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Reinterpreting Earth: A Plasma-Based Interior Structure and Geomagnetic Resonance Model

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Abstract

Recent geophysical anomalies—including nonlinear seismic propagation, discontinuous crustal transitions, and transient geomagnetic fluctuations—have raised fundamental questions about the classical solid-core model of Earth's interior. This study introduces a plasma–gas convection model in which Earth's inner system is characterized by ionized plasma flows, condensed gas dynamics, and electromagnetic field interactions. Central to this model is the hypothesis that Earth possesses a persistent internal energy source—analogous to a residual stellar core or "endogenous sun"—generating sub-crustal plasma layers through high-pressure ionization of deep-seated gases. This internal plasma source challenges the conventional assumption that planetary luminosity and thermodynamics are externally driven by solar irradiation. Magma, under this interpretation, arises as a nonlinear product of energetic plasma condensation rather than solely through silicate melting. The geomagnetic field is reframed as a resonance phenomenon—produced by vortical plasma flows—rather than a byproduct of molten iron convection. Observational validation includes ionospheric perturbation data from ESA's Swarm mission and GIS-based mappings of global seafloor fissures, both consistent with the model's internal energy distribution. Additionally, the correlation of geomagnetic resonance with Schumann frequencies and biological rhythms suggests a biosystemic integration between Earth's interior energetics and life processes. This interdisciplinary model provides a new conceptual basis for reinterpreting planetary illumination, geomagnetic variability, and the Earth–life system as components of a self-sustaining, internally radiant planetary mechanism.

Keywords: Earth interior dynamics; Plasma convection; Geomagnetic resonance; Deep ocean–core–atmosphere coupling

1 Introduction

1.1 Background

The Earth's interior has historically been conceptualized through a radially stratified framework composed of four primary layers: the crust, mantle, outer core, and inner core. This model is largely derived from seismic wave propagation patterns and inferred material density profiles. While it has served as the dominant paradigm in geophysics for decades, recent developments in satellite geodesy, ionospheric monitoring, and high-resolution bathymetric mapping have introduced a set of nonlinear geophysical phenomena that remain difficult to reconcile within this layered construct.

Anomalies such as persistent seafloor fissures along mid-ocean ridges, temporally asymmetric magma distribution, and episodic geomagnetic perturbations suggest that Earth's internal dynamics may be governed by mechanisms more fluid and interconnected than the current model allows. These observations motivate a reconsideration of the geosphere not as a rigidly segmented structure but as a complex, feedback-governed energetic system.

1.2 Limitations of the Classical Paradigm

The classical model assumes that Earth's interior consists of compositionally homogeneous and mechanically distinct layers, with the inner core described as a solidified iron–nickel alloy embedded within a convecting fluid outer core. However, several critical limitations challenge this framework. It does not incorporate the role or distribution of sub-crustal gas layers or volatiles. It explains magma genesis exclusively through vertical conductive and advective heat transfer. It further attributes geomagnetic field generation solely to large-scale fluid motion in the outer core, neglecting other forms of charged particle transport. These assumptions collectively preclude the inclusion of ionized plasma states, high-enthalpy gas convection, and electromagnetically coupled feedback loops—features that may be essential for explaining observed anomalies in Earth's energy and magnetic behavior. As such, the conventional model appears insufficient to capture the Earth as a thermodynamically open, self-regulating, and resonance-responsive system.

1.3 Purpose and Research Questions

This study introduces an alternative interpretation of Earth's internal dynamics, founded on the hypothesis that the planet's deep interior may host a persistent high-energy plasma system. Rather than a mechanically segmented solid body, Earth is reconceptualized as a coherent, vibratory structure that couples deep oceanic regions, the lower mantle, and even the ionosphere through interconnected plasma flows and electromagnetic resonances. One of the foundational shifts motivating this framework stems from the recognition that the Earth may not consist of discrete layers but of dynamically connected zones governed by energetic resonance and circulatory exchange.

This viewpoint supports the hypothesis that sub-crustal plasma convection zones, sustained by geothermal radiation, rotational shear, and latent energy release, may not only account for magma production but also act as a driver of planetary-scale magnetic fields. The symbolic notion of an "unburned sun beneath the crust" is employed not as metaphor but as a working model for an endogenous, internally radiant energy core. The primary aim of this study is to formulate and test a geophysically consistent plasma-based model of Earth's interior that integrates dynamic energy circulation, charged particle interactions, and thermodynamic resonance. To this end, the study addresses three key research questions. First, is there measurable evidence supporting the existence of a sub-crustal plasma or high-energy convection zone beneath the lithosphere? Second, can such energetic structures explain both magma generation and irregular geomagnetic phenomena more consistently than classical core–mantle dynamics? Third, does a resonance- and circulation-based interpretation of internal energetics offer a more predictive framework for understanding Earth's coupled geophysical systems?

1.4 Methodological Framework

To investigate the proposed model, the study employs a multi-pronged methodological framework that integrates reinterpretive geophysics, geospatial analysis, electromagnetic modeling, and interdisciplinary theoretical synthesis. This approach enables triangulation across empirical observations, physical theory, and data-driven inference. The seismic reinterpretation component involves a targeted review of P- and S-wave propagation anomalies, with emphasis on misfit regions and velocity discontinuities not adequately explained by homogeneous elastic media. The goal is to identify geophysical signals potentially indicative of sub-crustal plasma or gaseous discontinuities.

The geospatial mapping component draws upon satellite-derived bathymetric and tectonic datasets, such as GEBCO 2024 and NOAA NGDC, which are analyzed using GIS tools to identify fissure patterns and ridge discontinuities. Particular focus is placed on non-boundary fault systems and ridge asymmetries that may correlate with plasma convection zones. Electromagnetic modeling is pursued through the development of a conceptual simulation model designed to connect plasma convection, atmospheric thermodynamics, and geomagnetic perturbations. Preliminary simulations explore how rotating plasma vortices may produce frequency-locked geomagnetic fields and ionospheric oscillations. The theoretical synthesis component incorporates literature spanning plasma physics, magnetohydrodynamics, nonlinear thermodynamics, and chronobiological coupling in order to construct an integrated model of Earth's internal energy system.

Primary data sources include GEBCO 2024, which provides global bathymetric elevation datasets for structural mapping of deep-sea ridges and faults; the ESA Swarm Mission, accessed through VirES, which delivers real-time magnetic field and ionospheric data including electron density, current structures, and drift velocities; NOAA NGDC datasets, which offer global tectonic boundaries and spreading center data for cross-validation of crustal discontinuities; and the USGS Earthquake Catalog, which provides spatiotemporal seismic data that enable correlations between electromagnetic perturbations and lithospheric activity.

