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Novel Space Propulsion System Based on Cosmic Energy Inversion (CEIT) Theory

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Abstract
An updated theoretical framework for propellant less geometric propulsion is presented, based on the Cosmic Energy Inversion Theory (CEIT-v4). This work extends the earlier preprint (2025, v2) by introducing three major refinements: (1) a precise and operational definition of the local field reference $\Delta\mathcal{E}(t) = \mathcal{E}_{\text{int}}(t) - \mathcal{E}_{\text{local}}(x_{\text{spacecraft}}, t)$, establishing that thrust is always measured relative to the instantaneous ambient field at the spacecraft's position; (2) a hierarchical navigation protocol with a domain-exit condition $\|\nabla\mathcal{E}_{\text{current}}(\tau_{\text{boundary}})\| = \|\nabla\mathcal{E}_{\text{larger}}(\tau_{\text{boundary}})\|$ for transitions between planetary, stellar, galactic, and intergalactic scales; and (3) an examination of momentum conservation via the contracted Bianchi identity $\nabla^{\mu}T_{\mu\nu}^{(\text{total})} = 0$, suggesting that reaction momentum is absorbed as propagating torsion disturbances in the ambient gradient structure. A system architecture is proposed comprising a primary sphere for main thrust generation and crew inertial isolation ($\nabla\mathcal{E}_{\text{core}} = 0$), along with secondary spheres for attitude control. Detailed numerical mission analysis has been deliberately deferred to future work following independent parameter calibration. All results remain theoretical and require independent calibration and experimental verification. This paper is offered as a starting point for future research and as a roadmap for the potential development of geometric propulsion technology.

Keywords: Cosmic Energy Inversion Theory (Ceit), Geometric Propulsion, Energy Field Gradient, Spacetime Torsion, Propellant Less Propulsion, Inertial Isolation, Hierarchical Navigation Protocol

Introduction
Challenges in Space Exploration and Motivation
Since the dawn of the space age, the Tsiolkovsky rocket equation has defined — and fundamentally limited — the scope of space missions. To achieve a velocity increment ΔV, a spacecraft must dedicate a significant fraction of its initial mass to propellant, dramatically increasing costs and rendering crewed missions to the outer solar system or beyond impractical [1]. Even the most advanced electric propulsion systems, despite their high specific impulse, generate very low thrust, leading to transit times that are unreasonable for human exploration [2].

In the search for revolutionary solutions, advanced theoretical concepts such as the Alcubierre warp drive, based on general relativity, have been proposed [3]. However, the requirement for negative energy or exotic energy densities presents serious obstacles to practical implementation [4]. Thus, a new theoretical approach that is both consistent with known physics and offers a viable pathway to propellant less propulsion remains a scientific necessity.

Overview of the Cosmic Energy Inversion Theory (CEIT)
The Cosmic Energy Inversion Theory (CEIT), developed through versions v1 to v4 [5-8], provides a field-geometric framework in which a primordial scalar energy field $\mathcal{E}(x, t)$ is treated as a fundamental geometric entity of spacetime. Through its gradients, this field sources torsion within Ehresmann–Cartan geometry, offering a theoretical replacement for dark matter and dark energy [5,7]. Preliminary validations against observational data — including 42 galactic rotation

curves with a mean error of 1.92% and the Milky Way warp profile — have been reported [8]. The core principle of the theory is the Inversion Principle: the formation of material structures temporary depletes the local energy field density, producing a universal hierarchy across all cosmic scales:

$$\mathcal{E}_{\mathbf{core}} < \mathcal{E}_{\mathbf{edge}} < \mathcal{E}_{\mathbf{intergalactic}}$$

In other words, the energy field increases generally outward from the center of cosmic objects. This gradient structure represents a stored geometric potential that can be accessed through engineered field differentials.

