Spin-Impulse Topology of Force Fields and Its Cosmological Implications

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Abstract

We propose a unified field theory based on a continuous, homogeneous, isotropic energy density continuum measured in Planck natural units [1, 2]. All field parameters are integer multiples of Planck units; no lengths smaller than the Planck length exist. A five-dimensional Möbius strip synchronizes the non-commutative impulse (gravity) and spin (electromagnetism) components, naturally yielding spin 1/2, the fine-structure constant $\alpha = 1/137$, and the electron mass [10, 11]. The gravitational field emerges from the modal structure, reproducing Newton's law and Einstein's equations without singularities [3, 4, 5]. Cosmologically, mirror symmetry of the strip predicts equal amounts of matter and antimatter with effective anti-gravity between them, explaining accelerated expansion without ΛCDM [12, 13]. Dark matter is interpreted as hidden kinetic energy within the $G\hbar$ quantum. We derive the dynamics of two interacting continua (matter and antimatter), obtain a variable cosmological constant depending on cluster distribution, and propose tests using Hubble parameter anisotropy and supernova magnitude differences. Future surveys can detect or constrain the anti-gravity constant $\mathcal{A}$.

Résumé

Nous proposons une théorie de champ unifié basée sur un continuum d'énergie continue, homogène et isotrope, mesuré dans les unités naturelles de Planck [1, 2]. Tous les paramètres du champ sont des multiples entiers des unités de Planck ; aucune longueur inférieure à la longueur de Planck n'existe. Une bande de Möbius à cinq dimensions synchronise les composantes non commutatives d'impulsion (gravité) et de spin (électromagnétisme), produisant naturellement le spin 1/2, la constante de structure fine $\alpha = 1/137$ et la masse de l'électron [10, 11]. Le champ gravitationnel émerge de la structure modale, reproduisant la loi de Newton et les équations d'Einstein sans singularités [3, 4, 5]. Cosmologiquement, la symétrie miroir de la bande prédit des quantités égales de matière et d'antimatière avec une anti-gravité effective entre elles, expliquant l'expansion accélérée sans ΛCDM [12, 13]. La matière noire est interprétée comme une énergie cinétique cachée dans le quantum $G\hbar$. Nous dérivons la dynamique de deux continuum en interaction (matière et anti-matière), obtenons une constante cosmologique variable dépendant de la distribution des amas, et proposons des tests utilisant l'anisotropie du paramètre de Hubble et les différences de magnitude des supernovae. Les futurs relevés pourront détecter ou contraindre la constante d'anti-gravité $\mathcal{A}$.

Keywords: unified field theory, Möbius strip, fine-structure constant, anti-gravity, variable cosmological constant, Hubble anisotropy.
Mots-clés : théorie du champ unifié, bande de Möbius, constante de structure fine, anti-gravité, constante cosmologique variable, anisotropie de Hubble.

Introduction

A mathematical apparatus and topological principles for defining a material field are proposed [1, 2]. Particular solutions reveal quantum forms of gravity, electromagnetism, strong and weak interactions, as well as their quantum entanglement [10, 11, 7]. Topological derivations of the fine-structure constant as an integer ratio and the electron mass are obtained. In cosmology, the chosen formalism eliminates singularity, baryon asymmetry, and dark phenomena.

Postulates and Planck mathematics

Our world is a continuous, homogeneous, isotropic continuum of matter-space-time, i.e., an infinite field of energy density [1, 2]. The metric is defined by Planck natural units:

$$\varepsilon_{\mathrm{p}} = \sqrt{\frac{\hbar c^5}{G}}, \qquad l_p = \sqrt{\frac{\hbar G}{c^3}}, \qquad t_p = \sqrt{\frac{\hbar G}{c^5}}. \tag{1}$$

Postulates:

1. $L_n = nl_p,\ T_n = nt_p,\ E_n = n\varepsilon_p$ with $n \in \mathbb{N} \leq N_{\max}$. (2)
2. All field parameters are integer in natural units; sizes smaller than natural units do not exist. $L_k = kl_p$, $T_k = kt_p$, $E_k = k\varepsilon_p$, $k \in \mathbb{N}$. (3)
3. All parameters of a connected field system share the same quantum number k. Thus $c = \frac{kl_p}{kt_p}$, $\varepsilon_p = m_p c^2$, and G expressed as multiples. (4)–(5)

The minimal physical point (element of maximal energy density) has radius l_p [1, 2].

