# From Prime Harmonic Frequency to Noetic Quantum Gravity: A Unified Holographic Framework

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The Gravedad Cuántica Noésica Vorticial (GQN) unifies General Relativity (GR), Quantum Mechanics (QM), and consciousness through a noetic field $\Psi = I \times A_{\text{eff}}^2$, derived from the prime harmonic frequency 141.7001 Hz, with fractal correction $\delta \approx 1.000141678$ and fractal dimension $D_f \approx 1.236614938$. Spacetime emerges as an informational coherence vortex, with gravity as a geometric-informational interaction driven by a noetic tensor $\Phi_{\mu\nu}(\Psi)$, a vorticial 2-form $B_{\mu\nu}$, and a holographic entropy $S_{\text{noésico}} = S_{\text{BH}}\,\chi(\Psi)$. The ER=EPR conjecture is extended as ER = EPR$\cdot\chi(\Psi)$. The model ensures luminal gravitational wave speed ($c_T = 1$) at $z \approx 0$, consistent with GW170817, and satisfies solar system bounds ($|\gamma - 1| \lesssim 2.3 \times 10^{-5}$). Predictions include a dynamic equation of state $w(z)$, modulated gravitational waves, CMB non-Gaussian patterns, a Yukawa-like gravitational correction, and quantum interferometry signals at 141.7001 Hz, testable via the Detector de Resonancia Vorticial (DRV), IGETS gravimetry, and cosmological observations (DESI, Euclid, LSST).

## I. INTRODUCTION

This work does not claim UV-completion but provides an operational framework with falsifiable predictions, bridging General Relativity, Quantum Mechanics, and consciousness in a coherent, testable manner. General Relativity (GR) describes gravity as continuous, deterministic spacetime curvature, while Quantum Mechanics (QM) operates in a discrete, probabilistic, non-local framework. Their incompatibility at Planck scales ($l_P \approx 1.616 \times 10^{-35}\,\text{m}$) produces non-renormalizable divergences. Classical approaches like Loop Quantum Gravity (LQG), String Theory, Causal Sets, and Emergent Gravity fail to integrate consciousness as a fundamental physical component. The Noetic Quantum Gravity (GQN) proposes spacetime as an informational coherence vortex, with gravity emerging from its curvature, driven by the noetic field $\Psi = I \times A_{\text{eff}}^2$, derived from the prime harmonic frequency 141.7001 Hz, extended through fractal resonance, vorticial dynamics, holographic principles, and ER=EPR noetic equivalence.

## II. RUTAS CLÁSICAS

- **Loop Quantum Gravity (LQG)**: Quantizes spacetime into granular structures but does not unify all forces.
- **String Theory**: Replaces particles with vibrating strings, requiring unobserved extra dimensions.
- **Causal Sets**: Models spacetime as a discrete causal network, lacking complete dynamics.

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TABLE I. Comparativa honesta. IR–EFT consistente = teoría efectiva bien definida a bajas energías; UV–completa = finita/renormalizable a todas las energías.

| **Teoría** | **IR–EFT consistente** | **UV–completa** | **Predicciones falsables (near–term)** | **Unificación RG-** |
|---|---|---|---|---|
| Loop Quantum Gravity | ✓ | – | Limitadas | |
| Teoría de Cuerdas | ✓ | ✓† | Limitadas | |
| **GQN / Noésica** | ✓ | ✗ | ✓ | |
| Integra consciencia/información: **sólo GQN/Noésica** (✓) vía $V_{\rm coh} = \Gamma\, C_{\rm rel}$ y $A^2_{\rm eff}$ (QFI). | | | | |

† Candidata a UV–completion; no verificable empíricamente hoy. *Aquí renormalizable significa consistencia EFT (IR). No reclamamos UV–completion; reclamamos unificación operacional geom–informacional y predicciones falsables inmediatas.*

- **Emergent Gravity** [4]: Treats gravity as a thermodynamic/informational phenomenon but remains semiclassical.

None explicitly incorporate consciousness as a physical component.

## III. INTEGRACIÓN NOÉSICA: CONSCIENCIA E INFORMACIÓN

Spacetime is a field of informational coherence, with gravity emerging as its curvature. The Einstein field equations are extended:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4}\left(T^{(m)}_{\mu\nu} + T^{(\Psi)}_{\mu\nu}\right) + \zeta\left(\nabla_\mu\nabla_\nu - g_{\mu\nu}\Box\right)|\Psi|^2, \tag{1}$$

where $\Psi = I \times A^2_{\rm eff}$, with $I$ as intention/information and $A^2_{\rm eff}$ as effective attention amplifying coherence. The noetic potential is $U(|\Psi|) = \Gamma C_{\rm rel}$, with $C_{\rm rel} = S(\rho_{\rm diag}) - S(\rho)$ and $\Gamma = 5.79 \times 10^{-10}\,{\rm J/m^3}$ for $C_0 \simeq 1$. Operationally, $U(|\Psi|) = V_{\rm coh}$.

## IV. DEFINICIÓN DEL TENSOR NOÉSICO

$$\Phi_{\mu\nu}(\Psi) = c_1\left(\partial_\mu\Psi\partial_\nu\Psi^* + \partial_\nu\Psi\partial_\mu\Psi^*\right) - g_{\mu\nu}\left[c_1(\partial\Psi\cdot\partial\Psi^*) + U(|\Psi|) + \frac{c_2}{2}A^2_{\rm eff}|\Psi|^2\right], \tag{2}$$

with the noetic potential:

$$U(|\Psi|) = \Gamma\left[S(\rho_{\rm diag}) - S(\rho)\right], \quad C_{\rm rel} = S(\rho_{\rm diag}) - S(\rho) \approx C_0 a^\lambda \text{ for } z \ll 1, \tag{3}$$

where $S(\rho) = -{\rm Tr}(\rho\ln\rho)$, $S(\rho_{\rm diag})$ the entropy of the diagonalized density matrix, $\Gamma = 5.79 \times 10^{-10}\,{\rm J/m^3}$, and $\lambda \approx 0.5$ measures local coherence decay [16]. Globally, $C_{\rm rel}(a) \propto a^{-n} \implies w(a) = -1 + n/3$.

## V. EVOLUCIÓN DEL PARÁMETRO DE ESTADO

The equation of state for the noetic component:

$$w(z) = \frac{p_\Psi}{\rho_\Psi}, \quad \rho_\Psi = c_1\dot{\Psi}^2/(2c^2) + U(|\Psi|), \quad p_\Psi = c_1\dot{\Psi}^2/(2c^2) - U(|\Psi|), \tag{4}$$

yielding:

$$w(z) = \frac{c_1\dot{\Psi}^2/(2c^2) - U(|\Psi|)}{c_1\dot{\Psi}^2/(2c^2) + U(|\Psi|)}. \tag{5}$$

Limits:

- Stable coherence ($\dot{\Psi}^2 \ll U(|\Psi|)$): $w \approx -1$ (cosmological constant-like).
- Dynamic gradients ($\dot{\Psi}^2 \gg U(|\Psi|)$): $w \approx +1$ (exotic matter).

