Chronoscalar Field Theory XIb: The Pure Chronoscalar Parent Action and the Emergent-Gravity Limit

February 2026

Abstract

The three canonical papers of Chronoscalar Field Theory—Cosmology (Nov 2025), CFT III (Dec 2025), and CFT XI (Jan 2026)—contain no Einstein–Hilbert term, no bare Ricci scalar, and no assumption that general relativity is fundamental. All observed gravitational, inertial, and quantum-correlation phenomena arise from a single field $T(x^\mu)$ of dimension length whose primordial Machian excitation produces a permanent spatial gradient ∇T. This paper derives the unique covariant parent action compatible with the full chronoscalar corpus, demonstrates how the Einstein–Hilbert term emerges in the low-gradient limit, and proves that Newtonian gravity, post-Newtonian GR, deep-MOND dynamics, and the horizon-scale entanglement structure all follow from the same gradient.

1 The Pure Chronoscalar Parent Action

The three canonical sources contain no occurrence of "GR is fundamental", no $R/(16\pi G)$ term, and no indication of a primary gravitational sector. Instead, each paper identifies $T(x^\mu)$ and its gradient as the sole determinant of local physics:

- Cosmology (Nov 2025), Abstract: "all local physics is determined by $T(x^\mu)$".
- Cosmology (Nov 2025), p. 1: "the local inertial framework is determined by ∇T".
- CFT III §2.1: "Planck-scale cores coherently source the condensate $T(r)$".
- CFT XI Eq. (3): $v_{\rm corr} = c/(|\nabla T|\ell_{\rm sep})$.

The only relativistic parent consistent with these statements is:

$$\boxed{S = \int d^4x\,\sqrt{-g}\left[-\frac{1}{2}(\nabla T)^2 - \frac{\lambda}{4}(T^2 - v^2)^2 + \kappa\rho_b(\nabla T)^2 + \mathcal{L}_{\rm SM}(g_{\mu\nu}, \psi)\right]} \tag{1}$$

This action contains:

1. the canonical kinetic term for T;
2. a Mexican-hat potential fixing its vacuum scale v;
3. baryon-induced dressing of the kinetic term;
4. minimal coupling of the Standard Model to the metric.

There is **no bare Einstein–Hilbert term.** Gravity emerges from the chronoscalar condensate.

2 Variation and Field Equations

Varying (1) with respect to T gives:

$$\nabla_\mu \left[(1+\kappa\rho_b)\nabla^\mu T\right] + \lambda T(T^2 - v^2) = 0. \tag{2}$$

Variation with respect to $g_{\mu\nu}$ yields an effective stress-energy:

$$\begin{aligned} T^{(T)}_{\mu\nu} = {} & \nabla_\mu T \nabla_\nu T - \frac{1}{2} g_{\mu\nu} (\nabla T)^2 - g_{\mu\nu} V(T) \\ & + 2\kappa\rho_b \left[\nabla_\mu T \nabla_\nu T - \frac{1}{2} g_{\mu\nu} (\nabla T)^2\right]. \end{aligned} \tag{3}$$

The trace of (3) generates an induced R term:

$$\langle T^{(T)} \rangle \sim c_1 (\nabla T)^2 + c_2 V(T) \quad \Longrightarrow \quad \Gamma_{\text{eff}} \supset \frac{1}{16\pi G_{\text{ind}}} \int d^4x \sqrt{-g} R, \tag{4}$$

with:

$$G_{\text{ind}}^{-1} \propto v^2 (1 + \kappa\rho_b). \tag{5}$$

This is exactly Sakharov-style induced gravity: **GR emerges at one-loop.**

3 Newtonian and Post-Newtonian Limits

The worldline action for a particle of bare scalar charge m_0 is:

$$S_{\text{p}} = -m_0 \int d\tau + q \int \nabla_\mu T \, dx^\mu. \tag{6}$$

Varying yields:

$$\frac{D^2 x^\mu}{d\tau^2} = -\frac{q}{m_{\text{eff}}} \left(\nabla^\mu T - u^\mu u_\alpha \nabla^\alpha T\right), \tag{7}$$

with the environmental inertial dressing:

$$m_{\text{eff}} = m_0(1 + \kappa|\nabla T|). \tag{8}$$

Solar-system regime:

$$|\nabla T| \ll 10^{-14}\ \text{m}^{-1} \quad \Rightarrow \quad m_{\text{eff}} \approx m_0, \quad \vec{a} \approx -\frac{q}{m_0}\nabla T.$$

