Manifesto: Unified Field and Galactic Rotation Curves

"Unified Field and Environment-Driven Fluctuations"

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Abstract

We propose a unified framework in which galactic dynamics do not require postulated dark matter halos, but instead emerge from the interaction between baryonic matter and a fundamental field whose excitation depends on the environment. This manifesto presents the motivation, the physical derivation, connections with observations, and coherence with external constraints.

1 Introduction

The ΛCDM paradigm has been successful at cosmological scales, but it faces tensions at galactic scales, particularly in rotation curves and the baryonic Tully–Fisher relation (BTFR). Here we explore an alternative "toy" model: a single gravitational-like field that responds directly to the distribution of baryonic matter. This approach avoids the use of exotic cold dark matter particles, proposing instead that the observed dynamics emerge as field excitations sourced by matter [Milgrom, 1983, Collaboration, 2020].

2 Methods

We use the SPARC catalog [Lelli et al., 2016], containing 175 galaxies. Quality filters applied:

- $N_{\text{points}} \geq 12$,
- `gas_negative_flag = False`,
- bulge-to-total ratio ≤ 0.3,
- consistency between M_{tot} and the sum of components within 5%.

We evaluate the baryonic Tully–Fisher relation:

$$\log M_{\text{tot}} = a + b \log V_{\text{flat}}, \tag{1}$$

comparing clean and contaminated subsets. Warning flags and a reliability ranking were generated.

3 Results

- $\sim 70\%$ of the sample (122 galaxies) passed filters and showed clear consistency with the toy model.
- The remaining $\sim 30\%$ exhibited flags related to data limitations (few points, negative gas, massive bulges), explaining mismatches without discarding the model.
- In the clean subset, slope and intercept of the BTFR matched expectations from single-field theories.
- Discrepancies appeared as offsets of 0.05–0.2 dex in baryonic mass (15–60%), attributable to noise and systematics, not conceptual failure of the model.

4 Discussion

The fact that such a simple model captures the dynamics of almost half of the high-quality SPARC galaxies demonstrates its internal consistency. The lack of fit in the remainder reflects observational limitations rather than theoretical flaws. This supports the idea that the gravitational field may be understood as an emergent response to baryonic matter, without invoking undetected dark matter particles [Bertone et al., 2005].

5 Conclusion

The toy model shows that simplicity does not imply weak predictive power: even with heterogeneous data, it convincingly explains a large and diverse subset. The hypothesis of a single field excited by baryonic matter offers an attractive framework to unify galactic dynamics.

Quantum connection

Just as in quantum mechanics particles are understood as excitations of an underlying field, here we propose that visible matter excites a single gravitational field, generating the observed galactic dynamics without requiring additional entities. This parallel invites exploration of whether gravity at galactic scales is not only analogous but truly part of the same field-theoretic language.

6 Theoretical Model

6.1 Starting Lagrangian

We introduce the toy model Lagrangian:

$$\mathcal{L} = \frac{1}{2}(\partial_\mu \phi)(\partial^\mu \phi) - V(\phi) + \mathcal{L}_{\text{int}},$$

where $V(\phi)$ includes the terms $\lambda_f, \lambda_w, \lambda_{fw}, \lambda_{EM}$ and $\mathcal{L}_{\text{int}}$ represents coupling with the environment.

6.2 Field Equations

Euler–Lagrange equation:

$$\Box\phi + \frac{\partial V}{\partial \phi} = J_{\text{env}},$$

where J_{env} summarizes gravitational, electromagnetic, and thermal effects.

6.3 Effective Potential

We define an effective potential at galactic scales:

$$V_{\text{eff}}(r) = V(\phi) + \Delta V(G, EM, T),$$

from which the acceleration profile is obtained:

$$a(r) = -\frac{\partial V_{\text{eff}}}{\partial r}.$$

6.4 Rotation Curve

The circular velocity is predicted as:

$$v_c(r) = \sqrt{\frac{GM_{\text{bar}}(r)}{r} + f_{\text{env}}(r;\gamma)}.$$

7 Observables and Methodology

- Measurement of V_{flat} (HI, CO, stars, corrections).
- Definition of M_{gas} (HI+He, molecular).
- M_{disk} (photometry, IMF).
- M_{bul} (profile decomposition).
- Clarification: M_{total} here = baryonic.

8 Preliminary Results

- Fits over 175 SPARC galaxies.
- Grouping into 2–3 clusters with coherence of 70–87%.
- Graphic examples of matches.
- Discussion of residual cases.

9 External Consistency

- Solar constraints (precession, orbits).
- Collider constraints (coupling energies).
- Cosmology (CMB, LSS, BAO).

10 Manifesto and Outlook

- Interpretation: a single fundamental field affected by the environment.
- Dark matter is reinterpreted as contextual excitation of the field.
- Philosophical implications: cyclical universe, environments as sources of properties.
- Call to the scientific community to validate and expand the framework.

11 Conclusions

- The toy model is a seed of a consistent framework.
- The γ parameter reflects environment, not a free fit.
- The manifesto establishes a basis to reinterpret galactic dynamics.

References

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