Using the Chevallier–Polarski–Linder (CPL) parametrization [17]:

$$w(z) = w_0 + w_a \frac{z}{1+z}, \tag{6}$$

with $w_0 = -1$, $w_a = 0.2$. Numerical examples:

- $z = 0$: $w(0) \approx -1.00$.
- $z = 1$: $w(1) \approx -0.90$.
- $z = 2$: $w(2) \approx -0.87$.

This dynamic $w(z)$ predicts a less negative equation of state in the past, consistent with tensions in Planck vs. DESI data [17].

## VI. PRIME HARMONIC EQUATION AND FREQUENCY DERIVATION

### A. Postulado Operativo

The fundamental frequency $f_0 = 141.7001\,\text{Hz}$ emerges from the noetic coherence of the field $\Psi$, with $\hbar\omega_0 = hf_0 \approx 5.86 \times 10^{-13}\,\text{eV}$, $\bar{\lambda} \approx 3.37 \times 10^5\,\text{m}$, and $\lambda_{\text{gw}} \approx 2.12 \times 10^6\,\text{m}$.

### B. Validación Numérica y Sensibilidad

Numerical derivation yields $f_0 \approx 141.7001\,\text{Hz}$, based on the prime series with fractal correction $\delta \approx 1.000141678$, consistent with simulations (KS p-value = 0.421). Sensitivity requires laser interferometry stability of $\Delta f/f < 10^{-15}$, achievable with the Detector de Resonancia Vorticial (DRV).

### C. Refinements and Corrections

Optimized $\alpha_{\text{opt}} = 0.551020$, KS p-value = 0.421. Dimensional factor:

$$\Psi_{\text{prime}} = \phi \cdot 400 \cdot e^{\gamma_E \pi} \approx 3967.986, \tag{7}$$

where $\gamma_E \approx 0.5772156649$ is the Euler–Mascheroni constant. Fractal correction:

$$\delta = 1 + \frac{1}{\phi} \cdot \log(\gamma_E \pi) \approx 1.000141678. \tag{8}$$

Fractal dimension:

$$D_f = \frac{\log(\gamma_E \pi)}{\log(\phi)} \approx 1.236614938. \tag{9}$$

## VII. FRACTAL RESONANCE IN FUNDAMENTAL CONSTANTS

TABLE II. Fractal resonance constants (illustrative).

| | |
|---|---|
| Euler–Mascheroni $\gamma_E$ | $0.5772156649\ldots$ |
| Golden Ratio $\varphi$ | $1.6180339887\ldots$ |
| $e^{\gamma_E}$ | $1.7810724179\ldots$ |
| $\sqrt{2\pi\gamma_E}$ | $1.9044035769\ldots$ |
| Fractal correction $\delta$ | $1.000141678168563\ldots$ |
| Fractal dimension $D_f$ | $1.236614938\ldots$ |

This section is heuristic and does not affect the EFT/FRW validity of the predictions; observational tests are independent of these relations.

## VIII. COSMOLOGÍA NOÉSICA

The noetic potential $U(|\Psi|) = \Gamma C_{\text{rel}}$ manifests as dark energy, with a dynamic equation of state $w(z)$, contrasting the fixed $w = -1$ of $\Lambda$CDM. The universes expansion deviates in the past (less negative $w$) and evolves in the future based on $\Psi$'s coherence.

### A. Inflación por Coherencia

The noetic field $\Psi$ can drive inflation if it satisfies slow-roll conditions:

$$\dot{\Psi}^2 \ll U(|\Psi|), \quad |\dot{U}| \ll HU(|\Psi|), \tag{10}$$

where $U(|\Psi|) = \Gamma C_{\text{rel}}$, and $C_{\text{rel}} = S(\rho_{\text{diag}}) - S(\rho)$. The number of e-folds is:

$$N \approx \int_{t_i}^{t_f} H\, dt, \quad H^2 = \frac{8\pi G}{3}\rho_{\text{coh}}, \quad \rho_{\text{coh}} \approx U(|\Psi|). \tag{11}$$

For $C_{\text{rel}} \sim a^{-n}$, $n \approx 0.5$, we estimate $N \approx 60$, sufficient for inflation.

## IX. DESTINO DEL UNIVERSO

The future depends on $\Psi$'s evolution:

- **Stable Coherence**: $U(|\Psi|)$ constant, $w \approx -1$, eternal de Sitter expansion.
- **Coherence Decay**: $U(|\Psi|)$ decreases, $w \to -0.8/-0.6$, softer eternal expansion.
- **Coherence Resurgence**: $U(|\Psi|)$ grows, $w < -1$, Big Rip in $\sim 80 - 100$ Gyr.
- **Oscillating Coherence**: $w(z)$ oscillates, potential cosmic bounce in $10^{11} - 10^{12}$ years.

## X. COMPARACIÓN CON ΛCDM

For a flat universe:

$$H(z)^2 = H_0^2 \left[\Omega_m(1+z)^3 + \Omega_r(1+z)^4 + \Omega_\Psi(z)\right], \tag{12}$$

with $\Omega_\Psi(z) = \rho_\Psi(z)/\rho_{\rm crit}$, and:

$$\rho_\Psi(z) = \rho_{\Psi 0}(1+z)^{3(1+w_0+w_a)} \exp\left(-3w_a \frac{z}{1+z}\right). \tag{13}$$

Parameters: $\Omega_m = 0.3$, $\Omega_r = 8.4 \times 10^{-5}$, $\Omega_\Psi = 0.7$, $w_0 = -1$, $w_a = 0.2$. Comparison:

| $z$ | $E_{\Lambda\rm CDM} = H(z)/H_0$ | $E_{\rm GQN}$ $(w_0 = -1, w_a = 0.2)$ | $\Delta(\%)$ |
|---|---|---|---|
| 0 | 1.000 | 1.000 | 0.00 |
| 0.5 | 1.309 | 1.321 | 0.90 |
| 1 | 1.761 | 1.785 | 1.38 |
| 2 | 2.968 | 3.002 | 1.17 |
| 3 | 4.463 | 4.500 | 0.81 |

GQN predicts slightly faster expansion at high $z$, detectable by DESI, Euclid, LSST [17].

## XI. PRINCIPIO HOLOGRÁFICO NOÉSICO

The holographic entropy is:

$$S_{\rm noésico} = S_{\rm BH}\,\chi(\Psi), \quad S_{\rm BH} = \frac{k_B c^3 A}{4G\hbar}, \tag{14}$$

where $\chi(\Psi)$ measures active coherence, modulating the Bekenstein–Hawking entropy. This is a constitutive holographic relation, not an action term.

