. This means that, as long as the poles exist, then the earth's magnetic dipole will freely absorb virtual energy from the seething vacuum, integrate it to quantum size, and pour out real observable magnetic field energy steadily and without cessation.*

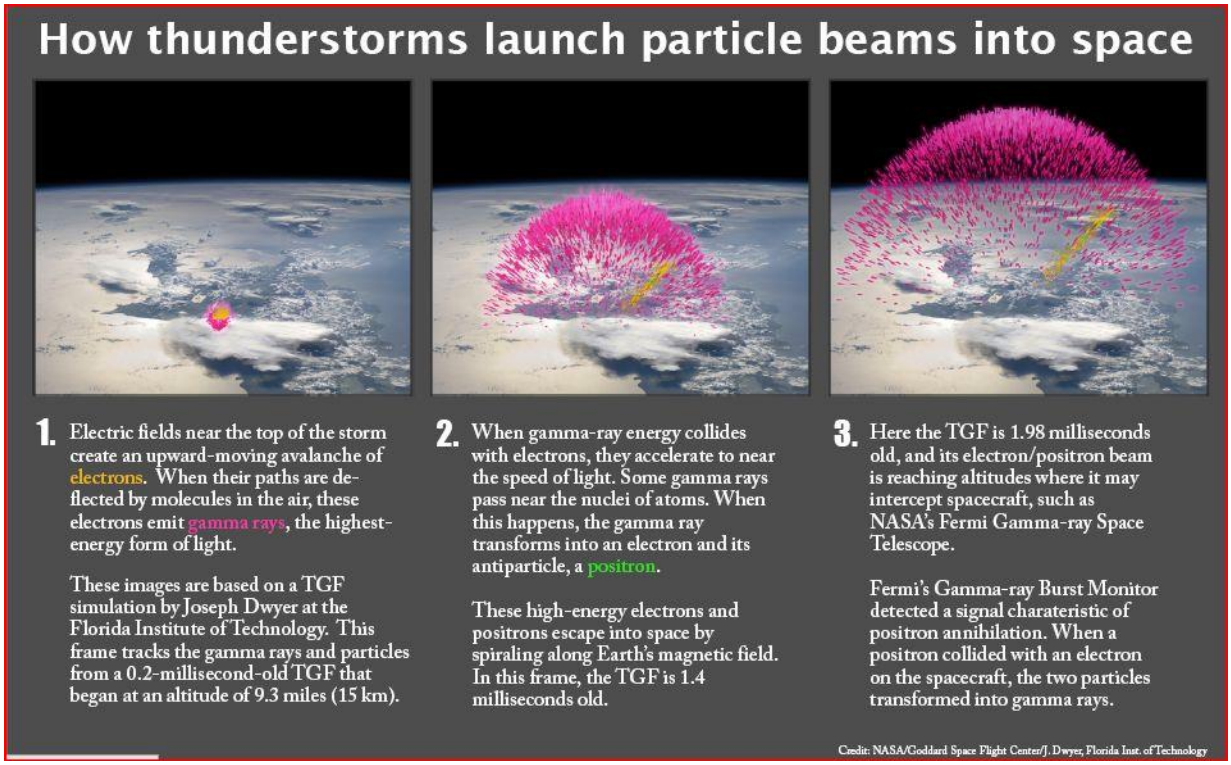
Anything that breaks that ironclad law would have to rather totally destroy the earth's two opposing magnetic poles. To destroy such monstrous poles, the effect would first have to be destroying jillions of minor subordinate dipoles throughout the earth, etc. I know of nothing in history that indicates such a calamity from the solar eruption. That doesn't mean it could not exist; but just that -- if it does exist -- it would be just about the most highly unusual thing that's ever been and I therefore have no knowledge of it.

Perhaps supporting that notion, a thin belt of antimatter, "antiproton radiation belt", or an "antimatter reservoir" was discovered (2011) in our upper atmosphere. Antiprotons, the antimatter version of protons, are formed naturally in interstellar space. Similar to what happens in high-energy collisions in accelerators, cosmic rays colliding with nuclei in the upper atmosphere create new particles, including pairs of protons and antiprotons. Most rapidly annihilate but those escaping interaction with ordinary matter may get trapped in Earth's geomagnetic field as the probe PAMELA (Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics) discovered. The flux of antiprotons in this region is three order of magnitude higher than in interstellar space.