1.5 Structure of the Paper

The remainder of the paper is organized as follows. Section 2 presents observational and empirical limitations of the classical solid-core model, with emphasis on seismic inconsistencies, crustal discontinuities, and episodic geomagnetic anomalies. Section 3 introduces the plasma-based convection framework, outlining the hypothesized phase transitions from deep-seated gases to ionized plasma under high-pressure conditions. Section 4 formulates a reinterpretation of geomagnetic field dynamics as resonant phenomena arising from plasma vortices and electromagnetic circulation, contrasting this with the conventional dynamo theory. Section 5 examines the geophysical interface between plasma structures and the hydrosphere, proposing that volcanism and hydrothermal activity may be surface expressions of deeper plasma–water interactions. Section 6 discusses the broader implications of the proposed model, including critical assessments of geodynamic assumptions and epistemological constraints within the current paradigm. Finally, Section 7 concludes with an exploration of interdisciplinary linkages that connect planetary energy cycles, biospheric regulation, and geomagnetic resonance, and it suggests directions for future empirical validation.

2 Reexamining the Conventional Structure of Earth's Interior

2.1 Assumptions of the Core-Based Earth Model

The standard geophysical model of Earth's interior is built upon a stratified configuration comprising four distinct layers, consisting of the crust, which forms a rigid silicate-based outer shell, the mantle, which is represented as a high-pressure, viscously convecting silicate zone, the outer core, which is described as a fluid layer predominantly composed of molten iron and nickel, and the inner core, which is presumed to be a solid sphere of crystallized iron–nickel alloy.

This framework is primarily supported by differential seismic wave propagation, gravimetric measurements, and thermodynamic assumptions. The geodynamo theory, which attributes geomagnetic field generation to convective motion in the liquid outer core, remains a cornerstone of this model. However, despite its widespread adoption, this paradigm faces persistent difficulties in explaining key observations related to energy distribution, seismic anomalies, and deep Earth conductivity.

2.2 Seismic Ambiguities and Boundary Conditions

Classical seismology interprets Earth's interior by analyzing the behaviors of P-waves and S-waves. While S-waves are known to be impeded by fluids, inconsistencies arise in regions such as deep-sea trenches and subduction zones, where S-wave delays and absences appear irregular. Likewise, P-wave velocity gradients often deviate from expected isotropic profiles. These anomalies are particularly pronounced in mid-oceanic ridge environments, where seismic reflections reveal discontinuities that challenge homogeneous layering assumptions. Standard models relying on isotropic elasticity and uniform density gradients struggle to account for such complexity.

Amplitude variation with offset (AVO) techniques also encounter limitations under nonlinear boundary conditions, especially when anisotropic or energized media such as plasma or charged gas flows are introduced. Weber (1993) noted that reflections at the base of the mantle suggest heterogeneities not attributable solely to thermal or compositional variation, providing early indications of structurally anomalous zones that may involve non-standard energy field phenomena. More recently, geomagnetic satellite data from ESA's Swarm mission have enabled high-resolution mapping of upper mantle conductivity (Balasis et al., 2024). These datasets reveal conductivity anomalies that are inconsistent with thermal models alone and may require electrically conductive, dynamic media to be accurately explained. Supporting studies, including Püthe et al. (2015) and Kuvshinov (2008), suggest that multi-layered anisotropic conductivity models better capture deep Earth behavior, reinforcing the need to revisit purely elastic–thermal interpretations in favor of models that incorporate energy-field interactions.

2.3 Thermodynamic Limitations of the Solid-Core Assumption

Conventional models estimate inner core temperatures to exceed 5500–6000 K. At such extremes, the theoretical preservation of a solid crystalline state, typically inferred to be iron, is thermodynamically tenuous. Although high pressures may suppress melting points, the inner core's proposed solidification remains largely theoretical and is not directly observable.

Several unresolved thermodynamic issues complicate this assumption. Density gradients at the core boundary may be overstated due to assumptions about compression and phase stability. Crystallization theories rely heavily on idealized reverse-compression mechanisms that lack empirical confirmation. Laboratory experiments have yet to replicate the pressure–temperature extremes of the inner core, leaving its stability unverified. Taken together, these considerations open the possibility that the so-called solid inner core may instead be a metastable plasma condensate, a phase governed by radiative compression, high-temperature gas condensation, and nonlinear feedback cycling. Within this view, the inner core functions not as a rigid crystalline sphere but as a quasi-stable energy vortex, serving as a central modulator of planetary thermal and electromagnetic behavior. This hypothesis repositions the inner core from a passive solid mass to a dynamic energy structure, potentially shaped by internal resonance, plasma convection, and radiative flux balance, and it invites further examination of alternative models of deep Earth energetics and structural organization.

2.4 Seafloor Discontinuities and Non-boundary Fault Systems

High-resolution bathymetric mapping and satellite-derived geospatial datasets, particularly those provided by the GEBCO 2024 compilation (GEBCO Compilation Group, 2024), EMODnet, and ESA's Swarm mission (VirES Team, 2023), reveal persistent seafloor discontinuities that deviate significantly from classical lithospheric plate boundary definitions.

Analyses of key tectonic zones such as the Mid-Atlantic Ridge and the East Pacific Rise indicate the presence of non-boundary fault networks characterized by continuous, branching fissure structures that extend well beyond the confines of conventional plate margins.

These features resemble distributed strain zones more than discrete fracture boundaries and suggest a more complex crustal deformation regime. Their alignment with anomalous geomagnetic signals and localized volcanic emissions further implies coupling between these fissure systems and deep-seated energetic processes. One possible mechanism involves sub-crustal gas-fluid layers under high pressure, which may act as channels for energy discharge through thermal–electrical interactions. Such processes could facilitate magma ascent, explosive degassing, and even transient plasma transport, contributing to a feedback-regulated geophysical system. Figure 1 provides a comparative bathymetric visualization of two major seafloor regions, the Hawaiian hotspot and the Mid-Atlantic Ridge. The continuity and spatial extension of fault structures in both regions illustrate the inadequacy of classical, boundary-confined plate tectonics in capturing seafloor energy dynamics.

