# COSMOLOGY AND THE COHERENCE–ENERGY LAW (LCE)

Magnetogravitational Dynamics of the Vacuum in Expansion and Contraction

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This work extends “The Ψ Field” and formulates the coherent dynamics of the vacuum as a cosmological law. The author is the theoretical and intellectual creator of the CMG framework; all mathematical and physical derivations have been developed using advanced AI-assisted reasoning tools to ensure rigor and reproducibility.

## Abstract

The Coherence–Energy Law (LCE) governs the evolution of the universe through the memory of the vacuum. Unlike the classical Big Bang paradigm, the CMG–LCE framework describes cosmic expansion and contraction as two complementary phases of energy coherence within the Ψ field. This approach removes the singularity, redefines dark energy as coherent release of vacuum memory, and provides falsifiable predictions based on measurable variations of Λ, magnetogravitational coupling, and large-scale coherence.

## 1. From the Ψ Field to Cosmology

Building upon The Ψ Field, the vacuum is treated as a physical medium with electromagnetic coherence Ψ(x, t). Cosmic evolution arises from the temporal relaxation of this coherence, which exchanges energy with curvature.

Fundamental relation — Coherence–Energy Law (LCE):

(1) ẋρΨ = − μ · ẋΨ · ẍΨ

## 2. The Coherence–Energy Equation in FLRW Geometry

We adopt the Friedman–Lemaître–Robertson–Walker metric ds² = −c²dt² + a²(t)[dr²/(1−kr²) + r² dΩ²]. In the presence of the coherent vacuum, the Friedmann equation acquires an additional energy density term ρΨ:

(2) (ȧ/a)² = (8πG/3) · (ρm + ρΨ) − (kc²/a²)

and the continuity relation for ρΨ reads both as LCE and as a fluid equation:

(3) ẋρΨ = − μ · ẋΨ · ẍΨ = −3H(ρΨ + pΨ)

which defines an effective equation of state:

(4) pΨ = wΨ ρΨ, wΨ = −1 + (1/(3μ))·(ẋΨ/H)²

The cosmological term becomes dynamical:

(5) Λ(t) = 8πG · ρΨ(t)

## 3. The Big Memory Model: Expansion and Contraction

CMG replaces the initial singularity by a meta-stable equilibrium of perfect coherence (Big Memory): ẍΨ = 0, ẋΨ = 0 ⇒ ẋρΨ = 0. A minimal perturbation δΨ breaks coherence and initiates expansion (coherence release).

Example parametrizations:

Expansion: Ψ(t) = Ψ₀ · e^(−t/τ) ⇒ ρΨ(t) ∝ e^(−2t/τ)

Contraction: Ψ(t) = Ψ₀ · e^(+t/τ) ⇒ ρΨ(t) ∝ e^(+2t/τ)

Thus, the universe ‘breathes’ through coherence cycles rather than expanding from a singular explosion.

## 4. Emergent Gravitation from Vacuum Coherence

Einstein’s equations acquire a coherence correction, representing the back-reaction of Ψ onto curvature:

(6) Gμν + f(Ψ) gμν = 8π Tμν, with f(Ψ) = ½ (ẋΨ/Ψ)² − (ẍΨ/Ψ)

## 5. Reinterpretation of Dark Matter and Dark Energy

Dark energy corresponds to the coherent release of vacuum memory:

(7) aΨ = (1/m) · d/dt ( κ Ψ EP )

For galaxies, the magnetogravitational contribution modifies rotation curves without invoking non-baryonic dark matter:

(8) v\_rot²(R) = GM(R)/R + R · aΨ(R), with aΨ ∝ B²

## 6. Thermodynamics of the Coherent Universe

Vacuum entropy evolves according to the first law for the coherent medium, where TΨ is an effective temperature of the Ψ field:

(9) ẋSΨ = (1/TΨ) · (ẋQΨ − pΨ ẋV)

During expansion, coherence decays (ẋSΨ > 0); during contraction, the vacuum reabsorbs coherence (ẋSΨ < 0). Local second-law behavior is preserved, while global coherence defines the cyclic arrow of time.

## 7. Magnetogravitational Coupling and Cosmic Structure

In curved spacetime, the effective current includes a coherence term: ∇μ H^{μν} = J\_eff^ν = α ∇μ(Ψ F^{μν}). Regions of strong magnetic flux (galaxies, clusters) reinforce curvature locally; filaments trace lines of coherent magnetism.

(10) ∇μ H^{μν} = J\_eff^ν = α ∇μ(Ψ F^{μν})

## 8. Observational Predictions

1) Λ(t) variability — Euclid, DESI, Roman: reconstruct Λ(z) and test dΛ/dt ≠ 0.

2) Magnetic–rotational correlation — LOFAR, ALMA, SKA pathfinders: test v\_rot residuals vs B² and alignment.

3) Gravitational wave coherence — LISA, PTA: search for phase-coherent components beyond tensor modes.

4) Vacuum polarization anisotropies — CMB residuals (Planck Legacy, CMB-S4).

5) Laboratory coherence tests — SQUID networks and interferometry for correlated EM–grav noise.

## 9. Falsifiability

CMG–LCE is empirically falsified if: (i) Λ is strictly constant; (ii) no magnetogravitational correlations exist between B-fields and rotational/lensing residuals; (iii) no coherent phase component appears in GW spectra at accessible sensitivities.

## 10. Physical and Philosophical Conclusions

The universe is governed by coherent memory rather than by initial singularity. Time emerges as the derivative of memory, and gravitation as the macroscopic manifestation of vacuum coherence. The CMG–LCE framework offers a testable unification of electromagnetism, gravitation, and thermodynamics, with clear predictions accessible to current and near-future observatories.

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## Author’s Declaration

The author, Eugenio Oliva Sánchez, is the theoretical and intellectual creator of the CMG framework. All mathematical and physical formulations were developed using advanced AI-assisted symbolic reasoning to ensure coherence, precision, and reproducibility across the entire formal structure.