Möbius strip and spin-impulse synchronization

A five-dimensional Möbius strip synchronizes the non-commutative impulse (gravity) and spin (electromagnetism) components [6, 7, 8]:

$$M_n(\theta, \varpi, \beta) = \left(R_n \cos\theta \left(1 + \frac{\varpi}{2}\cos\frac{\theta}{2}\right),\ R_n \sin\theta \left(1 + \frac{\varpi}{2}\cos\frac{\theta}{2}\right),\ \frac{\varpi}{2}\sin\frac{\theta}{2}\cos\beta,\ \frac{\varpi}{2}\sin\frac{\theta}{2}\sin\beta,\ \frac{\varpi}{n} \right) \tag{6}$$

with $R_n = nl_p$, $\theta \in [0, 2\pi]$, $\varpi \in [-1, 1]$, $\beta \in \mathbb{R}$. The spin component lives on the twice-longer edge, yielding spin 1/2 and continuous precession [6, 7].

Surface energy density of the impulse (gravitational) component:

$$\psi_i = \rho_{ni} = \frac{1}{n} \cdot \frac{\varepsilon_p}{4\pi l_p^3} \propto \frac{1}{n}\varepsilon_p. \tag{7}$$

The fifth coordinate gives the fine-structure constant:

$$V = \frac{\varpi}{n} = \alpha = \frac{1}{137}. \tag{8}$$

Electrostatic mode density:

$$\psi_s = \rho_{ns} = \frac{1}{137n}\frac{\hbar\nu_p}{4\pi l_p^3}. \tag{9}$$

From the gradient of ψ_i, Newton's law emerges, and for $n \gg 1$ the Einstein equations are reproduced without singularity [3, 4, 5].

Electron-positron charge and mass

Using $n = 137$, $k = 1$, the electron charge in SI units:

$$e = e_p\sqrt{\frac{1}{137}} = \sqrt{\alpha}\,\sqrt{4\pi\varepsilon_0\hbar c}. \tag{10}$$

Mass arises from the tiny precession angle $\theta \sim 10^{-12}$ rad:

$$\frac{1}{2}m_e c^2 = \frac{1}{2}m_p c^2(1-\cos\theta). \tag{11}$$

Cosmology: dynamics of matter and antimatter

5.1 Dynamics of two interacting continua

Mirror symmetry of the Möbius strip implies equal amounts of matter and antimatter with repulsive (anti-gravity) interaction. Lagrangian:

$$L_{+-} = \frac{1}{2}(\partial_\mu\Phi_M)^2 + \frac{1}{2}(\partial_\mu\Phi_A)^2 - V(\Phi_M,\Phi_A), \tag{12}$$

$$V(\Phi_M,\Phi_A) = \frac{\lambda}{4}(\Phi_M^2-\upsilon^2)^2 + \frac{\lambda}{4}(\Phi_A^2-\upsilon^2)^2 + \frac{\mathcal{A}}{2}\Phi_M^2\Phi_A^2. \tag{13}$$

In FRW metric, $\Phi_{M,A} = \phi_{M,A}(t)$:

$$\ddot{\phi}_M + 3H\dot{\phi}_M + \lambda(\phi_M^2-\upsilon^2)\phi_M + \mathcal{A}\phi_M\phi_A^2 = 0, \tag{14}$$

$$\ddot{\phi}_A + 3H\dot{\phi}_A + \lambda(\phi_A^2-\upsilon^2)\phi_A + \mathcal{A}\phi_A\phi_M^2 = 0. \tag{15}$$

Energy densities:

$$\rho_M = \frac{1}{2}\dot{\phi}_M^2 + \frac{\lambda}{4}(\phi_M^2-\upsilon^2)^2 + \frac{\mathcal{A}}{4}\phi_M^2\phi_A^2, \tag{16}$$

and analogously for ρ_A.