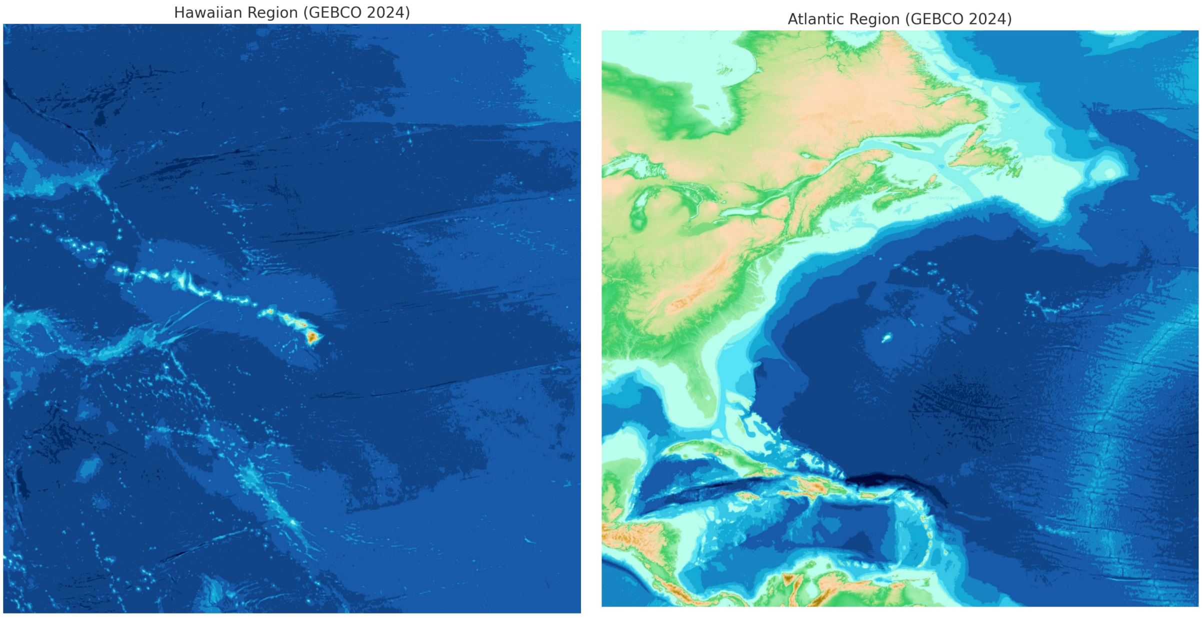

Figure 1: Topographic comparison between the Hawaiian hotspot and Mid-Atlantic Ridge reveals non-boundary fault continuity. (Source: GEBCO Compilation Group, accessed July 2024)

2.5 Rationale for a Non-core-centric Geophysical Framework

The conventional geodynamo model explains the genesis of magma, volcanism outside subduction zones, and the temporal variability of Earth's geomagnetic field primarily through convection within a fluid outer core and radiogenic heat from the mantle. However, the limitations identified across Sections 2.1 to 2.4 reveal systemic inconsistencies in this core-centric interpretation.

Several specific gaps become evident. The model is unable to account for off-boundary volcanic and fissure systems in tectonically quiescent zones. It oversimplifies geomagnetic variability, which often exhibits spatiotemporal decoupling from known convective cycles. Furthermore, it does not integrate non-solid-state energy structures, such as high-enthalpy gas reservoirs and ionized plasma domains.

To address these deficiencies, this study proposes the necessity of an expanded geophysical model. Such a framework incorporates subsurface plasma–gas convection as a mechanism for energy flux and matter transport. It further includes non-core-centric mechanisms of magnetic field generation, which may arise from resonance within circulating plasma structures. Finally, it advances a systems-based Earth model that recognizes thermodynamic and electromagnetic feedbacks as fundamental organizing principles.

These propositions are visually reinforced by Figure 2, which displays the global asymmetry of mid-ocean ridge systems—challenging the prediction of symmetrical spreading based solely on core–mantle convection.

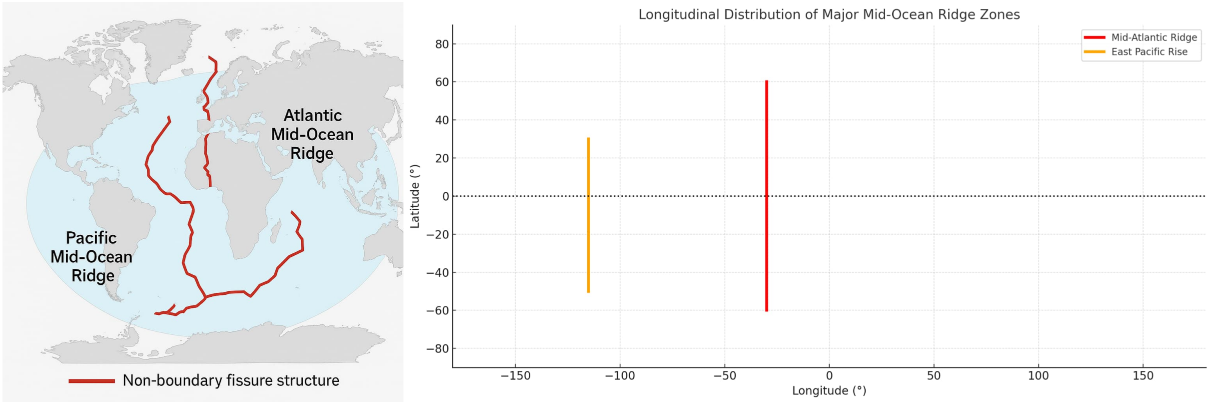

Figure 2: Asymmetry of global ridge zones suggests non-convective crustal dynamics (GEBCO Compilation Group, 2024). (Additional data from NOAA NGDC, accessed July 2024).

Collectively, these morphological and energetic asymmetries suggest that Earth's geodynamics may be governed not by a centralized convective engine, but by a distributed, feedback-governed plasma–gas system. Such a framework better accommodates the observed complexity in crustal deformation, geomagnetic fluctuation, and non-boundary tectonic activity, offering a more coherent and testable alternative to the classical core-centric paradigm.

3 Plasma–Gas Convection Theory of Earth's Interior

3.1 Hypothesis of a Dynamic Sub-Crustal Structure

The conventional Earth model, composed of stratified solid and liquid layers including the crust, mantle, outer core, and inner core, presumes deterministic material boundaries governed by density and elastic wave behavior. However, emerging observations such as nonlinear seismic propagation, hydrothermal emissions, and oscillatory geomagnetic fluctuations challenge this deterministic framework and suggest the existence of a more dynamic, thermodynamically active sub-crustal domain.

In this reinterpretation, the region beneath the lithosphere is conceptualized not as a rigid transition zone but as a multiphasic energetic reservoir in which ionized plasma, condensed gases, and supercritical fluids circulate through nonlinear convective dynamics. These media form a dynamically responsive system whose behavior is governed by phase transitions, electromagnetic interactions, and rotational shear. Such a system aligns with critiques of real-amplitude elastic wave models in seismology and invites the adoption of complex-valued, nonlinear frameworks for wave propagation in plasma-rich environments.

3.2 Nonlinear Circulation of Magma and Subsurface Gases

Magma generation has traditionally been attributed to the partial melting of mantle peridotite due to conductive and convective thermal gradients. However, this thermal-only model cannot fully account for the spatial irregularity and energetic explosiveness observed in many magmatic systems.