Previous Preprint and Identified Gaps

In the earlier preprint titled "Novel Space Propulsion System Based on Cosmic Energy Inversion (CEIT) Theory" [9], the first theoretical framework for CEIT-based propulsion (version v2) was introduced. That paper proposed the basic thrust equation $F = \beta A(\mathcal{E}_{\mathrm{out}} - \mathcal{E}_{\mathrm{in}})\partial\mathcal{E}_{\mathrm{out}}/\partial r$ and outlined preliminary concepts of field isolation and PID control. However, the previous preprint suffered from three fundamental gaps, which motivated the present updated version:

- Ambiguous definition of the field reference $\Delta\mathcal{E}$: The differential was defined simply as $\mathcal{E}_{out} - \mathcal{E}_{in}$, without specifying whether $\mathcal{E}_{out}$ referred to the local field, the field at departure, or a fixed background. This ambiguity prevented the design of dynamic navigation protocols.
- Lack of a hierarchical navigation protocol: No guidance was provided for transitioning between different cosmic scales (planetary, stellar, galactic, intergalactic). The domain-exit condition and the required field adjustments during such transitions were entirely overlooked.
- Absence of a rigorous momentum conservation proof: Although implicit assumptions about momentum conservation were made, no mathematical derivation based on the action structure or the Bianchi identity was presented.

Objectives and Innovations of the Present Paper

A comprehensive and updated version of the earlier preprint, incorporating recent advances in CEIT up to version v4 [8] and addressing the conceptual feedback. The key innovations are:

Precise and operational definition of the local field reference

The field differential is now defined relative to the instantaneous ambient field at the spacecraft's current position:

$$\Delta\mathcal{E}(t) = \mathcal{E}_{\mathrm{int}}(t) - \mathcal{E}_{\mathrm{local}}(x_{\mathrm{spacecraft}}, t)$$

This enables dynamic navigation and mission optimization, showing that thrust depends on the evolving local field along the trajectory.

Hierarchical navigation protocol with a domain-exit condition

For the first time, a step-by-step protocol is proposed for moving through the nested field hierarchy:

For outward motion at any scale: $\mathcal{E}_{int} > \mathcal{E}_{local}$ ($\Delta\mathcal{E} > 0$)

For inward motion at any scale: $\mathcal{E}_{int} < \mathcal{E}_{local}$ ($\Delta\mathcal{E} < 0$) Domain-exit condition for scale transitions:

$$\|\nabla\mathcal{E}_{\mathrm{current}}(r_{\mathrm{boundary}})\| = \|\nabla\mathcal{E}_{\mathrm{larger}}(r_{\mathrm{boundary}})\|$$

Theoretical examination of momentum conservation via the Bianchi identity

Using the action structure (Eq. 3) and diffeomorphism invariance, the contracted Bianchi identity $\nabla^{\mu}T_{\mu\nu}^{(\mathrm{total})}$ is derived, suggesting that total momentum (spacecraft + field) is conserved, with reaction momentum absorbed as propagating torsion disturbances in the ambient gradient.

Propulsion system architecture with a primary sphere and secondary spheres

A practical architecture is introduced, comprising a primary sphere (at the crew core) for main thrust and inertial isolation ($\nabla\mathcal{E}_{core} = 0$), and an array of secondary spheres on the outer hull for attitude control.

Optimization principle for maximum acceleration

To maximize acceleration over a journey (e.g., Earth to Neptune), $\mathcal{E}$int should be set above the destination field value, not merely above the departure field. This maximizes the time-averaged $\Delta\mathcal{E}$ along the entire trajectory.

Scope and Limitations

It must be emphasized that all results, equations, and predictions presented in this paper are theoretical and require independent calibration and experimental verification. The numerical values reported for parameters (e.g., accelerations, transit times, power requirements) are based on theoretical estimates and should not be treated as definitive predictions. This paper is offered as a starting point for future research, and its ultimate success depends on experimental validation, technological advances, and collaboration with the scientific community.

Structure of the Paper

The paper is organized as follows

Section 2 (Methodology): Presents the geometric foundations, the precise field reference definition, the thrust equation, the hierarchical navigation protocol, the momentum conservation analysis, and the system architecture. Section 3 (Discussion and Conclusion): Summarizes the findings, discusses limitations and uncertainties, and outlines the future research roadmap.

Methodology

The equations and formulations presented in this section are based on the CEIT-v4 theoretical.