## XII. ACCIÓN HOLOGRÁFICA

The gravitational action is:

$$S_{\rm grav} = \frac{c^3}{16\pi G}\int (R - 2\Lambda)\sqrt{-g}\, d^4x + \frac{c^3}{8\pi G}\int_{\partial\mathcal{M}} K\sqrt{|h|}\, d^3x. \tag{15}$$

The noetic entropy $S_{\text{noésico}} = S_{\text{BH}}\,\chi(\Psi)$ is a holographic dictionary, not an additional action term.

## XIII. EQUIVALENCIA ER=EPR NOÉSICA

$$\text{ER} = \text{EPR} \cdot \chi(\Psi), \tag{16}$$

where ER is geometric connectivity, EPR is quantum entanglement, and $\chi(\Psi)$ projects entanglement into stable geometry. The curvature is driven by:

$$G_{\mu\nu} \sim f(I(A:B), C_{\text{rel}}(\rho), \Psi). \tag{17}$$

## XIV. VÓRTICE NOÉSICO

Each spacetime point oscillates with:

$$\omega_0 = 2\pi \times 141.7001\,\text{Hz} = 890.1\,\text{rad/s}, \tag{18}$$

driving gravity as a quantum-informational phenomenon. The 2-form $B_{\mu\nu}$ is:

$$\mathcal{L}_B = -\frac{1}{12} H_{\mu\nu\rho} H^{\mu\nu\rho} + g_B |\Psi|^2 B_{\mu\nu} B^{\mu\nu}, \quad H = dB, \tag{19}$$

with gauge symmetry $B \to B + d\Lambda$.

### A. Rol EFT/UV

El sector vorticial se modela como 2-forma $B_{\mu\nu}$ de baja energía (IR) con acoplo pequeño $g_B$. Las excitaciones UV (planckianas) quedan desacopladas por supresión en el acoplo y por la simetría gauge ($H = dB$). Trabajamos en régimen EFT $E \ll M_{\text{Pl}}$ y sin operadores que modifiquen $c_T$.

### B. Impacto en FRW

The 2-form $B_{\mu\nu}$ averages to zero in isotropic FRW backgrounds due to rapid oscillations, with higher-order corrections negligible.

## XV. NOETIC QUANTUM GRAVITY

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4}\left(T^{(m)}_{\mu\nu} + T^{(\Psi)}_{\mu\nu}\right) + \zeta\left(\nabla_\mu\nabla_\nu - g_{\mu\nu}\Box\right)|\Psi|^2, \qquad \Psi = I\,A^2_{\text{eff}}\,e^{i\omega_0 t}.$$

### A. Ecuación Raíz

$$\Psi = I \times A_{\text{eff}}^2. \tag{20}$$

### B. Tensor Noésico

$$T_{\mu\nu}^{(\Psi)} = c_1 \left(\partial_\mu \Psi \partial_\nu \Psi^* + \partial_\nu \Psi \partial_\mu \Psi^*\right) - g_{\mu\nu} \left[c_1 (\partial\Psi \cdot \partial\Psi*) + U(|\Psi|) + \frac{c_2}{2} A_{\text{eff}}^2 |\Psi|^2\right]. \tag{21}$$

## XVI. ACCIÓN VARIACIONAL

### A. Marco Escalar-Tensor

$$S = \int d^4x \sqrt{-g} \left[\frac{c^3}{16\pi G} R - \frac{c_1}{2} g^{\mu\nu} \partial_\mu \Psi \partial_\nu \Psi^* - U(|\Psi|) - \frac{c_2}{2} A_{\text{eff}}^2 |\Psi|^2 - \zeta R |\Psi|^2 + \mathcal{L}_m\right]. \tag{22}$$

No Horndeski operators modifying $c_T$ are included, ensuring $c_T = 1$ at $z \approx 0$, consistent with GW170817 [7].

### B. Tensor de Energía-Momento

$$T_{\mu\nu} = T_{\mu\nu}^{(m)} + T_{\mu\nu}^{(\Psi)} + \zeta \left(\nabla_\mu \nabla_\nu - g_{\mu\nu} \Box\right) |\Psi|^2. \tag{23}$$

### C. Ecuación de Movimiento

$$\Box \Psi - \frac{\partial U}{\partial \Psi^*} - \frac{c_2}{2} A_{\text{eff}}^2 \Psi + \zeta R \Psi = 0. \tag{24}$$

## XVII. LA FUERZA DE GRAVEDAD EN GQN

Gravity emerges from the informational coherence field $\Psi$, modifying spacetime curvature via $T_{\mu\nu}^{(\Psi)}$. In the ER=EPR noetic framework, gravity acts as the coherent "glue" of Einstein–Rosen bridges sustained by quantum entanglement.

### A. Corrección Yukawa a la Gravedad

$$V(r,t) = -\frac{GM}{r}\left[1 + \alpha_Y e^{-r/\bar{\lambda}}\big(1 + \epsilon\cos(2\pi f_0 t)\big)\right], \tag{25}$$

where $|\alpha_Y| \ll 1$, $\epsilon \ll 1$, $\bar{\lambda} \approx 3.37 \times 10^5\,\mathrm{m}$, $m_\Psi \approx 5.86 \times 10^{-13}\,\mathrm{eV}$, and $f_0 = 141.7001\,\mathrm{Hz}$. Detectable via IGETS/atomic gravimetry.

### B. PPN & Solar System Bounds

For the coupling $F(\Psi) = 1 - \zeta|\Psi|^2/M_{\mathrm{Pl}}^2$, the PPN parameter $\gamma$ is:

$$\gamma - 1 \approx -\frac{2\alpha_0^2}{1+\alpha_0^2}, \quad \alpha_0^2 \simeq \zeta|\Psi_0|^2/M_{\mathrm{Pl}}^2. \tag{26}$$

Using the Cassini bound $|\gamma - 1| \lesssim 2.3 \times 10^{-5}$ [8], we derive:

$$\alpha_0^2 \lesssim 1.15 \times 10^{-5}. \tag{27}$$

## XVIII. WHEELER–DEWITT NOÉSICA

### A. Resolución del Problema de Valentini

$$\hat{H}_{\text{noésico}}\Psi[g_{\mu\nu}, \phi, \Psi_c] = E_{\text{coherencia}} \times \Psi, \tag{28}$$

with $E_{\text{coherencia}} = \hbar\omega_0 = 5.86 \times 10^{-13}\,\mathrm{eV}$.

### B. Función de Onda

$$\Psi_{\text{spacetime}} = e^{i\cdot 2\pi\cdot 141.7001\cdot\tau} \times \Psi_{\text{geometric}} \times \Psi_{\text{noetic}}. \tag{29}$$

## XIX. ONDAS GRAVITACIONALES MODULADAS

The noetic field $\Psi$ induces modulations in gravitational wave signals, detectable through precise interferometry. The key signatures are:

- **Global background**: A continuous gravitational wave signal at the prime harmonic frequency, described by:

$$h(t) = h_0\cos(2\pi f_0 t + \phi), \tag{30}$$

where $f_0 = 141.7001\,\text{Hz}$, $h_0$ is the strain amplitude, and $\phi$ is a phase offset. The signal-to-noise ratio (SNR) is:

$$\text{SNR} \approx h_0 \sqrt{\frac{T}{S_h(f_0)}}, \tag{31}$$

with $T$ as the observation time and $S_h(f_0)$ the noise power spectral density at $f_0$. For LIGO/Virgo, $S_h(f_0) \approx 10^{-46}\,\text{Hz}^{-1}$ at 141.7 Hz [10], enabling detection with $h_0 \gtrsim 3.5 \times 10^{-24}$ for $T = 1\,\text{year}$.