This study proposes an alternative mechanism in which magma formation arises from nonlinear energetic interactions among subsurface gas layers, geothermal flux, and electromagnetic fields. In this view, accumulated volatiles such as CO_2, CH_4, and H_2S may undergo pressurization and transition to plasma states under geothermal heating and rotational shear, thereby enabling conductivity and charge separation. Seismic stress waves and tectonic deformation zones further contribute through frictional and vibrational excitation, producing localized ionization, transient plasma bursts, and thermal disequilibria. In regimes of high enthalpy and pressure, plasma, gas, and superheated liquid phases engage in dynamic multiphase convection, resulting in resonant feedback loops and field-induced condensation. This framework repositions magma not as melted rock but as a metastable product of energetic restructuring within field-governed plasma domains.

Seismological evidence supports this interpretation. Gallot et al. (2015) demonstrated that increasing S-wave amplitudes can modulate P-wave velocities in multiphasic media, indicating strong intermodal coupling and confirming the presence of nonlinear wave–field interactions within plasma-enriched regions.

3.3 Geomagnetic Circulation and the Maintenance of Earth's Energy Field

The widely accepted geodynamo model explains geomagnetic field generation via fluid convection of conductive iron alloys in the outer core. However, this model struggles to account for several critical anomalies. Localized and transient ionospheric disturbances are not spatially correlated with core convection. Irregular polar magnetic events and ultra-low-frequency (ULF) wave bursts are also poorly explained, as are time-varying and asymmetric geomagnetic field drifts observed across high-latitude ionospheric zones. These observations suggest the presence of alternative or complementary field-generation mechanisms.

This study proposes that Earth's geomagnetic field may instead originate, or at least be modulated, by sub-crustal plasma convection zones in which circulating charged particles produce local electric currents. These currents, through Maxwellian feedback, can induce dynamic magnetic field domains that self-organize and amplify. This mechanism is conceptually supported by magnetic helicity theory, a conserved quantity in turbulent plasma flows that enables the stabilization of magnetohydrodynamic (MHD) systems and facilitates the emergence of large-scale dipolar magnetic fields (Shebalin, 2021). Unlike core convection, helicity-driven systems exhibit local resonance, field reversal tolerance, and energy conservation under rotation, making them well suited to modeling the complexity of Earth's observed geomagnetic behavior.

Empirical evidence further reinforces this hypothesis. ESA's Swarm mission has detected ultra-low-frequency magnetic pulses, electron density fluctuations, and ion drift anomalies in the upper ionosphere that precede major seismic events. For example, prior to the 2016 Italy earthquake, Swarm satellites recorded significant localized plasma disturbances indicative of subsurface–ionospheric coupling (Balasis et al., 2024). These findings support the plausibility of electromagnetic feedback loops originating from plasma dynamics beneath the lithosphere. This behavior is illustrated in Figure 3, where plasma–fluid–gas transitions are mapped along conductivity and pressure axes.

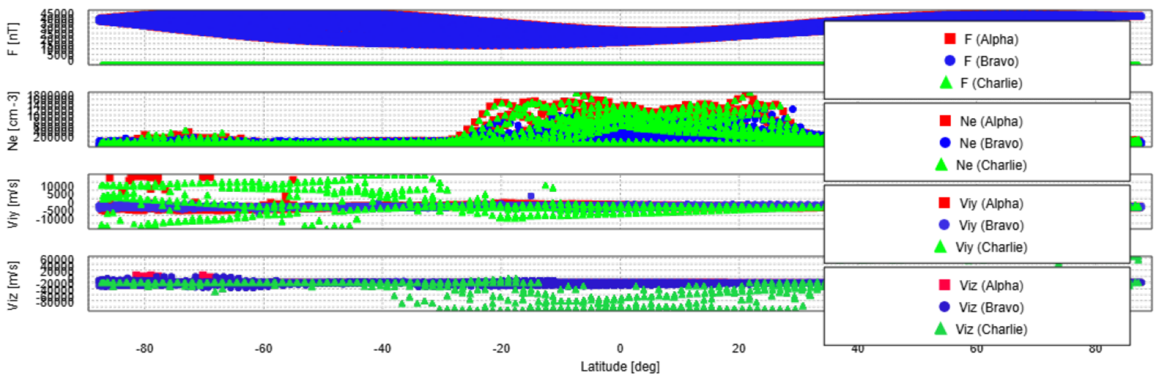

Figure 3: Swarm satellite data shows correlated plasma–geomagnetic fluctuations prior to seismic events. (Source: ESA VirES for Swarm, accessed July 2024)

3.4 Endogenous Plasma and the Architecture of the Geomagnetic–Biological System

Magnetic Resonance and Biological Systems

Multiple studies have demonstrated that living organisms are sensitive to weak, time-varying magnetic fields. Circadian cycles, melatonin regulation, serotonin levels, and brainwave synchronization have all been linked to diurnal and seasonal variations in geomagnetic intensity. This evidence implies that Earth's magnetic field is not merely a geophysical byproduct of fluid convection but a biologically resonant field, intricately coupled to homeostatic regulation and neurophysiological entrainment.

Resonance-based interpretations propose that the geomagnetic field functions as a carrier of frequency-specific signals, capable of synchronizing biological oscillators through Schumann resonance harmonics, such as 7.83 Hz and 14.3 Hz, as well as ultra-low-frequency magnetic pulses. The coupling between geophysical and biological systems thus supports the broader hypothesis that Earth operates as a bioelectromagnetic system, dynamically linking internal plasma flows to biospheric coherence.

Magnetic Properties of Subsurface Plasma Domains

Under high-pressure and high-temperature conditions characteristic of the deep lithosphere, partially ionized gases such as H_2S, CH_4, and CO_2 may transition into anisotropic plasma states. These plasma domains exhibit nonlinear charge separation, field-aligned currents, and magnetic helicity, enabling them to sustain and modulate large-scale electromagnetic structures. Unlike the molten iron geodynamo model, this framework allows for localized field generation and drift, consistent with observed geomagnetic anomalies including the South Atlantic Anomaly and non-dipolar crustal fields. The dipole alignment of Earth's geomagnetic field may therefore emerge from a complex summation of rotating plasma vortices and field-interfering condensed gas layers, rather than solely from core-scale convective loops.

Architecture and Composition of Condensed Gas Layers

Geochemical and geophysical evidence supports the presence of stratified reservoirs of volatile gases within seafloor sediments, subduction zones, and lithospheric fractures. These endogenous gas accumulations serve multiple roles. They act as electrically conductive media, initiate energetic plasma transitions via ionization and rotational shear, and sustain magma generation and volcanic activity through pressure-induced convection. Moreover, isotopic anomalies in helium-3, methane clathrates, and sulfur compounds in deep-sea vent systems suggest that these layers are dynamically recycled into Earth's electromagnetic system, functioning not only as chemical reservoirs but also as active modulators of geomagnetic flux.