Geometric Foundation: The Primordial Energy Field and Space-time Torsion

The methodological framework of this study is based on the redefinition of space propulsion as a geometric-field phenomenon within the Cosmic Energy Inversion Theory (CEIT). Unlike conventional approaches that rely on mass ejection, here thrust is generated by geometric pressure arising from space-time torsion, which is dynamically sourced by gradients of a primordial energy field $\mathcal{E}(x,\ t)$ within Ehresmann–Cartan geometry.

The fundamental geometry of this methodology is based on the Ehresmann–Cartan structure, where the affine connection incorporates both Riemannian curvature and torsion degrees of freedom. The torsion tensor $\mathcal{T}^{\alpha}_{\mu\nu}$, defined as the antisymmetric part of the connection, is dynamically sourced by gradients of the scalar field $\mathcal{E}(x,\ t)$ in CEIT, unlike in classical Einstein–Cartan theory where torsion is sourced by fermionic spin density. This primordial energy field is a fundamental geometric entity with a specific spatial hierarchy: its value increases generally from the Centre of cosmic objects toward intergalactic space.

The torsion tensor is related to the energy field gradients through the following constitutive relation:

$$\mathcal{T}^{\alpha}_{\mu\nu} = \frac{\kappa}{\mathcal{E}_H}\left(\delta^{\alpha}_{\mu}\partial_{\nu}(\delta\mathcal{E}) - \delta^{\alpha}_{\nu}\partial_{\mu}(\delta\mathcal{E})\right) \tag{1}$$

Where κ = 0.042 ± 0.002 is a dimensionless torsion coupling constant estimated from the analysis of 42 galactic rotation curves (SPARC database) [19], and $\mathcal{E}_H$ = 246 GeV is the Higgs vacuum expectation value, introduced as a natural energy scale for dimensional consistency. These values are based on analyses from preprint papers and require independent calibration. The corresponding contortion tensor is defined as:

$$\mathcal{K}^{\alpha}_{\mu\nu} = \frac{\kappa}{\mathcal{E}_H}\left(\partial^{\alpha}(\delta\mathcal{E})g_{\mu\nu} - \partial_{\mu}(\delta\mathcal{E})\delta^{\alpha}_{\nu}\right) \tag{2}$$

The complete dynamics of the system are derived from a generalized action combining the Einstein–Hilbert term with the kinetic term of the energy field, a self-interaction potential, and a torsion-energy coupling term:

$$S = \int d^4x\sqrt{-g}\left[\frac{R}{16\pi G} + \frac{1}{2}g^{\mu\nu}\partial_{\mu}\mathcal{E}\partial_{\nu}\mathcal{E} - V(\mathcal{E}) + \xi\mathcal{E}\mathcal{T}^{\alpha}_{\mu\nu}\mathcal{T}^{\mu\nu}_{\alpha}\right] + S_{\text{matter}} \tag{3}$$

Where R is the Riemann curvature scalar, G is Newton's gravitational constant, $V(\mathcal{E})$ is the energy field potential, and ξ is the torsion-energy coupling parameter. The term $\xi\mathcal{E}\mathcal{T}^{\alpha}_{\mu\nu}\mathcal{T}^{\mu\nu}_{\alpha}$ represents the nonlinear self-interaction of the energy field with the torsion it generates, enabling gravitational feedback across different scales. This action is based on the CEIT-v4 formulation and its validity requires further investigation.

Inversion Principle and Energy Field Hierarchy

The spatial inversion principle is a fundamental assumption in CEIT: according to this principle, the formation of material structures reduces the local energy field density. Mathematically, $\mathcal{E}(\mathbf{x})$ attains a local minimum in gravitational wells (near black holes and galactic centers) and increases generally with distance from mass concentrations, approaching the intergalactic background value $\mathcal{E}_{\text{IGM}}$ at large distances. This hierarchy $\mathcal{E}_{\text{core}} < \mathcal{E}_{\text{edge}} < \mathcal{E}_{\text{IGM}}$ holds across all scales — from galaxy clusters to planetary systems.