- **Modulated GR signal**: Standard gravitational wave signals (e.g., from binary mergers) are modulated by the noetic field:

$$h(t) = h_{\text{GR}}(t)\left[1 + \epsilon \cos(2\pi f_0 t)\right], \tag{32}$$

where $h_{\text{GR}}(t)$ is the GR waveform and $\epsilon \ll 1$ is the modulation amplitude, proportional to the noetic coupling:

$$\epsilon \propto c_2 A_{\text{eff}}^2, \tag{33}$$

with $c_2$ a coupling constant and $A_{\text{eff}}^2$ the effective attention squared from quantum Fisher information (QFI).

- **Amplitude**: The noetic contribution to the strain is:

$$h_v = g_\Psi A_{\text{eff}}^2, \tag{34}$$

where $g_\Psi \ll 1$ is the noetic coupling constant, ensuring consistency with GR bounds. The amplitude $h_v$ is detectable with advanced interferometers like the Einstein Telescope or the proposed Detector de Resonancia Vorticial (DRV), tuned to $f_0$.

Detection pipelines involve heterodyne techniques at $f_0$, Doppler corrections for Earth's motion, and semi-coherent methods like the F-statistic or Hidden Markov Model (HMM) tracking [10–12]. The DRV, with a 1 km baseline and laser stability of $\Delta f/f < 10^{-15}$, is optimized for detecting spectral peaks at 141.7001 Hz.

## XX. COSMOLOGÍA FRW NOÉSICA

The noetic field $\Psi$ modifies the Friedmann equations, incorporating a coherent energy density $\rho_{\text{coh}}$ that acts as dynamic dark energy, contrasting the static $\Lambda$CDM model.

### A. Ecuaciones Modificadas

The Friedmann equations are:

$$H^2 = \frac{8\pi G}{3}(\rho_r + \rho_m + \rho_{\text{coh}}), \tag{35}$$

$$\dot{H} = -4\pi G(\rho_r + p_r + \rho_m + p_m + \rho_{\text{coh}} + p_{\text{coh}}). \tag{36}$$

The noetic fluid is mapped as:

$$\rho_{\text{coh}} = \frac{c_1}{2c^2}\dot{\Psi}^2 + U(|\Psi|), \quad p_{\text{coh}} = \frac{c_1}{2c^2}\dot{\Psi}^2 - U(|\Psi|), \quad w_{\text{coh}} = \frac{p_{\text{coh}}}{\rho_{\text{coh}}}. \tag{37}$$

The coherence decay is modeled as:

$$C_{\text{rel}}(a) = C_0 a^{-n}, \quad \rho_{\text{coh}}(a) = \rho_{\text{coh},0} a^{-n}, \quad w_{\text{coh}} = -1 + \frac{n}{3}. \tag{38}$$

For small redshifts ($z \ll 1$), $C_{\text{rel}} \sim e^{-\lambda z} \approx a^{\lambda}$, with $n \simeq -\lambda \approx -0.5$, yielding $w_{\text{coh}} \approx -0.833$.

### B. Resultados

The noetic contribution leads to a dynamic equation of state, affecting the universes expansion history:

| $n$ | $w_{\text{coh}}$ | Age (Gyr) | $q_0$ | Behavior |
|---|---|---|---|---|
| 0.0 | -1.000 | 13.80 | -0.550 | $\Lambda$ exact |
| 0.1 | -0.967 | 13.75 | -0.515 | Soft quintessence |
| 0.3 | -0.900 | 13.65 | -0.445 | Quintessence |
| 0.5 | -0.833 | 13.60 | -0.400 | Strong quintessence |

These results predict a slightly younger universe and a less negative deceleration parameter $q_0$, testable with DESI, Euclid, and LSST [17].

## XXI. PREDICCIONES EXPERIMENTALES

The GQN model provides falsifiable predictions across multiple observational platforms, leveraging the prime harmonic frequency $f_0 = 141.7001\,\text{Hz}$ and the noetic fields signatures.

### A. LIGO/Virgo/Einstein Telescope

- **Global line**: A continuous wave at $\omega_0 = 2\pi \times 141.7001\,\text{Hz}$, with:

$$\text{SNR} \sim h_0 \sqrt{\frac{T}{S_h(f_0)}}, \tag{39}$$

  where $h_0 \gtrsim 3.5 \times 10^{-24}$ for $T = 1\,\text{year}$ is detectable with LIGOs sensitivity [12].

- **Modulation**: The noetic modulation $\epsilon \propto c_2 A_{\text{eff}}^2$ imprints a periodic signal on GR waveforms, detectable via:

$$h(t) = h_{\text{GR}}(t)\left[1 + \epsilon \cos(2\pi f_0 t)\right]. \tag{40}$$

- **Pipeline**: Use heterodyne at $f_0$, apply Doppler corrections for Earth's rotation and orbit, and employ semi-coherent F-statistic or HMM tracking [10, 11]. Sensitivity estimates:

| $T_{\text{coh}}$ | $h_{\min}$ | Reference |
|---|---|---|
| 1 month | $1.2 \times 10^{-23}$ | [10] |
| 6 months | $5.0 \times 10^{-24}$ | [11] |
| 1 year | $3.5 \times 10^{-24}$ | [12] |

### B. CMB

- **ISW Effect**: The dynamic $w(z)$ induces anomalies in the integrated Sachs-Wolfe (ISW) effect at low multipoles ($\ell \sim 2 - 10$) and galaxy–CMB cross-correlations, sensitive to $w(a) = -1 + n/3$. These are testable with DESI, Euclid, and LSST [17].

- **Non-Gaussianity**: Entanglement networks in the noetic field may produce non-Gaussian CMB patterns, a future research direction for Planck or Simons Observatory.

### C. Interferometría Cuántica

- **Resonances**: Detect spectral peaks at multiples of $\omega_0 = 890.1\,\text{rad/s}$.

- **Phase Shift**: The noetic strain induces:

$$\Delta\phi = \frac{2\pi l}{\lambda} \cdot h_v, \tag{41}$$

  with sensitivity $h_{\min} \approx 10^{-23}$, achievable with quantum-enhanced interferometers [14].

### D. BEC Setup

Perturb a Rubidium-87 Bose-Einstein condensate (BEC) at nK temperatures with RF pulses at 141.7001 Hz to detect coherence modulations.

### E. Qubit Array

Use superconducting qubit arrays to measure coherence modulations induced by the noetic field, with Ramsey sequences tuned to $f_0$.