Endogenous Illumination Hypothesis

In contrast to exogenous solar-based illumination models, this study proposes the existence of internal atmospheric light-emission mechanisms arising from interactions among water vapor, ionized gases, and electromagnetic fields within the crust–atmosphere interface. Such endogenous processes may emit broadband electromagnetic radiation, including visible and infrared light, particularly in desert regions, polar latitudes, and high-altitude zones. Although subtle, these emissions may contribute to the maintenance of circadian rhythmicity and photoreception even in areas with minimal solar exposure. This hypothesis aligns with observed anomalies in nocturnal light environments and may explain biologically synchronized behavior in polar ecosystems during periods of prolonged darkness.

Integrative Conclusion

Earth's interior, composed of condensed gases and ionized plasma flows, should not be conceived as a passive thermal reservoir. Instead, it functions as an active thermoelectromagnetic structure, sustaining the planet's magnetic field, regulating crustal dynamics, and influencing biological systems through resonant field interactions. This integrated model reframes Earth as a self-luminous, self-regulating, and biologically coupled energetic system in which light, magnetism, and life emerge from the same plasma-governed architecture.

4 Geomagnetic Circulation and Planetary Dynamics of an Electromagnetic Body

This chapter redefines Earth not as a mere rotating solid body but as a planetary-scale electromagnetic circulation system. It reconceptualizes the generation of magnetic fields, polar reversals, and planetary rotation within the framework of plasma-based energy field theory, emphasizing intrinsic frequencies, sub-crustal plasma flow, and the dynamic behavior of the magnetic poles.

4.1 Limitations of Conventional Geomagnetic Theory

The conventional geodynamo model attributes Earth's magnetic field to thermal convection of molten iron in the outer core combined with Coriolis forces. However, several empirical anomalies challenge the completeness of this explanation. These include unpredictable and non-periodic geomagnetic pole reversals, localized anomalies in magnetic intensity and direction such as the South Atlantic Anomaly, and inconsistencies between magnetic field lines and geological or topographic boundaries. Collectively, these anomalies suggest that geomagnetic dynamics may involve energy convection processes beyond core-bound fluid mechanics, extending into more complex sub-crustal plasma behavior.

4.2 Plasma Circulation and Field Induction

Sub-crustal plasma, a conductive and ionized medium, can induce magnetic fields through its motion. Helically structured or anisotropic plasma flows originating from the inner mantle may generate distributed magnetic loops that diverge from classical dipole patterns. Shaped by thermodynamic gradients and differential pressure zones, these plasma currents provide a plausible alternative explanation for polarity reversals and localized magnetic anomalies. Unlike deterministic mechanical flows, plasma convection exhibits nonlinear bifurcation and self-organization, enabling emergent electromagnetic phenomena. This leads to a more flexible and distributed field induction mechanism, diverging from the rigid architecture implied by traditional geodynamo theory.

4.3 Redefining "Rotation": Phase Shifts in Electromagnetic Resonance

Rather than a constant angular motion around a fixed axis, Earth's rotation may be interpreted as a perceptual byproduct of internal electromagnetic phase transitions. Plasma convection, density asymmetries, and thermal gradients alter the planet's intrinsic resonant frequency, dynamically shifting resonance nodes—points of constructive interference in Earth's electromagnetic field. Such spatiotemporal shifts can externally manifest as planetary rotation. This field-based interpretation aligns with oscillatory patterns observed in seismic activity, oceanic currents, and geomagnetic anomalies, suggesting that planetary rotation is an emergent outcome of cyclic energetic phase modulation within a self-organizing electromagnetic system.

4.4 Human–Earth Magnetic Resonance (Brief Overview)

Human neurophysiology appears to be entrained by Earth's electromagnetic field, particularly at the Schumann resonance of approximately 7.8 Hz. This coupling influences biological rhythms including EEG alpha activity, heart rate variability, circadian melatonin cycles, and possibly emotional regulation. Multiple studies have shown that extremely low frequency fields within the Schumann band are phase-locked with human brainwaves and autonomic functions. These findings indicate that the geomagnetic field may act as a resonance interface between the Earth and living organisms, forming the basis for what may be described as a resonant biosphere. Further empirical data are provided in Supplementary Appendix A.

4.5 Conclusion: The Magnetic Field as a Reactive, Non-fixed Energy Layer

Planetary rotation, under this model, is better understood as an emergent feature of large-scale, spatiotemporal phase modulation within Earth's plasma–electromagnetic matrix. The magnetic field is not a fixed dipole generated by a solid iron core but rather a dynamic, thermodynamically reactive field circulating through nonlinear plasma and gas flows beneath the crust. This reinterpretation not only challenges conventional geophysical models but also provides a theoretical foundation for exploring how neurobiological orientation systems may have evolved in resonance with planetary electromagnetic behavior.

5 Oceanic–Volcanic Interactions in a Plasma Convection Framework

This section investigates how deep-sea gas pressures, sub-crustal plasma flows, and surface volcanism interact as part of a continuous geodynamic system. Volcanic eruptions are reinterpreted not merely as manifestations of molten rock ascent but as emergent expressions of complex thermomagnetic–fluidic phase transitions.

5.1 Submarine Crustal Fissures as Vertical Energy Conduits

Oceanic crusts are not sealed tectonic shells but porous and energy-active structures. Geological features such as hydrothermal vents and mid-ocean ridges function as energy transmission channels, allowing plasma-like fluids to ascend from sub-lithospheric depths. In particular, the Aeolian Arc system has demonstrated co-emission of methane (CH_4) and helium-3 (^3He), indicating deep lithospheric gas migration (Lupton et al., 2011). These emissions are accompanied by anomalies in thermal and magnetic measurements, implying that such fissures act as energy–field interfaces within Earth's plasma–gas circulation system.

5.2 Volcanism as Plasma–Gas Overpressure Events

Instead of originating solely from thermally liquefied silicates, volcanism may result from rapid overpressure and discharge of plasma-saturated gas pockets. At the Piip submarine volcano, for instance, over 80% of vent gases comprise methane, suggesting a deep thermogenic or plasma-induced origin (Taran et al., 1992). This evidence supports a reconceptualization of volcanic activity as the critical release of nonlinear plasma energy, activated by electromagnetic perturbations, structural stress, or gravitational phase shifts.