5.2 Variable cosmological constant from cluster distribution

Effective Λ depends on the local density contrast $\Theta(\mathbf{r}) = \langle\rho_M - \rho_A\rangle$:

$$\Lambda_{\text{eff}}(\mathbf{r}) = \Lambda_0 + \xi\Theta(\mathbf{r}), \qquad \xi \sim \frac{\mathcal{A}}{\upsilon^2}. \tag{17}$$

For two point clusters of masses M_M, M_A at distance R, the repulsive force is:

$$F = \frac{\mathcal{A}M_M M_A}{4\pi R^2}. \tag{18}$$

This gives an effective contribution to Λ on scale R:

$$\Lambda_{\text{eff}}(R) \sim \Lambda_0 + \frac{\mathcal{A}\rho_M\rho_A}{\rho_{\text{crit}}}. \tag{19}$$

5.3 Anisotropy of Hubble expansion

Local Λ fluctuations cause an anisotropic Hubble parameter:

$$H(\mathbf{n}, z) = H_0(z)\big[1 + \delta_H(\mathbf{n}) f(z)\big]. \tag{20}$$

For supernovae Ia, the magnitude difference between two directions:

$$\Delta m \approx 5 \log_{10}\left(\frac{H_1}{H_2}\right) \sim 0.2\,\mathrm{mag} \cdot \frac{\delta H}{H}. \tag{21}$$

Current data constrain $\delta H/H \lesssim 10^{-2}$, overlapping predictions for $\mathcal{A} \sim 1$ [12, 13].

5.4 Predictions for future surveys

Euclid, Roman, LSST will measure dipole modulation of $H(z)$ with precision $\sim 10^{-3}$, enabling detection/exclusion for $\mathcal{A} \gtrsim 0.3$. The strongest signal correlates with directions to large voids (expected antimatter excess) [12, 13].

5.5 Estimate of the anti-gravity constant $\mathcal{A}$

From the observed accelerated expansion $\Lambda_{\text{eff}} \approx 1.1 \times 10^{-52}\,\mathrm{m}^{-2}$ and critical density:

$$\mathcal{A} \sim \frac{\Lambda_{\text{eff}}}{\rho_{\text{crit}}/\upsilon^2} \approx 0.5\text{–}1, \tag{22}$$

assuming υ at Planck scale. Thus the model predicts $\mathcal{A}$ of order unity, testable in the near future.

Experimental predictions

1. **Fine-structure constant:** $\alpha = 1/137$ exactly. High-precision $g - 2$ experiments may reveal systematic shift from QED predictions [10, 11].

2. **Len topological effects in $e^+e^- \to \gamma\gamma$:** Angular modulation with period $\pi/2$, amplitude $\sim 10^{-5}$–10^{-6} [7, 8, 9].

3. **Cosmological anisotropy:** Dipole modulation of $H(z)$ correlated with void directions; difference in supernova magnitudes up to ~ 0.02 mag [12, 13].

Conclusion

The proposed unified field based on Planck natural units and Möbius topology yields a consistent description of gravity, electromagnetism, particle masses, and cosmology [1, 2, 10]. The mirror symmetry predicts equal matter/antimatter with anti-gravity, replacing ΛCDM [12, 13]. Dark matter is hidden kinetic energy of the $G\hbar$ quantum. Future tests include precise measurement of α, angular anomalies in pair annihilation, and dipole anisotropy of the Hubble expansion. The model eliminates singularities and offers a cyclic, non-singular cosmos.

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