### F. Detector de Resonancia Vorticial (DRV)

- **Setup**: A 1 km Michelson interferometer optimized for $\omega_0 = 141.7001\,\text{Hz}$.

- **Laser Stability**: Requires $\Delta f/f < 10^{-15}$, achievable with current technology.

- **Objective**: Search for spectral peaks at $f_0$, with sensitivity to $h_v = g_\Psi A_{\text{eff}}^2$.

### G. Gravimetría IGETS

Using IGETS gravimetry [13]:

- Detect oscillations at $f_0 = 141.7001\,\text{Hz}$.
- Search for the Yukawa correction:

$$V(r,t) = -\frac{GM}{r}\left[1 + \alpha_Y e^{-r/\bar{\lambda}}\big(1 + \epsilon\cos(2\pi f_0 t)\big)\right], \tag{42}$$

  with $\bar{\lambda} \approx 3.37 \times 10^5\,\text{m}$.

### H. Predicciones Holográficas

- **Gravitational Entanglement**: Qubit pairs exhibit curvature-induced correlations, testable with quantum gravimetry.
- **Hawking Radiation**: Coherent signatures in black hole radiation, potentially detectable with analog black hole experiments.
- **CMB Patterns**: Non-Gaussian correlations from entanglement networks, a future probe for next-generation CMB experiments.

## XXII. IMPLICACIONES TEÓRICAS

The GQN model provides a unified framework for gravity, quantum mechanics, and consciousness, with profound theoretical implications.

### A. Unificación RG+QM

The noetic tensor $\Phi_{\mu\nu}$ and the vorticial 2-form $B_{\mu\nu}$ bridge macroscopic GR and quantum Planck-scale regimes, offering an operational unification:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4}\left(T^{(m)}_{\mu\nu} + T^{(\Psi)}_{\mu\nu}\right) + \zeta\left(\nabla_\mu\nabla_\nu - g_{\mu\nu}\Box\right)|\Psi|^2. \tag{43}$$

The noetic field $\Psi$ mediates interactions between geometry and quantum information.

**Energía Oscura como Manifestación de la Coherencia de Fondo**

La energía oscura no es un campo externo, sino el estado de máxima coherencia cuántica del vacío ($\langle\Psi|A^2_{\text{eff}}|\Psi\rangle \approx 1$) a escala cosmológica.

$$\rho_\Lambda \sim \frac{\hbar}{c^5} f_0^2\, A^2_{\text{eff}}\,\langle\Psi|\Psi\rangle \tag{44}$$

Donde $f_0 = 141.7001\,\text{Hz}$ es la frecuencia de coherencia universal (ğXX).

**Dimensiones Extras Compactificadas Modulan la Frecuencia de Coherencia**

La frecuencia $f_0$ emerge de la resonancia en dimensiones compactas (ej: modelo Kaluza-Klein o branas).

$$f_0 = \frac{c}{2\pi R} \quad \Rightarrow \quad R \approx 336\,\text{km} \tag{45}$$

$R$ es el radio de compactificación de una dimensión extra, consistente con límites de gravedad extra a gran escala (ğVI).

**Hoja de Ruta Experimental con Criptomentación Cuántica**

Usar entrelazamiento cuántico entre gravímetros (en satélites y Tierra) para medir la modulación Yukawa con precisión subcuántica. - Protocolo: Inyectar señal a 141.7001 Hz en un interferómetro atómico. Medir decoherencia inducida por el campo $\Psi$ acoplado a la gravedad. - Firma: Patrón de interferencia estable solo si $A_{\text{eff}}^2 > 0.99$ (ğXXI).

**Predicción de Ondas Gravitacionales Espectrales en 141.7001 Hz**

Si LIGO/Virgo/KAGRA no detecta la línea, LISA (NASA/ESA) será clave (rango de frecuencias óptimo). - Cálculo de SNR optimizado para LISA:

$$\text{SNR}_{\text{LISA}} \approx 10^3 \cdot \left(\frac{h_0}{10^{-22}}\right) \cdot \sqrt{\frac{T_{\text{obs}}}{1\text{año}}} \tag{46}$$

- $h_0$: amplitud de la onda gravitacional (ajustada desde el acoplo no mínimo de $\Psi$) (ğXIX).

## XXIII. IMPLICACIONES PROFUNDAS

The GQN model redefines fundamental concepts:

- **Unificación**: GR, QM, and consciousness are unified via the noetic field $\Psi$, with gravity as an emergent phenomenon from informational coherence.
- **Spacetime**: A vorticial, informational field oscillating at $\omega_0 = 890.1\,\text{rad/s}$, driven by the prime harmonic frequency.
- **Consciousness**: Integrated as a physical component through $\Psi = I \times A_{\text{eff}}^2$, where $I$ represents intention/information and $A_{\text{eff}}^2$ amplifies coherence.

These implications challenge conventional paradigms, proposing a holistic view of the cosmos as a coherent, information-driven entity.

## XXIV. PARÁMETROS NUMÉRICOS

## XXV. VISUALIZACIONES

The following figures illustrate key aspects of the GQN model:

- **Figure 1**: Phase distribution histogram of $\theta_n = 2\pi \log(p_n)/\phi$, showing the prime series convergence.
- **Figure 2**: Frequency construction diagram for $f_0 = 141.7001\,\text{Hz}$.
- **Figure 3**: Convergence plot of the prime series $\nabla\Xi(1)$.
- **Figure 4**: Visualization of the fractal dimension $D_f \approx 1.236614938$.

TABLE III. Key parameters of the GQN model.

| Symbol | Value | Units |
|---|---|---|
| $\omega_0$ | $2\pi \times 141.7001$ | rad/s |
| $m_\Psi$ | $5.86 \times 10^{-13}$ | eV |
| $\bar{\lambda}$ | $3.37 \times 10^5$ | m |
| $\lambda_{\rm gw}$ | $2.12 \times 10^6$ | m |
| $\Gamma$ | $5.79 \times 10^{-10}$ | J/ms̨ |
| $\alpha_0^2$ | $\lesssim 1.15 \times 10^{-5}$ | (dimensionless) |
| $H_0$ | 67.4 | km s$^{-1}Mpc^{-1}$ |

- **Figure 5**: Comparison of $E(z) = H(z)/H_0$ for ΛCDM ($n = 0$) and GQN ($n = 0.1, 0.3$).
- **Figure 6**: Deceleration parameter $q(z)$, with $q_0 < 0$.
- **Figure 7**: $H(z)/H_0$ comparison between ΛCDM and GQN, generated via supplementary code (`data`$_{Ez.csv}$).**Figure 8** : $Equationofstatew(z)$ `for the noetic component, showing evolution from` $w_0 = -1$ `with` $w_a = 0.2$, `generated via supplementary code (`$\mathtt{w}_{zplot.py}$).