5.3 Fire as a Thermodynamic Consequence, Not a Causal Agent

Within a plasma-centric geodynamic model, fire is not the initiating agent of geological transformation but rather the thermal and luminous output of a deeper electromagnetic process. Magma is the byproduct, not the cause, of dynamic phase transitions within plasma–pressure fields. When ionization occurs in deep subsurface fluids due to stress-induced phase shifts, emergent phenomena such as light, sound, and high-temperature gas release manifest at the surface. Volcanism thus functions as an energetic expression of internal state changes rather than as a simple mechanical rupture.

5.4 Subaqueous Plasma Emissions and Magneto-Hydrothermal Feedback

Submarine volcanoes can emit ionized plasma streams even within cold, high-pressure aquatic environments. Kick'em Jenny, an active volcano in the Caribbean Sea, demonstrates CO_2-rich hydrothermal flows that alter local salinity and conductivity (Carey et al., 2016). These phenomena suggest the presence of magnetoplasmic discharge loops operating below the seafloor. Localized conductivity anomalies and transient magnetic pulses observed in such regions reinforce the hypothesis of plasma–fluid coupling beneath oceanic crust, extending Earth's energy field dynamics into the hydrosphere.

Figure 4 provides a schematic representation of the differential conductivity and thermal retention across continental and oceanic regions.

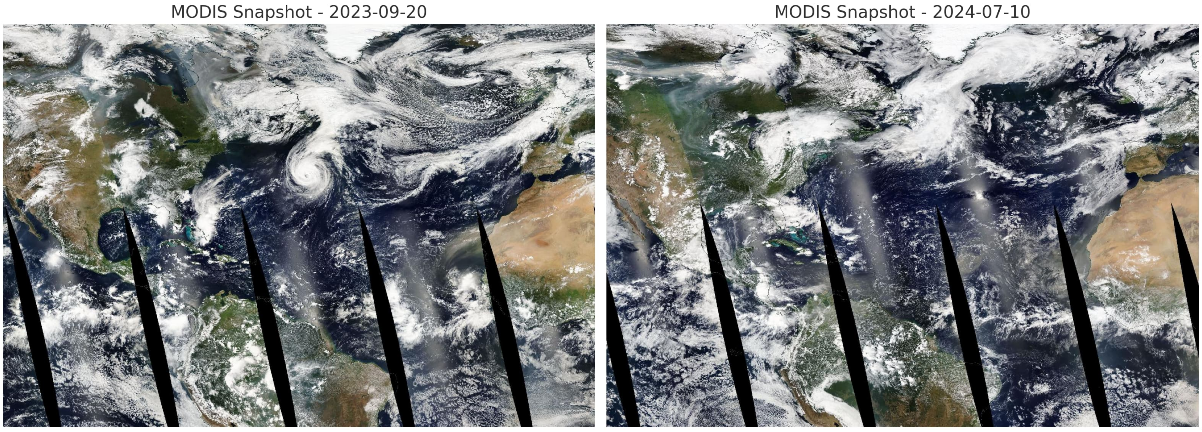

Figure 4: Satellite imagery shows increased atmospheric brightness linked to plasma activity. (Source: (NASA Worldview, 2024))

Table 1: Key observations from MODIS satellite imagery comparisons.

Observation Date	Key Features
September 2023	More localized cyclonic structure with sharp boundaries.
July 2024	Significantly expanded brightness and diffuse reflectivity across the Atlantic basin.

Interpretation: The July 2024 image suggests ionospheric or upper-atmospheric excitation not fully explainable by solar angle or cloud albedo. This supports the view that Earth's internal plasma convection can influence atmospheric charge distributions and radiative features.

Data Source: (NASA Worldview, 2023, 2024)

5.5 Magnetically Induced Eruptions and Atmospheric Feedback Loops

Plasma convection beneath the lithosphere dynamically modulates the surrounding geomagnetic field, subsequently influencing surface atmospheric pressure patterns. These perturbations may refract regional oceanic currents and, through upper-atmospheric coupling, contribute to the formation of spiral weather systems such as hurricanes and cyclones.

Within this framework, plasma-induced pressure gradients at the ocean–atmosphere interface function not only as local energy triggers but also as alternative generators of ocean wave activity, offering a reinterpretation of traditional wind–gravity wave dynamics. Due to variations in Earth's gravitational and magnetic field intensities across geographic locations, plasma flow structures are inherently asymmetrical. This asymmetry manifests as region-specific, anisotropic wave propagation patterns.

Accordingly, surface ocean waves can be reconceptualized as emergent phase products of subcrustal magnetoplasmic fields, resonating through the hydrosphere rather than responding solely to mechanical surface friction. Extended Figure 5 provides a comparative visualization of MODIS satellite imagery from September 2023 and July 2024 (NASA Worldview, 2023, 2024), which reveals fluctuations in upper-atmospheric brightness and regional reflectivity likely linked to internal energy dynamics.

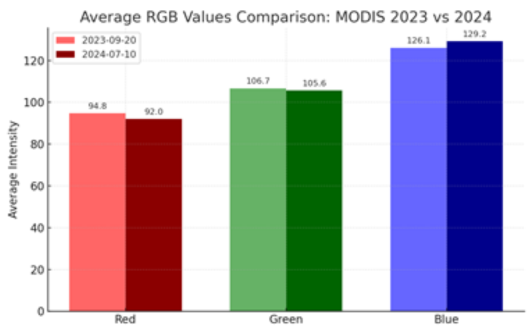

Figure 5: Atmospheric plasma diffusion pattern detected over North Atlantic in July 2024. (Source: NASA Worldview, accessed July 10, 2024)

5.6 Conclusion

Volcanoes should not be regarded as isolated geologic anomalies but rather as high-energy discharge nodes embedded in a continuous ocean–plasma–magnetosphere system. Within this framework, the traditional dichotomy of water in the hydrosphere versus fire in volcanism collapses into a unified continuum of energetic phase transitions.

The coupling between submarine plasma convection, magnetic field dynamics, and atmospheric resonance yields a multi-scalar energy circulation model that positions Earth as a wave–plasma resonator. This theoretical construct provides novel avenues for interpreting crustal rupture events and forecasting geophysical instabilities, while also advancing an integrative framework for natural disaster prediction rooted in plasma geophysics and field-resonance theory.

6 Discussion: Toward a Plasma-Based Model of Planetary Evolution

6.1 Reinterpreting Earth's Structure through Thermo-Gas-Magnetic Interactions

The traditional stratified Earth model presents the planet as a mechanically stable body composed of discrete layers. In contrast, the present study reconceptualizes Earth as a dynamically organized system, sustained by interactions among thermal fluxes, plasma–gas circulation, and geomagnetic field structures. Sub-crustal plasma flows, previously regarded as incidental or hypothetical, are here proposed as thermodynamically coherent architectures capable of influencing atmospheric dynamics, oceanic convection, and even chronobiological regulation.