The big break came from an area known as the South Atlantic Anomaly, which is a region of space where the Van Allen Radiation Belts are the closest to our surface. . . The International Space Station requires extra shielding just to protect its astronauts as it passes through it, and the Hubble Space Telescope has to be turned off every single time it passes through the anomaly...which is multiple times daily. [T]he PAMELA team [declared] the South Atlantic Anomaly "the most abundant source of antiprotons near the Earth." (Adriani)

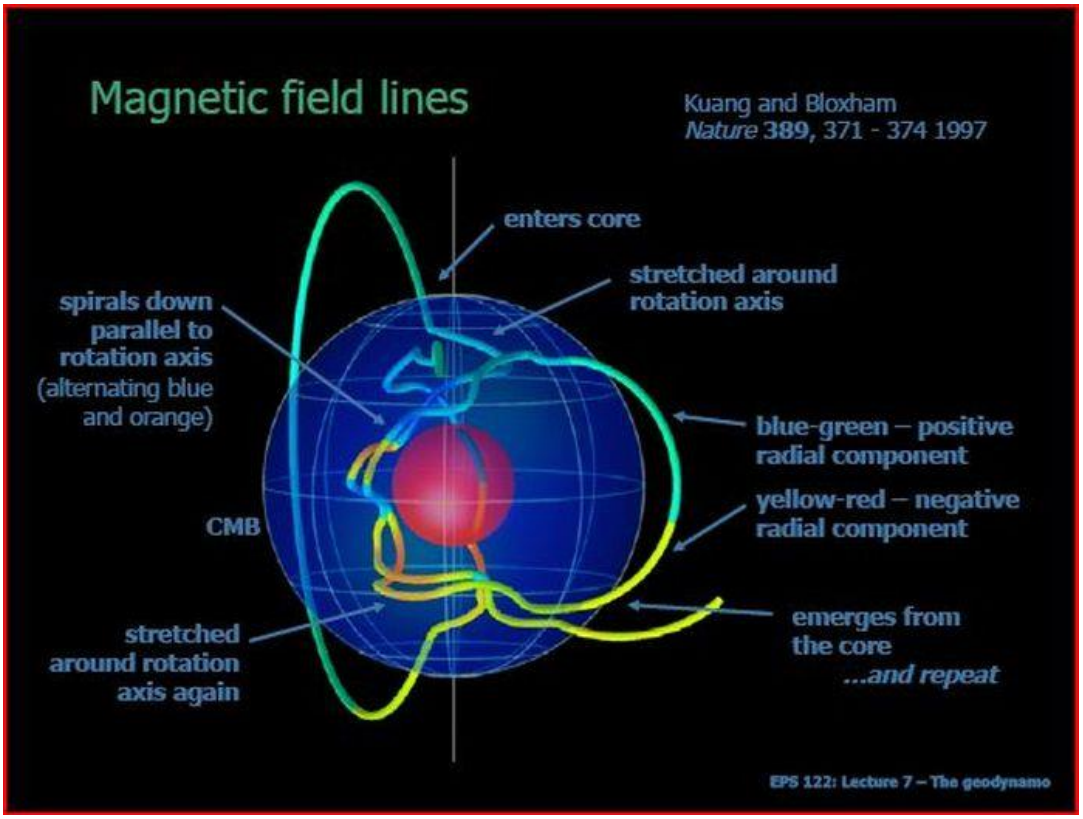
The existence of a significant flux of antiprotons confined to Earth's magnetosphere has been considered in several theoretical works. These antiparticles are produced in nuclear interactions of energetic cosmic rays with the terrestrial atmosphere and accumulate in the geomagnetic field at altitudes of several hundred kilometers. A contribution from the decay of albedo antineutrons has been hypothesized in analogy to proton production by neutron decay, which constitutes the main source of trapped protons at energies above some tens of MeV. . . . PAMELA data show that the magnetospheric antiproton flux in the SAA exceeds the cosmic-ray antiproton flux by three orders of magnitude at the present solar minimum, and exceeds the sub-cutoff antiproton flux outside radiation belts by four orders of magnitude, constituting the most abundant source of antiprotons near the Earth. (Adriani)

But a second pathway that involves a few more steps produces the majority of these particles in our planet's vicinity. Small numbers of neutrons (neutrally charged particles) escape the upper atmosphere, where they first decay into protons that are captured by the Earth's magnetic field. Following collisions with cosmic rays, these protons produce antineutrons (in pairs with neutrons), that then decay into antiprotons. These antiprotons will remain held in orbit until they collide with normal matter and are annihilated; they typically travel distances of several Earth radii before this happens. (Niemeyer)



(Source: Credit: NASA's Goddard Space Flight Center/J. Dwyer, Florida Inst. of Technology http://www.nasa.gov/pdf/509357main_Trio_noshadow_300dpi.pdf)

NASA also discovered thunderstorms may be producing antimatter "particle beams" in the upper atmosphere. *Scientists think the antimatter particles were formed in a terrestrial gamma-ray flash (TGF), a brief burst produced inside thunderstorms and shown to be associated with lightning. It is estimated that about 500 TGFs occur daily worldwide, but most go undetected.* (NASA 2011)



The Earth's mantle plays a role in controlling the frequency of magnetic field reversals. Heat flux varies across the core-mantle boundary. http://seismo.berkeley.edu/~rallen/eps122/lectures/L07.pdf

Geodynamics & Geomagnetic Excursions

We are only beginning to understand the potential sets that influence geodynamic cycles and anomalies. Our globe is a self-exciting dynamo coupled to fluid motion in the Earth's outer core through magnetohydrodynamics involving heat transfer and convection. Thermal and compositional buoyancy causes flow. The magnetic field is generated and regulated by outer core flow.