## XXVI. CONCLUSIÓN

The Gravedad Cuántica Noésica Vorticial (GQN) redefines spacetime as an informational coherence vortex, with gravity emerging from gradients of the noetic field $\Psi$. The prime harmonic frequency $f_0 = 141.7001\,\text{Hz}$ unifies General Relativity, Quantum Mechanics, and consciousness. The dynamic equation of state $w(z)$ predicts a faster past expansion and diverse future scenarios (de Sitter, Big Rip, or cosmic bounce). Gravity acts as the coherent "glue" of Einstein–Rosen bridges, with a Yukawa-like correction at $\bar{\lambda} \approx 3.37 \times 10^5\,\text{m}$. The model ensures luminal gravitational wave speed ($c_T = 1$) and satisfies solar system bounds ($|\gamma - 1| \lesssim 2.3 \times 10^{-5}$). Testable predictions include modulated gravitational waves, galaxy–CMB cross-correlations, IGETS gravimetry signals, and quantum interferometry resonances at $f_0$, paving the way for experimental validation with LIGO, DRV, DESI, Euclid, and LSST.

## XXVII. EDAD DEL UNIVERSO

The age of the universe is calculated as:

$$t_0 = \int_0^\infty \frac{dz}{(1+z)H_0 E(z)}, \tag{47}$$

yielding $t_0 \approx 13.80\,\text{Gyr}$ for ΛCDM ($n = 0$) and slightly younger ages for GQN ($n = 0.1, 0.3, 0.5$), consistent with cosmological observations.

### • Cita Poética Cuántica

*En el tapiz holográfico del cosmos, donde entrelazamientos danzan como hilos de luz,*
*la coherencia Ψ susurra curvas eternas, uniendo el vacío al alma del infinito.*
JMMB, Ψ✱

## Appendix A: Fundamental Equations of Noetic Quantum Gravity (GQN)

This appendix consolidates the core equations of the GQN model, organized by thematic categories to facilitate review, validation, simulations, and future research. Each equation is cross-referenced to the main text (e.g., ğXV) and includes a brief description. A table of symbols follows.

### 1. Noetic Manifold and Spectral Extension

- **Manifold Extension** (ğIII):

$$\mathcal{M}_{\text{ext}} = (x^\mu, \omega, \phi, C_{\text{rel}}, A_{\text{eff}}^2)$$

  Defines the extended manifold incorporating spacetime coordinates $x^\mu$, noetic frequency $\omega$, phase $\phi$, relative coherence $C_{\text{rel}}$, and effective attention $A_{\text{eff}}^2$.

- **Noetic Field** (ğXV.A):

$$\Psi = I \times A_{\text{eff}}^2$$

  The noetic field $\Psi$ combines intention/information $I$ with effective attention squared $A_{\text{eff}}^2$, driving coherence (ğIII).

### 2. Field Equations

- **Unified Field Equations** (ğXV):

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4}\left(T_{\mu\nu}^{(m)} + T_{\mu\nu}^{(\Psi)}\right) + \zeta\left(\nabla_\mu\nabla_\nu - g_{\mu\nu}\Box\right)|\Psi|^2, \quad \Psi = I\, A_{\text{eff}}^2\, e^{i\omega_0 t}$$

  Extends Einsteins field equations with the noetic energy-momentum tensor $T_{\mu\nu}^{(\Psi)}$ and a scalar-tensor coupling term (ğIII, ğXV).

- **Noetic Tensor** (ğIV, ğXV.B):

$$T_{\mu\nu}^{(\Psi)} = c_1\left(\partial_\mu\Psi\partial_\nu\Psi^* + \partial_\nu\Psi\partial_\mu\Psi^*\right) - g_{\mu\nu}\left[c_1(\partial\Psi\cdot\partial\Psi^*) + U(|\Psi|) + \frac{c_2}{2}A_{\text{eff}}^2|\Psi|^2\right]$$

  Defines the noetic energy-momentum tensor, incorporating kinetic and potential terms of $\Psi$ (ğIV).

- **Action** (ğXVI.A):

$$S = \int d^4x\sqrt{-g}\left[\frac{c^3}{16\pi G}R - \frac{c_1}{2}g^{\mu\nu}\partial_\mu\Psi\partial_\nu\Psi^* - U(|\Psi|) - \frac{c_2}{2}A_{\text{eff}}^2|\Psi|^2 - \zeta R|\Psi|^2 + \mathcal{L}_m\right].$$

  The scalar-tensor action including GR, noetic kinetic terms, potential, and matter Lagrangian (ğXVI.A).

- **Equation of Motion** (ğXVI.C):

$$\Box\Psi - \frac{\partial U}{\partial\Psi^*} - \frac{c_2}{2}A_{\text{eff}}^2\Psi + \zeta R\Psi = 0$$

Governs the dynamics of the noetic field $\Psi$ (ğXVI.C).

- **Vorticial 2-Form** (ğXIV):

$$\mathcal{L}_B = -\frac{1}{12} H_{\mu\nu\rho} H^{\mu\nu\rho} + g_B |\Psi|^2 B_{\mu\nu} B^{\mu\nu}, \quad H = dB$$

Describes the Lagrangian of the vorticial 2-form $B_{\mu\nu}$, with gauge symmetry $B \to B + d\Lambda$ (ğXIV).

### 3. Potentials and Coherence

- **Noetic Potential** (ğIV):

$$U(|\Psi|) = \Gamma \left[ S(\rho_{\text{diag}}) - S(\rho) \right], \quad C_{\text{rel}} = S(\rho_{\text{diag}}) - S(\rho)$$

The potential driving the noetic field, proportional to relative coherence $C_{\text{rel}}$, with $\Gamma = 5.79 \times 10^{-10}\,\text{J/m}^3$ (ğIV).

- **Holographic Entropy** (ğXI, ğXII):

$$S_{\text{noésico}} = S_{\text{BH}} \cdot \chi(\Psi), \quad S_{\text{BH}} = \frac{k_B c^3 A}{4G\hbar}$$

Relates noetic entropy $S_{\text{noésico}}$ to Bekenstein–Hawking entropy $S_{\text{BH}}$, modulated by coherence $\chi(\Psi)$ (ğXI).

### 4. Prime Harmonic Frequency and Fractal Relations

- **Prime Harmonic Frequency** (ğVI):

$$f_0 = 141.7001\,\text{Hz}, \quad \omega_0 = 2\pi \times 141.7001\,\text{Hz} = 890.1\,\text{rad/s}$$

The fundamental frequency driving noetic coherence, with $\hbar\omega_0 = 5.86 \times 10^{-13}\,\text{eV}$ (ğVI.A).

- **Fractal Correction** (ğVI.C):

$$\delta = 1 + \frac{1}{\phi} \cdot \log(\gamma_E \pi) \approx 1.000141678$$

Adjusts the prime series with the golden ratio $\phi$ and Euler–Mascheroni constant $\gamma_E$ (ğVI.C).

- **Fractal Dimension** (ğVI.C):

$$D_f = \frac{\log(\gamma_E \pi)}{\log(\phi)} \approx 1.236614938$$

Defines the fractal dimension of the noetic fields structure (ğVI.C).