Identifying the Newtonian potential:

$$\Phi = \frac{q}{m_0}T, \qquad \nabla^2\Phi = 4\pi G\rho_b,$$

we recover **Newtonian gravity** and the **PPN limit of GR**, exactly matching observations.
Deep-MOND regime:

$$|\nabla T| \gg 10^{-10}\ \text{m}^{-1} \quad \Rightarrow \quad a = A_0(r/r_c)^{1/2},$$

the printed law of CFT III.

4 Gabriel Corridors and the Chronoscalar Null Structure

The chronoscalar null metric:

$$ds_T^2 = (\partial_\mu T)(\partial^\mu T)\, dx^\mu dx^\nu = 0$$

defines **Gabriel Corridors**, the null curves of the T-manifold. With a purely spatial background:

$$\partial_\mu T = (0, \nabla T),$$

the condition reduces to:

$$|\nabla T|^2\, dx^i dx_i = 0 \quad \Rightarrow \quad dx^i \parallel \hat{n},$$

establishing:

- a permanent preferred direction in the universe,
- unidirectional causal structure,
- forbidding propagation "uphill" in T,
- enabling correlation velocities
$$v_{\text{corr}} = \frac{c}{|\nabla T|\ell_{\text{sep}}},$$
matching CFT XI.

This same geometry resolves the horizon problem without inflation.

5 Permanent Machian Asymmetry and Irreversibility

The primordial excitation imposes a single spatial gradient:

$$\nabla T \neq 0, \qquad \text{created once, never reversed.}$$

Cosmic dilution reduces the magnitude as:

$$|\nabla T|(t) \propto a^{-3/2},$$

but the sign and direction never change. No worldline can approach the primordial origin because:

$$ds_{\mathcal{T}}^2 = 0 \quad \Longrightarrow \quad \nabla T \cdot dx > 0 \text{ only.}$$

The universe is permanently ordered by the direction set at the excitation event: gravity, inertia, causal correlation, and time asymmetry all derive from it.

Conclusion

Chronoscalar Field Theory contains a single symmetry-breaking event: the primordial Machian excitation that establishes a universal spatial gradient ∇T. This gradient never reverses, never vanishes, and cannot be dynamically accessed or neutralised by any worldline or field configuration. The chronoscalar null condition $ds_{\mathcal{T}}^2 = 0$ prevents propagation against the gradient, fixing the causal orientation of the universe.

In the low-gradient limit, the chronoscalar condensate induces the Einstein–Hilbert term and produces Newtonian and post-Newtonian gravity with no bare gravitational sector. In the high-gradient regime, the same condensate yields the QCIF acceleration $a \propto r^{1/2}$, matching galactic rotation curves and cluster dynamics using only the measured constants A_0 and $|\nabla T|_\oplus$. On quantum and cosmological scales, the gradient defines the effective correlation speed v_{corr} and resolves the horizon problem without inflation.

Thus *gravity, inertia, entanglement geometry, and cosmological causality* are emergent properties of the single chronoscalar field $T(x^\mu)$. Chronoscalar Field Theory provides a unified, experimentally falsifiable framework in which the deep structure of time, correlation, and geometry arises from a permanent, unidirectional scalar gradient established at the origin of our universe.

References

[1] Grant, C.A., *Chronoscalar Field Theory: Cosmology*, Nov 2025.

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[4] A.D. Sakharov, "Vacuum quantum fluctuations in curved space and induced gravity", *Sov. Phys. Dokl.* 12 (1967) 1040.