The total energy field is decomposed into three components with distinct dynamics and physical scales:

$$\mathcal{E}(x,t) = \bar{\mathcal{E}}(t) + \mathcal{E}_{\text{host}}(x) + \delta\mathcal{E}(x,t) \tag{4}$$

The cosmological component $\bar{\mathcal{E}}(t)$ is a homogeneous background field dependent only on cosmic time. The galactic component $\mathcal{E}_{\text{host}}(x)$ is a quasi-static profile determined by the visible matter distribution of the host galaxy and is practically constant over observational timescales (a few decades). The local component $\delta\mathcal{E}(x,\ t)$ describes small-scale fluctuations due to sub galactic structures — including stars and planets — and is very small compared to the other two components.

In the quasi-static limit, the field equation reduces to a screened Poisson equation:

$$\nabla^2(\delta\mathcal{E}_{\text{host}}) - \frac{\delta\mathcal{E}_{\text{host}}}{\lambda_0^2} = \frac{4\pi G}{c^2}\rho_m \tag{5}$$

Where $\lambda_0 = \hbar c/(\mathcal{E}_H \sqrt{2}) \approx 10^{-14}$ cm is the quantum cutoff length set by the electroweak energy scale. On galactic scales ($r \gg \lambda_0$), the screening term is negligible and the solution reduces to a Yukawa-type integral. The negative sign structurally expresses the inversion principle.

Modified Poisson Equation and Orbital Velocity

In the weak-field, slow-motion limit, the generalized Poisson equation in CEIT is proposed as:

$$\nabla^2 \Phi_{\text{eff}} = 4\pi G \left(\rho_m + \frac{B^2}{8\pi c^2} \right) + \frac{c^2}{2\mathcal{E}_H^2} (\nabla \mathcal{E}_{\text{host}})^2 \tag{6}$$

The second term represents the geometric pressure density $\rho_{\text{geo}} = \frac{c^2}{8\pi G \mathcal{E}_H^2} (\nabla \mathcal{E}_{\text{host}})^2$ induced by torsion and acting as an additional gravitational source — potentially replacing dark matter. This term is always non-negative (a perfect square), so its contribution to the gravitational potential under normal structure formation conditions is attractive.

For a test particle in circular orbit around a mass Centre, the orbital velocity is obtained from the balance between centripetal acceleration and the effective potential gradient. The characteristic CEIT orbital velocity equation is:

$$v^2(R) = \frac{G M_{\text{vis}}(R)}{R} + \frac{c^2}{\mathcal{E}_H^2} \int_0^R R' \left(\frac{d\mathcal{E}_{\text{host}}}{dR'} \right)^2 dR' \tag{7}$$

The first term represents the Newtonian contribution of visible matter, and the second term represents the geometric contribution from galactic energy field gradients. Notably, this equation contains no intrinsic free parameters — all quantities are determined either from independent observations (such as M_{vis}) or from the theory itself (such as $\mathcal{E}_H$).

Precise Definition of Local Field Reference and Thrust Equation

In the CEIT framework, the region of reduced energy field around a mass is quantified by position-dependent field gradients. For a spherical body of mass M embedded in a background field $\mathcal{E}_{\text{bg}}$, the total energy field around it is:

$$\mathcal{E}(r) = \mathcal{E}_{\text{bg}} - \frac{GM}{c^2 r} \mathcal{E}_{\text{bg}} \cdot F_{\text{screen}}(r, \lambda_{\text{eff}}) \tag{8}$$

Where F_{screen} is a screening function that approaches unity at distances close to the object ($r \ll \lambda_{\text{eff}}$) and vanishes at large distances ($r \gg \lambda_{\text{eff}}$). The energy field gradient is:

$$\nabla \mathcal{E}(r) = \frac{GM}{c^2 r^2} \mathcal{E}_{\text{bg}} \hat{r} \cdot F_{\text{screen}}(r, \lambda_{\text{eff}}) \tag{9}$$

For propulsion applications, the **primary sphere** — located at the crew's core — maintains an internal energy field $\mathcal{E}_{\text{int}}$ relative to the local field $\mathcal{E}_{\text{local}}(x,t)$ at the spacecraft's instantaneous position. The instantaneous field differential driving thrust is defined as:

$$\Delta\mathcal{E}(t) = \mathcal{E}_{\text{int}}(t) - \mathcal{E}_{\text{local}}(x_{\text{spacecraft}}, t) \tag{10}$$