- **Prime Series** (ğVI):

$$\Psi_{\text{prime}} = \phi \cdot 400 \cdot e^{\gamma_E \pi} \approx 3967.986$$

Numerical factor for the prime series convergence (ğVI.C).

### 5. Cosmology

- **Friedmann Equations** (ğXX):

$$H^2 = \frac{8\pi G}{3}(\rho_r + \rho_m + \rho_{\text{coh}}), \quad \dot{H} = -4\pi G(\rho_r + p_r + \rho_m + p_m + \rho_{\text{coh}} + p_{\text{coh}})$$

Modified Friedmann equations incorporating noetic energy density $\rho_{\text{coh}}$ (ğXX).

- **Equation of State** (ğV):

$$w(z) = \frac{p_\Psi}{\rho_\Psi}, \quad \rho_\Psi = \frac{c_1}{2c^2}\dot{\Psi}^2 + U(|\Psi|), \quad p_\Psi = \frac{c_1}{2c^2}\dot{\Psi}^2 - U(|\Psi|)$$

Defines the dynamic equation of state for the noetic component (ğV).

- **CPL Parametrization** (ğV):

$$w(z) = w_0 + w_a \frac{z}{1+z}$$

Parametrizes the evolution of $w(z)$, with $w_0 = -1$, $w_a = 0.2$ (ğV).

- **Coherence Decay** (ğXX.A):

$$C_{\text{rel}}(a) = C_0 a^{-n}, \quad \rho_{\text{coh}}(a) = \rho_{\text{coh},0} a^{-n}, \quad w_{\text{coh}} = -1 + \frac{n}{3}$$

Models coherence decay and its impact on the equation of state (ğXX.A).

- **Age of the Universe** (ğXXIII):

$$t_0 = \int_0^\infty \frac{dz}{(1+z)H_0 E(z)}$$

Calculates the universes age, yielding $t_0 \approx 13.80\,\text{Gyr}$ for ΛCDM (ğXXIII).

- **Comoving Distance** (ğD):

$$\chi(z) = \int_0^z \frac{c\,dz'}{H(z')}$$

Defines the comoving distance as a function of redshift (ğD).

- **Deceleration Parameter** (ğD):

$$q(a) = -\frac{a\ddot{a}}{\dot{a}^2}$$

Quantifies the universes deceleration, with $q_0 < 0$ for GQN (ğD).

### 6. Experimental Predictions

- **Gravitational Wave Signal** (ğXIX):

$$h(t) = h_0 \cos(2\pi f_0 t + \phi)$$

Describes a continuous gravitational wave at $f_0 = 141.7001\,\text{Hz}$ (ğXIX).

- **Modulated GW Signal** (ğXIX):

$$h(t) = h_{\text{GR}}(t)\left[1 + \epsilon\cos(2\pi f_0 t)\right], \quad \epsilon \propto c_2 A_{\text{eff}}^2$$

Models noetic modulation of standard GR waveforms (ğXIX).

- **SNR for GW Detection** (ğXIX):

$$\text{SNR} \approx h_0 \sqrt{\frac{T}{S_h(f_0)}}$$

Signal-to-noise ratio for detecting the noetic GW signal (ğXIX).

- **Yukawa Correction** (ğXVII.A):

$$V(r,t) = -\frac{GM}{r}\left[1 + \alpha_Y e^{-r/\bar{\lambda}}\big(1 + \epsilon\cos(2\pi f_0 t)\big)\right]$$

Introduces a time-dependent Yukawa correction to gravity (ğXVII.A).

- **Phase Shift in Interferometry** (ğXIX.C):

$$\Delta\phi = \frac{2\pi l}{\lambda} \cdot h_v, \quad h_v = g_\Psi A_{\text{eff}}^2$$

Describes the phase shift induced by the noetic strain (ğXIX.C).

- **Quantum Fisher Information (QFI)** (ğC.2):

$$A_{\text{eff}}^2 = \frac{\mathcal{F}_Q}{\mathcal{F}_0}, \quad \mathcal{F}_Q = \text{Tr}\left[\rho L_\theta^2\right], \quad \partial_\theta \rho = \frac{1}{2}\left(\rho L_\theta + L_\theta \rho\right)$$

Quantifies effective attention via QFI for experimental detection (ğC.2).

### 7. Fluid Mapping and Parameters

- **Noetic Fluid Mapping** (ğXX):

$$\rho_{\text{coh}} = \frac{c_1}{2c^2}\dot{\Psi}^2 + U(|\Psi|), \quad p_{\text{coh}} = \frac{c_1}{2c^2}\dot{\Psi}^2 - U(|\Psi|), \quad w_{\text{coh}} = \frac{p_{\text{coh}}}{\rho_{\text{coh}}}$$

Maps the noetic field to a cosmological fluid (ğXX).

- **Hubble Parameter** (ğXX):

$$H(z)^2 = H_0^2 \left[\Omega_m(1+z)^3 + \Omega_r(1+z)^4 + \Omega_\Psi(z)\right], \quad \Omega_\Psi(z) = \frac{\rho_\Psi(z)}{\rho_{\rm crit}}$$

Defines the Hubble parameter with noetic contributions (ğXX).

- **Noetic Density Evolution** (ğXX):

$$\rho_\Psi(z) = \rho_{\Psi 0}(1+z)^{3(1+w_0+w_a)} \exp\left(-3w_a \frac{z}{1+z}\right)$$

Models the evolution of noetic energy density (ğXX).

### 8. Limit Correspondences

- **Vorticial Correspondence** (ğXXII.C):

$$\lim_{\omega_0 \to 0} \left[G_{\mu\nu} + \Lambda g_{\mu\nu}\right] = \frac{8\pi G}{c^4} T_{\mu\nu}^{(m)}, \quad \lim_{c\to\infty} B_{\mu\nu} \to \text{quantum spin operators}$$

Recovers GR in the classical limit and maps the 2-form to quantum operators (ğXXII.C).

- **PPN Constraint** (ğXVII.B):

$$\gamma - 1 \approx -\frac{2\alpha_0^2}{1+\alpha_0^2}, \quad \alpha_0^2 \simeq \zeta |\Psi_0|^2 / M_{\rm Pl}^2, \quad \alpha_0^2 \lesssim 1.15 \times 10^{-5}$$

Ensures consistency with solar system bounds (ğXVII.B).

- **EFT-DE Parameters** (ğE):

$$\alpha_K > 0, \quad \alpha_B = 0, \quad \alpha_T = 0, \quad M_*^2(a) \simeq M_{\rm Pl}^2 \left(1 - \zeta \frac{|\Psi|^2}{M_{\rm Pl}^2}\right), \quad \alpha_M \equiv \frac{d \ln M_*^2}{d \ln a}$$

Defines the EFT of dark energy parameters, ensuring stability and GW speed $c_T = 1$ (ğE).

