# THE Ψ FIELD

Vacuum Memory as a Coherent Phase Structure in Magnetogravitational Cosmology

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This work forms the theoretical foundation of the Cosmología Magnetogravitacional (CMG) and the Coherence–Energy Law (LCE). The author is the theoretical and intellectual creator of the CMG framework. The mathematical formalism and physical derivations were developed through the systematic use of advanced AI-assisted research tools.

## Abstract

The Ψ Field formalism redefines the physical vacuum as a coherent electromagnetic phase endowed with memory. This structure links electromagnetism and gravitation through coherence, generating the Coherence–Energy Law (LCE). The theory unifies gravitational anomalies, magnetic correlations, and cosmic acceleration, forming the basis of Magnetogravitational Cosmology (CMG).

## 1. Introduction and Historical Context

Extending the work of Maxwell, Einstein, and Kaluza–Klein, the Ψ Field views the vacuum as an active, coherent medium. Observational anomalies like the Pioneer effect, Pluto’s orbit, and the object 3I/ATLAS suggest the vacuum retains electromagnetic memory influencing gravitation.

## 2. Fundamental Physical Principles

The CMG–Ψ framework unifies mass, charge, and field as manifestations of a single magnetogravitational continuum. Two key postulates define this system: (1) the vacuum possesses electromagnetic memory, and (2) gravitation and electromagnetism are linked through coherence of phase.

## 3. Effective Action and Variational Formulation

The coherent vacuum is governed by the action:  
S = ∫ d⁴x √(-g) [ (1/2κ)R - (1/4)χ^{μναβ}(x,ℳ)F\_{μν}F\_{αβ} + L\_mem(ℳ) ] (3)  
From which follow: ∇\_μ H^{μν}=J\_eff^ν, H^{μν}=χ^{μναβ}F\_{αβ}, G\_{μν}=κ T\_{μν}(F,ℳ,g).

## 4. Memory Dynamics and Retarded Kernels

Vacuum memory arises from causal kernels introducing retardation:  
χ^{μναβ}(x)=χ₀^{μναβ}+∫\_{-∞}^{x⁰}K^{μναβ}(x⁰−τ;ℳ)dτ (6)  
Past electromagnetic states influence present curvature and energy flow.

## 5. Quantum and Axionic Corrections

The action includes nonlinear Heisenberg–Euler terms and axionic coupling:  
S=∫ d⁴x √(-g)[(1/2κ)R-(1/4)χ^{μναβ}F\_{μν}F\_{αβ}+(α²/90πmₑ⁴)[(F²)²+(7/4)(F\*F)²]-(1/4)θ(x)F\*F+L\_mem] (13)  
This introduces vacuum polarization, magnetoelectric coupling, and temporal coherence.

## 6. Evolution Equation of the Memory Field

The memory field ℳ evolves by:  
∇\_μ∇^μ ℳ + ∂V(ℳ)/∂ℳ = (1/4)(∂χ^{μναβ}/∂ℳ)F\_{μν}F\_{αβ} (14)

## 7. Quantum–Phase Coherence and Field Life

Continuity and quantum potential equations:  
∂ρ/∂t+∇·(ρv)=0, m dv/dt=−∇(V+Q), Q=−(ħ²/2m)(∇²√ρ/√ρ) (18)  
Global coherence leads to magnetogravitational condensates.

## 8. Mathematical Framework (Open Problems)

Remaining challenges include defining χ^{μναβ}(ℳ,R\_{ρσλδ}), ensuring energy positivity and causality, and describing the memory manifold ℳₓ with its functional:  
E\_ℳ=∫[(1/2)(∇\_μℳ)(∇^μℳ)+V(ℳ)]√(-g)d³x ≥ 0 (A7)

## 9. Empirical Predictions and Falsifiability

Predictions: (1) vacuum birefringence, (2) nonthermal emission in old matter, (3) magnetospheric memory oscillations, (4) transient magnetogravitational waves, (5) coherent biosignatures.

## 10. Physical Meaning and Conclusions

Matter is a condensed phase of Ψ; spacetime is an electromagnetic medium with memory. The universe does not merely curve—it remembers. The LCE bridges electromagnetism, gravitation, and quantum coherence.

## Author’s Declaration

The author, Eugenio Oliva Sánchez, is the theoretical and intellectual creator of the CMG framework. The mathematical formalism and physical derivations were developed with AI-assisted reasoning and symbolic computation to ensure reproducibility and scientific rigor.