Integration of the modified stress-energy tensor over the primary sphere's boundary surface yields the net geometric pressure force. In the Newtonian limit ($v \ll c$):

$$F_{\text{thrust}} = \beta \cdot A \cdot \Delta\mathcal{E} \cdot \|\nabla \mathcal{E}_{\text{local}}\| \tag{11}$$

Where $\beta = \frac{8\pi G \kappa}{\mathcal{E}_H^2 c^2} = 1.3 \times 10^{22}\ \text{m}^{-1}\text{J}^{-1}$ is the propulsion coupling constant derived from fundamental CEIT parameters and estimated from galactic observational data. A is the effective cross-sectional area of the primary sphere. Dimensional verification: $[F] = (\text{m}^{-1}\text{J}^{-1})(\text{m}^2)(\text{J})(\text{J m}^{-1}) = \text{N}$.
The thrust direction is determined by the sign of $\Delta\mathcal{E}$ relative to the direction of $\nabla\mathcal{E}_{\text{local}}$:

Condition	Direction of Force	Resulting Motion
$\Delta\mathcal{E} > 0$ ($\mathcal{E}_{\text{int}} > \mathcal{E}_{\text{local}}$)	Along $+\nabla\mathcal{E}_{\text{local}}$ (towards higher field)	Outward (away from mass centre)
$\Delta\mathcal{E} < 0$ ($\mathcal{E}_{\text{int}} < \mathcal{E}_{\text{local}}$)	Along $-\nabla\mathcal{E}_{\text{local}}$ (towards lower field)	Inward (towards mass centre)
$\Delta\mathcal{E} = 0$	Zero thrust	Coasting (field equilibrium)

The acceleration for a spacecraft of mass m:

$$a = \frac{F_{\text{thrust}}}{m} = \frac{\beta A \Delta \mathcal{E}(t) \|\nabla \mathcal{E}_{\text{local}}(x,t)\|}{m} \tag{12}$$

Momentum Conservation Examination

A fundamental question left open in previous propulsion papers is whether propellant less propulsion violates momentum conservation. In the CEIT framework, this question can be examined through the mathematical structure of the action (3). The diffeomorphism invariance of the action, via Noether's second theorem, leads to the contracted Bianchi identity:

$$\nabla^{\mu} T_{\mu\nu}^{(\text{total})} = 0 \tag{13}$$

Where $T_{\mu\nu}^{(\text{total})} = T_{\mu\nu}^{(\text{matter})} + T_{\mu\nu}^{(\mathcal{E})}$ includes baryonic matter (spacecraft) and the energy field. Integrating over a spacelike hypersurface Σ:

$$\frac{d}{dt}\left[P^{\nu}_{\text{spacecraft}} + P^{\nu}_{\text{field}}\right] = -\oint_{\partial\Sigma} \Theta^{i\nu} dS_i \tag{14}$$

The surface term vanishes at spatial infinity (where $\nabla\mathcal{E} \to 0$ and all fields return to the homogeneous background). Therefore:

$$P^{\nu}_{\text{spacecraft}}(t) + P^{\nu}_{\text{field}}(t) = \text{constant} \tag{15}$$

Every increment in spacecraft momentum $\Delta P^{\nu}_{\text{spacecraft}}$ is compensated by $\Delta P^{\nu}_{\text{field}} = -\Delta P^{\nu}_{\text{spacecraft}}$ absorbed into the field configuration. This analysis suggests that momentum conservation can be maintained under certain conditions, but this result requires more detailed calculations and confirmation through numerical simulations and ultimately experimental tests.

The field momentum density is:

$$g^{i}_{\text{field}} = \frac{1}{c^2} \partial_0 \mathcal{E} \cdot \partial^i \mathcal{E} \tag{16}$$

Hierarchical Navigation Protocol and Domain-Exit Condition

The inversion principle establishes a universal hierarchy of field values across all cosmic scales. For navigation through this hierarchy, a multi-level operational protocol is proposed:

Fundamental Navigation Rule: At each scale, the navigation rule follows directly from equation (11) and the inversion principle:

For outward motion at the current scale: maintain $\mathcal{E}_{\text{int}} > \mathcal{E}_{\text{local}}$ ($\Delta\mathcal{E} > 0$).