Clearly, much remains for us to learn about the nuances of geophysics, much less its effects on our psychobiology. We don't know what happens to the human organism under reduced field strength and global magnetic chaos. Mean human expansion time is approximately 40,000 years ago. It also marks a time of potential interbreeding with Neanderthals and perhaps *Devisova Hominin***.**

But, 40,000 Years Ago a trifecta of catastrophes impacted the globe: Climate Shifts, Geomagnetic Field Reversal and a Super Volcano. Scientists have probed the link between magnetic polarity reversal and heat in the planet's interior. Mega-magma plumes underlying supervolcanoes arise from increased heat flow from the earth's core -- the changing pattern of heat loss across the core-mantle boundary. Supervolcanoes can have global catastrophic effects comparable to major meteorite impacts. The Campanian Ignimbrite super-eruption took place 39,000 years ago, decimating vast stretches of the Mediterranean.

41,000 years ago, say the researchers, a complete and rapid reversal of the geomagnetic field occurred. Along with the Black Sea sediment cores, they look at other studies in the North Atlantic, the South Pacific and Hawaii, and say it proves that this polarity reversal was a global event. (Science 2.0)

Researchers discovered numerous abrupt climate changes during the last ice age locked in cores from the Black Sea, and already known from the Greenland ice cores. Synchronizing the Black Sea and Greenland data reveals the largest volcanic eruption on the Northern hemisphere in the past 100,000 years. A supervolcano erupted 39,400 years ago near Naples, Italy, as documented in the Black Sea sediment.

Forty thousand years ago Earth's shields went down in a geomagnetic excursion called the Laschamp Event. The field was only 5% of today's strength. For 440 years it was associated with a field strength that was only one quarter of today's field. The actual polarity changes lasted 250 years. The Earth nearly lost its protective shield against hard cosmic rays, leading to significantly increased radiation exposure, as revealed in ice cores. High-energy protons from space collided with atoms of the atmosphere.

Naturally, genes mutate all the time, but increased exposure to cosmic rays increases such likelihood. Mutations can be useful, harmful or neutral in their effects. Most simply turn genes off. Did such radiation produce reproductive challenges? Some believe the red hair mutation first appeared between 38,000 to 18,000 B.C. in Europe. Environmental variables related to latitudinal variation, such as species richness and mean annual temperature, may have influenced adaptation.

Arguably, the boundary between the Middle and Upper Palaeolithic marks the transition to fully modern humans. There may or may not be causal links to cosmic bombardment, but around the same era, some theorize mutations occurred in human bloodtypes, and "The Leap" in intelligence (40-45Kya). Language, creative and technological innovation increased dramatically. Homo sapiens extended its population to Europe, Asia and Australia about 40,000 - 50,000 years ago. Also, 40,000 to 45,000 years ago some groups migrated from the Levant back to Africa as well as toward Europe. Genetic mapping shows that a mutation from RH positive to RH negative occurred somewhere in the Basque area of Europe maybe as much as 40,000 years ago.

Cro-Magnon man appeared approximately 40,000 years ago. European-Asian groups diverged 40,000 years ago. Ancient DNA reveals humans living 40,000 years ago in the Beijing area are related to present-day Asians and Native Americans. For the Chinese, Korean, and European genomes, effective population size fell from about 13,500 (at 150,000 years ago) to about 1200 between 20,000 and 40,000 years ago. Hunting bands found their way to Australia between 40,000 and 30,000 years ago. Art and music were born suddenly, about 40,000 years ago, in Ice Age Europe. The earliest evidence for personal ornaments appeared in anatomically modern humans about this time.

There were other local stressors including glaciation, drought, and climate change. About 40,000 years ago in what we now call Italy and the Caucasus Mountains, which straddle Europe and Asia, several volcanoes erupted in quick succession. It's likely the eruptions reduced or wiped

out local bands of Neanderthals and indirectly affected farther-flung populations, a team concluded after analyzing pollen and ash from the affected area. The researchers examined sediments layer from around 40,000 years ago in Russia's Mezmaiskaya Cave and found that the more volcanic ash a layer had, the less plant pollen it contained. (Than, 2010)

If mankind was able to make such quantum leaps during environmentally chaotic times, perhaps that bodes well for our adaptive future. Life and culture appears to be quite different before and after 40,000 years ago. Whatever complex forces drove it this was a cultural Big Bang that seems to coincide with the most recent geomagnetic excursion. Paradoxically, we might not have expected magnetic chaos to have any positive effect on our organism, but the total environment may have created a unique psychobiological challenge for our species.

(Continued on Part II which also contains the references)