Rather than being understood as a rigid geophysical monolith, Earth is instead interpreted as an open thermodynamic system, capable of responding to internal perturbations through magnetic modulation and phase-state transformations. Supporting this reinterpretation is experimental evidence for cathodoluminescence phenomena in minerals such as quartz under low-pressure plasma exposure (Foster, 2004). These findings suggest that internally circulating plasma may generate observable light phenomena through interactions with crustal silicates, providing a plausible mechanism for geogenic luminescence beyond surface volcanism.

6.2 Magma and Deep-Sea Gases as Phase Variants of the Same Energy Flow

Conventionally treated as distinct physical substances, magma and deep-ocean gases are considered here as different phase-state expressions within a common energetic continuum. Under conditions of extreme pressure and temperature, plasma-rich gaseous mixtures may condense into magma. Conversely, upon ascent or decompression, the same material may re-evaporate into a high-temperature gaseous state. Such nonlinear phase transitions challenge traditional thermomechanical models and offer explanations for the irregular periodicity of volcanic eruptions and seismic activity. These processes represent field-induced phase bifurcations rather than simple heating of silicates.

6.3 Continents and Oceans as Magnetic Phase Dipoles

This model interprets Earth's continental and oceanic domains not only as topographic features but also as electromagnetic phase dipoles. Continents may encode high-temperature plasma "memories" within their crustal and lithospheric matrices, while oceans function as low-temperature, fluidic conductors that ground global magnetothermal circuits. The spatial asymmetry between continental and oceanic masses aligns with planetary magnetic resonance nodes, suggesting that large-scale geophysical morphology is at least partially shaped by electromagnetic phase partitioning. This framework extends to biophysical analogs such as cerebral hemispheric asymmetry, circadian hormone periodicity, and morphological duality, suggesting a planet–biosphere resonance coupling as a fundamental structural principle.

6.4 Earth as an Autonomous Entropy-Regulating System

Geophysical phenomena such as earthquakes, volcanic eruptions, magnetic reversals, and ionospheric anomalies, which are typically categorized as instability events, may instead constitute expressions of planetary homeostasis. These manifestations represent Earth's adaptive rebalancing of internal entropy gradients. In this view, the planet operates as a self-regulating entropy exchange system, driven by feedback loops involving plasma circulation, thermal flows, and magneto-fluid dynamics.

This model departs from closed-system thermodynamics and emphasizes irreversibility, recurrence, and field-driven adaptation. Recent laboratory experiments also support the feasibility of internal luminescent behavior under extreme mechanical and plasma conditions. For example, triboluminescent responses to gas–solid friction under CO_2 and argon mixtures have been demonstrated (Sharipov & Tukhbatullin, 2024), providing analogues for deep-Earth plasma discharges and radiative emissions. This supports the possibility that Earth's inner regions, particularly at the boundaries of gas-rich reservoirs and plasma fields, may emit light through electromechanical excitation, reinforcing the concept of Earth as a luminous, dynamically coherent energy system.

6.5 Biogenic Modulation of Atmospheric Conductivity and Electromagnetic Resonance

Emerging theoretical frameworks propose that atmospheric electromagnetic phenomena, particularly those within the Extremely Low Frequency (ELF) and Very Low Frequency (VLF) ranges, may be modulated not solely by geophysical or solar inputs but also by biogenic activity. Seasonal changes in microbial populations, vegetation density, and biological productivity can influence ionic concentrations, aerosol nucleation, and the dielectric properties of the lower atmosphere.

Microorganisms capable of ionic metabolism or photon-sensitive reactions may participate in charge redistribution through ion–molecule interactions, charge trapping, or bioelectrical coupling mechanisms. Such processes can locally perturb electrical conductivity, atmospheric permittivity, and plasma boundary conditions, thereby modulating the propagation of ELF and VLF electromagnetic waves and affecting cavity resonance characteristics such as Schumann resonances. Seasonal and latitudinal variability in biospheric mass, particularly within the tropospheric boundary layer, may act as a dynamic dielectric interface that alters the ionospheric–ground waveguide configuration. The resulting effects may include spectral drift, phase fluctuation, and modulated amplitude envelopes in global resonance patterns.

These modulations are physically plausible through mechanisms such as charge–mass coupling via biogenic aerosols, dielectric modulation by polar biomolecules, and conductivity perturbation through bio-generated ions. Although direct empirical evidence remains limited, the hypothesis generates testable predictions, particularly concerning the spectral variability of ELF and VLF bands under biologically active conditions.

Thus, Earth's resonant field system should not be treated as a passive mineral-cavity oscillator but rather as a biophysically interactive resonance network, subject to modulation by co-evolving atmospheric and biological processes. Interdisciplinary inquiry linking atmospheric electrodynamics, microbial ecology, and biosphere–geosphere coupling is essential to fully assess these interactions within a unified systems framework.

6.6 Conclusion: Toward a Resonant Plasma-Geodynamic Framework

This study proposes a field-based reinterpretation of Earth's internal architecture, rejecting the conventional solid-core stratification paradigm in favor of a plasma-convection model governed by non-equilibrium thermodynamics, electromagnetic coupling, and dynamic phase transitions.

The principal conclusions of this framework can be summarized as follows. Sub-crustal plasma–gas convection is identified as a plausible mechanism for large-scale internal energy redistribution and geomagnetic field modulation, offering an alternative to classical fluid-core dynamo theories. Magma and deep-sea gases are reconceptualized as continuous thermodynamic states along a plasma–fluid–gas continuum, governed by pressure–temperature–conductivity gradients rather than discrete phase separation. Continents and oceans are interpreted as magneto-thermodynamic dipoles differing in electrical conductivity, heat retention, and plasma permeability, and this asymmetry may underlie both magnetic field anisotropy and the global arrangement of geophysical resonances. Seismic, volcanic, and magnetic events are reframed as homeostatic entropy-regulating mechanisms that enable dynamic feedback control in an open, self-adjusting planetary system. Global electromagnetic resonance patterns, including ELF and VLF behavior, are proposed to evolve in response to temporal variations in dielectric profiles, ionospheric conductance, and surface impedance, rather than being bound to static cavity geometries.

Taken together, these insights advocate a conceptual transition from a mechanically layered geosphere to a resonant, thermodynamically open plasma system in which magnetism, heat, and fluid flow are dynamically interlinked through nonlinear feedback. This framework also implies new directions for Earth system science and geophysical modeling, including spectral analysis of geomagnetic resonance as a diagnostic of subsurface activity, mapping dielectric anomalies as potential proxies for plasma flux, and incorporating biogenic conductivity into models of atmospheric–magnetospheric coupling.