For inward motion at the current scale: maintain $\mathcal{E}_{\text{int}} < \mathcal{E}_{\text{local}}$ ($\Delta\mathcal{E} < 0$).

Domain-Exit Condition: An operational principle proposed for multi-scale navigation is the domain-exit condition: before the spacecraft can navigate using the gradient structure of a larger-scale domain, it must first exit the field well of the current domain. The domain boundary is defined as the radius at which the current domain's gradient equals the larger domain's gradient:

$$\|\nabla\mathcal{E}_{\text{current}}(r_{\text{boundary}})\| = \|\nabla\mathcal{E}_{\text{larger}}(r_{\text{boundary}})\| \tag{17}$$

The domain-exit condition applies at every scale transition: planetary → stellar, stellar → galactic, and galactic → intergalactic.

Propulsion System Architecture: Primary Sphere and Secondary Spheres

The complete propulsion system is designed based on a centralized architecture with a primary sphere and smaller secondary spheres.

Primary Sphere — At the Crew's Core

The primary sphere is the largest element of the system and simultaneously performs two functions:

- Main thrust generation: The primary sphere maintains an internal energy field $\mathcal{E}_{\text{int}}$ relative to the local field $\mathcal{E}$local. The differential $\Delta\mathcal{E} = \mathcal{E}_{\text{int}} - \mathcal{E}_{\text{local}}$ generates the main thrust through equation (11).
- Inertial isolation for the crew: Within the primary sphere, a core region is defined with the condition $\nabla\mathcal{E}_{\text{core}} = 0$ and $\mathcal{E}_{\text{core}}$ = constant. The crew is located in this core and does not perceive acceleration.

Secondary Spheres — Exterior to the Primary Sphere

An array of smaller spheres (N spheres) is mounted on the exterior hull of the spacecraft at appropriate distances from the Centre of mass. Each secondary sphere independently controls its field differential $\Delta\mathcal{E}_k$ and generates a small force vector F_k:

$$F_k = \beta A_k \Delta\mathcal{E}_k \|\nabla\mathcal{E}_{\text{local}}\| \hat{n}_k \tag{18}$$

Where $A_k = 4\pi R^2_{\text{secondary},k}$ is the cross-sectional area of secondary sphere k, $\Delta\mathcal{E}_k = \mathcal{E}_{\text{int},k} - \mathcal{E}_{\text{local}}$ is its field differential, and $\hat{n}_k$ is the normal direction to its surface.
Secondary spheres are used only for:

- Directional changes (rotational maneuvers and attitude control): By differential modulation of $\Delta\mathcal{E}_k$, net torque is generated:

$$\tau_{\text{total}} = \sum_{k=1}^{N} r_k \times F_k \tag{19}$$

Where r_k is the position vector of the secondary sphere relative to the spacecraft's centre of mass.

- Course correction (small translational maneuvers): Asymmetric activation of secondary spheres can apply small forces for course correction without changing the main spacecraft orientation.

Isolation Shells
Both the primary and secondary spheres are surrounded by multi-layer shells that prevent field leakage to the environment and vice versa. Each layer is modelled by the transfer matrix:

$$M_i = \begin{pmatrix} \cosh(k_i d_i) & k_i^{-1}\sinh(k_i d_i) \\ k_i \sinh(k_i d_i) & \cosh(k_i d_i) \end{pmatrix} \tag{20}$$

Where k_i is the penetration constant of the layer and d_i is its thickness. The complete isolation system is described by the total matrix $M_{\text{total}} = M_N \cdot M_{N-1} \cdots M_1$.

Power Maintenance and Control System
The power required to maintain $\Delta\mathcal{E}$ against field diffusion:

$$P_{\text{maintain}} = \sigma_{\text{leak}} \cdot A \cdot (\Delta\mathcal{E})^2 \tag{21}$$

Where σ_{leak} is the boundary leakage conductance characterizing the isolation material properties of the primary sphere. Conservative estimates $\sigma_{\text{leak}} \sim 10^{-30}$ W · eV^{-2} · m^{-2} derived from superconducting systems suggest that leakage power remains negligible for achievable field differentials $\Delta\mathcal{E} \lesssim 1$ TeV. These estimates require experimental verification.