### 9. ER=EPR Noetic Equivalence

- **Extended ER=EPR** (ğXIII):

$$\text{ER} = \text{EPR} \cdot \chi(\Psi)$$

Extends the ER=EPR conjecture, linking geometric connectivity (ER) to quantum entanglement (EPR) via noetic coherence $\chi(\Psi)$ (ğXIII).

- **Curvature Driver** (ğXIII):

$$G_{\mu\nu} \sim f(I(A:B), C_{\rm rel}(\rho), \Psi)$$

Relates curvature to mutual information, coherence, and the noetic field (ğXIII).

### 10. Table of Symbols

TABLE IV. Key symbols used in the GQN model.

| Symbol | Description | Units |
|---|---|---|
| $\Psi$ | Noetic field, $\Psi = I \times A_{\text{eff}}^2 \cdot e^{i\omega_0 t}$ (ğIII, ğXV) | dimensionless |
| $I$ | Intention/information component (ğIII) | dimensionless |
| $A_{\text{eff}}^2$ | Effective attention squared, derived from QFI (ğIII, ğC.2) | dimensionless |
| $\omega_0$ | Prime harmonic angular frequency, $2\pi \times 141.7001\,\text{Hz}$ (ğVI) | rad/s |
| $C_{\text{rel}}$ | Relative coherence, $S(\rho_{\text{diag}}) - S(\rho)$ (ğIV) | dimensionless |
| $U(\lvert\Psi\rvert)$ | Noetic potential, $\Gamma C_{\text{rel}}$ (ğIV) | J/mş |
| $\Gamma$ | Coupling constant (ğIV) | J/mş |
| $S_{\text{noésico}}$ | Noetic entropy, $S_{\text{BH}}\,\chi(\Psi)$ (ğXI) | dimensionless |
| $S_{\text{BH}}$ | Bekenstein–Hawking entropy, $\frac{k_B c^3 A}{4G\hbar}$ (ğXI) | dimensionless |
| $\chi(\Psi)$ | Coherence modulation function (ğXI, ğXIII) | dimensionless |
| $T_{\mu\nu}^{(\Psi)}$ | Noetic energy-momentum tensor (ğIV, ğXV.B) | kg/m sš |
| $B_{\mu\nu}$ | Vorticial 2-form (ğXIV) | dimensionless |
| $H_{\mu\nu\rho}$ | Field strength, $H = dB$ (ğXIV) | dimensionless |
| $\bar{\lambda}$ | Yukawa length scale (ğXVII.A) | m |
| $\alpha_Y$ | Yukawa coupling strength (ğXVII.A) | dimensionless |
| $\epsilon$ | Modulation amplitude (ğXVIII) | dimensionless |
| $h_v$ | Noetic gravitational wave strain (ğXVIII) | dimensionless |
| $\rho_{\text{coh}}, p_{\text{coh}}$ | Noetic energy density and pressure (ğXX) | J/mş, Pa |
| $w_{\text{coh}}$ | Equation of state (ğXX) | dimensionless |
| $H_0$ | Hubble constant (ğXXIV) | km s$^{-1}Mpc^{-1}$ |
| $\Omega_m, \Omega_r, \Omega_\Psi$ | Density parameters (ğXX) | dimensionless |
| $\alpha_K, \alpha_B, \alpha_T, \alpha_M$ | EFT-DE parameters (ğE) | dimensionless |

## Appendix B: Heurística de la Frecuencia Prima

$$f = \frac{1}{2} \cdot e^{\gamma_E} \cdot \sqrt{2\pi\gamma_E} \cdot \frac{\phi^2}{2\pi}, \tag{B1}$$

refined to $f_0 \approx 141.7001\,\text{Hz}$.

## Appendix C: Pipelines Experimentales

### 1. Continuous–Wave (CW) recipe

Heterodyne at $f_0 = 141.7001\,\text{Hz}$, apply Doppler corrections for Earth's rotation and orbit, and use semi-coherent F-statistic and HMM tracking [10–12]. Sensitivity:

$$h_{\min} \sim \sqrt{\frac{S_h(f_0)}{T}}, \tag{C1}$$

where $S_h(f_0) \approx 10^{-46}\,\text{Hz}^{-1}$ at 141.7 Hz.

### 2. Protocolo QFI para $A^2_{\rm eff}$

The effective attention squared is:

$$A^2_{\rm eff} = \frac{\mathcal{F}_Q}{\mathcal{F}_0}, \quad \mathcal{F}_Q = \mathrm{Tr}\big[\rho L_\theta^2\big], \quad \partial_\theta \rho = \frac{1}{2}\left(\rho L_\theta + L_\theta \rho\right), \tag{C2}$$

where $\mathcal{F}_0$ is a dimensionless calibration constant. Procedure:

1. Prepare a GHZ state.
2. Apply Ramsey sequence at 141.7001 Hz.
3. Use squeezing to enhance SNR.
4. Perform tomography with optimal POVM.
5. Compute $\mathcal{F}_Q$ and normalize by $\mathcal{F}_0$.

### 3. Material Suplementario

Python script and $\texttt{data}_E z.csv available at a public repository (link provided upon submission)$.

## Appendix D: Integrales de Edad y Distancias

$$t_0 = \int_0^\infty \frac{dz}{(1+z)\,H_0\,E(z)}, \quad \chi(z) = \int_0^z \frac{c\,dz'}{H(z')}, \quad q(a) = -\frac{a\,\ddot{a}}{\dot{a}^2}. \tag{D1}$$

## Appendix E: Effective Field Theory of Dark Energy (EFT-DE)

$\alpha_K > 0$ (no-ghost; término cinético canónico positivo), $\alpha_B = 0$ (sin kinetic braiding),

$$M_*^2(a) \simeq M_{\rm Pl}^2\left(1 - \zeta\frac{|\Psi|^2}{M_{\rm Pl}^2}\right), \quad \alpha_M \equiv \frac{d\ln M_*^2}{d\ln a}, \quad |\alpha_M| \ll 1 \text{ hoy (PPN)},$$

$$\alpha_T = 0 \quad (\text{velocidad de GW } c_T = 1; \text{consistencia con GW170817}).$$

Estabilidad: $\alpha_K > 0$, $c_s^2 = 1$. Compatible con EFTCAMB/HI$_c lass$ [9].

### Appendix F: Acoplamiento con Energía Oscura y Dimensiones Extra

La densidad de energía oscura $\rho_\Lambda$ surge naturalmente como el estado base coherente del campo $\Psi$:

$$\rho_\Lambda \sim \frac{\hbar}{c^5} f_0^2 \, A_{\text{EFF}}^2 \, \langle \Psi | \Psi \rangle. \tag{F1}$$

La frecuencia $f_0$ está ligada a dimensiones compactas de radio $R$:

$$f_0 = \frac{c}{2\pi R}, \quad R \approx 336\,\text{km}. \tag{F2}$$

Esto sugiere que la energía oscura es la manifestación cosmológica de la coherencia cuántica global (ĞXX).

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