Although the hypotheses presented remain speculative and warrant empirical validation, they are theoretically grounded in established physical principles from nonlinear dynamics, plasma electrodynamics, and thermodynamic systems theory. Future applications, particularly those addressing biophysical or ecological modulation, must proceed with scientific caution, avoiding unwarranted extrapolation or speculative techno-environmental interventionism. The model is not prescriptive but invitational: to view Earth not as a silent stone but as a resonant, self-organizing energy system in which matter, field, and life co-evolve.

Interestingly, global desert belts appear aligned along a tilted toroidal pattern resembling a Möbius-twisted surface trace. This may reflect deep-seated plasma convection pathways within the Earth, possibly connected to large-scale resonance structures and electromagnetic interference zones. As visualized in Figure 6, the global desert belts appear aligned along a spiral Möbius-like path suggestive of internal toroidal plasma resonance.

7 Conclusion and Perspectives

This study presents a critical reevaluation of the conventional solid-core model of Earth's internal structure, advancing instead a plasma–gas convection framework anchored in nonlinear thermodynamics and electromagnetic field theory.

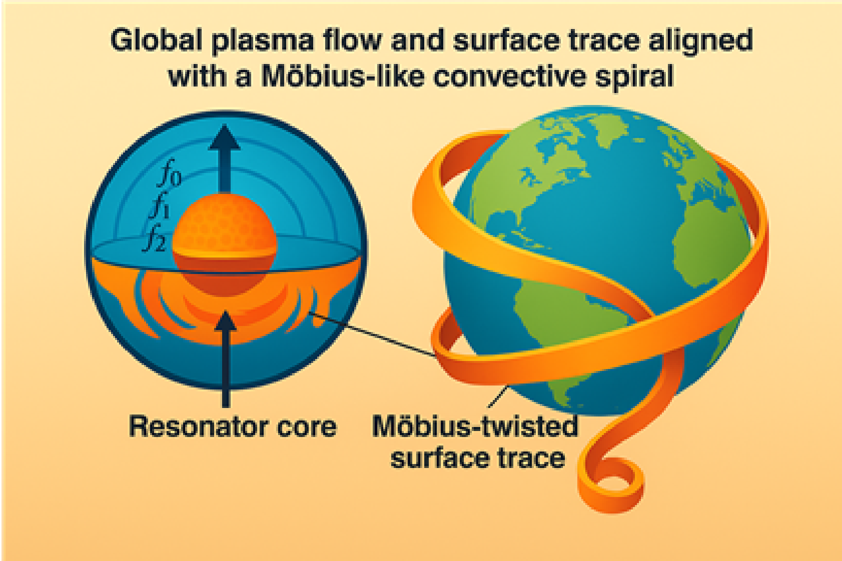

Figure 6: Conceptual illustration of the proposed resonant plasma model. Sub-crustal plasma convection emanates from a central resonator core, producing geomagnetic resonance zones at quantized frequency bands (f_0, f_1, f_2). Global desert belts appear to align along a tilted, Möbius-like convective spiral, potentially representing surface traces of internal electromagnetic circulation pathways.

By synthesizing evidence across geophysical, atmospheric, and biospheric domains—including deep plasma flows, high-pressure gas venting, and oceanic–geomagnetic coupling—the Earth is reconceived not as a rigid, stratified lithosphere but as a dynamically evolving energetic phase system.

Central to this model is the proposal that magma, deep-sea gases, and sub-crustal plasma comprise a continuum of energetically coupled phase states rather than isolated geological entities. The geomagnetic field, long attributed to convective flows within a fluid outer core, is reinterpreted as a composite structure emerging from multilayered interactions that include plasma vortices, ionized gas flows, and nonlinear crustal dynamics. This conceptual shift provides explanatory reach into several empirical anomalies that remain unresolved under the traditional geodynamo model. These anomalies include the rapid and irregular drift of geomagnetic poles, localized distortions in field intensity such as the South Atlantic Anomaly, and magnetically correlated seismic and atmospheric disturbances.

Beyond geophysics, the model extends to the biospheric domain by proposing that Earth's electromagnetic environment may exert regulatory influence over biological systems. Correlative evidence suggests that variations in the ELF magnetic spectrum, particularly Schumann resonance harmonics, are phase-locked with neurophysiological rhythms, hormonal cycles, and behavioral states in living organisms. This supports a novel view of the Earth–life system as a coupled oscillator, in which biophysical coherence arises from planetary field dynamics. Hence, Earth is posited not merely as a mechanical body but as a self-regulating electromagnetic system that responds to internal energy flux and maintains dynamic equilibrium through phase transitions. This reframing invites a transdisciplinary geoscientific framework that integrates plasma physics, nonlinear dynamics, chronobiology, and environmental resonance theory.

Ultimately, the plasma-centered field model proposed herein holds promise for unifying disparate domains of inquiry. It bridges deep Earth physics and geomagnetic modeling, atmospheric electrodynamics and plasma–ionospheric interactions, biophysical regulation and neurogeophysical coherence, as well as astrophysical analogs to planetary resonance behavior. While speculative in scope, the model is anchored in plausible physical mechanisms and generates testable hypotheses. It encourages continued empirical validation and interdisciplinary collaboration, particularly across fields not traditionally integrated within Earth system science.

This study therefore calls for a paradigm shift in planetary modeling, toward a conception of Earth as an open, resonant, and living electromagnetic system.

Appendix A. Supplementary Evidence: Human–Earth Electromagnetic Coupling

Schumann–EEG Phase Coherence

Multiple empirical studies have documented resonant interactions between Earth's extremely low-frequency (ELF) electromagnetic fields and human neurophysiology. Persinger and Saroka (Persinger & Saroka, 2016) observed phase synchronization between the fundamental and harmonic components of the Schumann resonance, typically spanning 7.8–14 Hz, and EEG signals in the alpha and mu bands. They reported average phase lags of approximately 300 ms, indicating entrainment behavior. Huang et al. (Huang et al., 2022) demonstrated that ELF exposure at 7.8 Hz improved sleep onset latency and overall sleep efficiency in individuals with insomnia, suggesting modulation of circadian and thalamocortical rhythms. More recently, Sugiwaki et al. (Sugiwaki et al., 2023) reported increased expression of antioxidant genes and enhanced epidermal regeneration in cell cultures exposed to ELF electromagnetic fields aligned with Schumann-band frequencies.

Functional Implications

These studies collectively suggest that Earth's ELF field spectrum may entrain neural oscillations and modulate circadian regulation, functioning as a geophysical synchronizer. Within the plasma–field model, this interaction is not incidental but intrinsic, implying that magnetic oscillations generated by plasma–gas phase dynamics serve bioregulatory roles alongside their geophysical functions. Such findings lend support to the resonant biosphere hypothesis, which proposes that Earth's electromagnetic structure is not an inert backdrop but a biologically coherent oscillator intimately coupled to the life systems it hosts.

Declaration

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