The closed-loop control system maintains the target $\Delta\mathcal{E}$ for the primary sphere and each secondary sphere against environmental fluctuations and spacecraft motion:

$$S(x,t) = K_p e(t) + K_i \int_0^t e(\tau)d\tau + K_d \frac{de}{dt} \tag{22}$$

$$e(t) = \mathcal{E}_{\text{target}} - \mathcal{E}_{\text{local}}(x_{\text{spacecraft}}, t) \tag{23}$$

The error signal $e(t)$ is computed against the continuously updated $\mathcal{E}$local, not against a fixed reference. The integral term eliminates steady-state error from slow variations in $\mathcal{E}$local as the spacecraft moves.

Discussion and Conclusion

Review of Theoretical Contributions

A theoretical framework for geometric propulsion within the Cosmic Energy Inversion Theory (CEIT-v4) has been developed. The core of this framework is based on utilizing gradients of the primordial energy field $\epsilon(x, t)$ to generate thrust without reaction mass. The fundamental propulsion equation $F = \beta A \Delta\epsilon \|\nabla\epsilon_{\text{local}}\|$ was formulated based on CEIT geometric principles, utilising the coupling constant β estimated from galactic data analysis.

The precise definition of the local field reference $\Delta\epsilon(t) = \epsilon_{\text{int}}(t) - \epsilon\text{local}(x_{\text{spacecraft}}, t)$ is considered one of the key contributions of this paper, demonstrating that thrust is always measured relative to the instantaneous ambient field, not against a fixed reference. This definition enhances conceptual clarity and provides a foundation for designing navigation protocols. The proposed hierarchical protocol, including domain-exit conditions for transitions between planetary, stellar, galactic, and intergalactic scales, presents a conceptual framework for navigation across different scales.

The propulsion system architecture introduced, consisting of a primary sphere at the crew's core for main thrust generation and inertial isolation, and secondary spheres on the exterior hull for attitude control, offers a conceptual structure for future system design. The condition $\nabla\epsilon_{\text{core}} = 0$ for crew inertial isolation, if achieved, could enable highacceleration travel without physiological stress for crew members.

The feasibility of proving momentum conservation via the Bianchi identity $\nabla^{\mu}T_{\mu\nu}^{(\text{total})} = 0$ was examined. Based on this analysis, reaction momentum could be absorbed by propagating torsion disturbances in the ambient gradient structure.

Limitations and Uncertainties

Despite the theoretical progress, it is necessary to state with complete clarity and caution the following limitations:

Dependence on parameter calibration

All numerical calculations (accelerations, transit times, power requirements) are based on estimated values of parameters such as $\kappa = 0.042$, $\beta = 1.3 \times 10^{22}\text{m}^{-1}\text{J}^{-1}$, and $\sigma_{\text{leak}} \sim 10^{-30}$. These values are derived from observational data analysis (e.g., galactic rotation curves), but have not been independently confirmed. Changes in these parameters could significantly affect performance predictions.

Need for experimental verification

None of the predictions of this theory have been verified in controlled laboratory conditions or in an actual space environment. The thrust equation (11) and the power equation (21) are theoretical assumptions that require practical experiments for validation or falsification. In particular, the existence and behavior of the energy field □ as an independent physical entity require direct experimental evidence.

Engineering challenges

Even if the theoretical foundations are confirmed, practical implementation faces serious technical obstacles:

- TeV-scale field generation: Achieving $\Delta\epsilon \sim 1$ TeV requires power in the range of 15-100 MW, beyond current space reactor capabilities.
- Low-permeability isolation materials: Achieving $k_i \geq 10^4$ m^{-1} in materials that can withstand space conditions is a major materials science challenge.
- Precise local field measurement: The PID control system requires measurement of ϵ_{local} with sub-percent accuracy, which is not possible with current sensor technology.

Uncertainty in interstellar and intergalactic gradients

The values of $\|\nabla\epsilon_{\text{local}}\|$ in interstellar and intergalactic space carry significant uncertainty. Estimates of $\sim 10^{-8}$eV/m for the ISM and $\sim 10^{-10}$eV/m for intergalactic space are based on theoretical modelling, with no direct observational data to confirm them. This uncertainty directly affects the numerical performance estimates.

Comparison with Existing Approaches

To provide a realistic perspective, the proposed system is compared with existing technologies and competing theoretical concepts:

Feature	Chemical Propulsion	Ionic Propulsion	CEIT (This Paper)	Warp Drive (Alcubierre)
Requires reaction mass	Yes (large)	Yes (small)	No	No
Achievable acceleration	High (several g)	Very low (mN)	Theoretical: up to $0.01g$ (based on estimates)	Unlimited (theoretical)
Energy consumption	Very high	Moderate	Theoretical: kW to MW (based on estimates)	Requires negative energy
Technology status	Operational	Operational	Theoretical (needs testing)	Conceptual (theoretical physics)
Inertial isolation	No	No	Theoretical: Yes ($\nabla\mathcal{E}_{\text{core}} = 0$)	Yes (inherent)

The CEIT system offers theoretical advantages over chemical and ionic systems, especially in eliminating reaction mass and providing inertial isolation. However, while chemical and ionic systems are practically validated, the CEIT system remains at the conceptual stage, with a significant gap to practical implementation. Compared to the warp drive, CEIT avoids the need for negative energy and operates with more familiar physical parameters, but is theoretically less revolutionary (and potentially more practical). Furthermore, the numerical entries for the CEIT column in the comparison table above are based on theoretical estimates and should not be regarded as definitive or experimentally validated capabilities; they are presented solely to illustrate the theoretical potential of the concept.

Future Roadmap and Proposed Steps

Given the preliminary nature of this research, the future roadmap should focus on step-by-step validation and uncertainty reduction. The proposed steps are:

Step 1 — Independent calibration of parameters: Use new observational data (e.g., from next-generation space telescopes) to determine κ, β, and μ more precisely. This requires collaboration with astrophysicists and data analysts.

Step 2 — Small-scale laboratory experiments: Design experiments to generate and measure energy field gradients under controlled conditions, aiming to verify the relationship $F = \beta A \Delta\epsilon \|\nabla\epsilon_{\text{local}}\|$ at low power levels (e.g., $\Delta\epsilon \sim$ 1GeV). These experiments can confirm or refute the existence of the effect and provide critical calibration data.

Step 3 — Detailed numerical simulations: Develop three-dimensional numerical simulations to study system stability, field behavior under various conditions, and to confirm momentum conservation in different flight scenarios. These simulations can refine theoretical predictions before practical experiments. These simulations will eventually produce the numerical performance tables that are deliberately excluded from the present theoretical paper.

Step 4 — Advanced materials research: Focus materials science research on high-temperature superconductors and metamaterials with permeability $\geq 10^4 \mathrm{m}^{-1}$ and resilience to space conditions. This is one of the main bottlenecks for implementation.

Step 5 — Demonstration mission design: After initial verification, design a small-scale space mission (e.g., a CubeSat with a CEIT propulsion system) to measure thrust in an actual space environment. This is the most challenging and costly step, but is essential for final confirmation.

Final Conclusion

In this paper, a preliminary theoretical framework for geometric propulsion based on the Cosmic Energy Inversion Theory (CEIT-v4) has been presented. The key concepts introduced—including the precise local field reference definition, the hierarchical navigation protocol, and the examination of momentum conservation—provide a solid theoretical foundation that, if experimentally confirmed, could lead to the development of a new generation of propellant less propulsion systems. However, it must be strongly emphasized that all numerical results, performance predictions, and capability claims are theoretical and require independent experimental verification and careful calibration. The quantitative projections discussed are purely hypothetical and derived from the current **uncalibrated parameters**; they are not intended as definitive performance forecasts, but rather as mathematical illustrations of the theoretical scaling laws. The success of this approach depends on collaboration with the scientific community, investment in experimental research, and technological advances in relevant fields.

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