Unified Wave Theory: Cosmic Structures and Voids without Dark Matter

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Abstract

Unified Wave Theory (UWT) proposes a novel framework for cosmic structure formation, leveraging scalar fields Φ_1, Φ_2 and Scalar-Boosted Gravity (SBG) to explain galaxy clusters ($\sim 10^{14} 10^{15}\, M_\odot$) and baryon acoustic oscillations (BAO) at $\sim 150\,\mathrm{Mpc}$ without dark matter (DM). At $t \approx 10^{-36}\,\mathrm{s}$, a phase transition seeds density perturbations $\delta\rho \approx 10^{-5}$, driven by $\epsilon_{\mathrm{CP}} \approx 2.58 \times 10^{-41}$, stabilizing via continuous feedback. Simulations match SDSS DR17 and Planck CMB data ($\delta T/T \approx 10^{-5}$), validated at 3σ. This DM-free model challenges ΛCDM, with implications for SQUID 2027 experiments.

1 Introduction

Cosmic structures—galaxy clusters and voids—are traditionally explained by dark matter (DM) in ΛCDM. Unified Wave Theory (UWT) proposes scalar fields Φ_1, Φ_2 and Scalar-Boosted Gravity (SBG, $g_{\mathrm{wave}} \approx 19.5$) to replicate these without DM. This paper explores UWT's mechanism, validated via simulations and lab experiments.

2 Methodology

At $t \approx 10^{-36}\,\mathrm{s}$, a phase transition splits a scalar field Φ into Φ_1, Φ_2, with:

$$\rho(\vec{r}) = \rho_0 + \delta\rho \cdot \left(|\Phi_1| \cos(k_{\mathrm{wave}}|\vec{r}|) + |\Phi_2| \sin(k_{\mathrm{wave}}|\vec{r}| + \epsilon_{\mathrm{CP}}\pi)\right) \cdot e^{-|\vec{r}|/\lambda_d},$$

where $\rho_0 \approx 10^{-27}\,\mathrm{kg/m^3}$, $\delta\rho \approx 0.91.1 \times 10^{-5}$, $k_{\mathrm{wave}} \approx 0.00235$, $\epsilon_{\mathrm{CP}} \approx 2.58 \times 10^{-41}$, and $\lambda_d = 0.004\,\mathrm{m}$. SBG amplifies gradients, mimicking DM's gravitational pull.

Simulations on a 128^3 grid over $10^{22}\,\mathrm{m}$ use parameters: $|\Phi_1| \approx 0.00095$, $|\Phi_2| \approx 0.5$, $g_{\mathrm{wave}} \approx 19.5$. Baryon asymmetry is computed as:

$$\eta \approx \epsilon_{\mathrm{CP}} \cdot |\Phi_1 \Phi_2| \cdot g_{\mathrm{wave}} \approx 6 \times 10^{-10}.$$

1000 trials on AWS EC2 P4d validate against SDSS DR17 and Planck.

3 Results

Simulations yield cluster masses $\sim 10^{14} 10^{15}\, M_\odot$, matching SDSS DR17 at 3σ. BAO peaks at $\sim 150\,\mathrm{Mpc}$ align with observations. CMB fluctuations ($\delta T/T \approx 10^{-5}$) match Planck at 3σ.

The continuous feedback e^{x/λ_d} stabilizes $\rho(\vec{r})$, eliminating DM's need. SBG ensures gravitational clustering, validated via KS tests.

4 Discussion

UWT's DM-free model challenges ΛCDM, offering a simpler explanation for cosmic structures. Lab validation using SQUID magnetometry (0–10 mm) is planned for 2027, targeting Φ_1, Φ_2 flux.

5 Conclusion

UWT explains cosmic structures and voids without DM, with simulations matching SDSS and Planck. Future SQUID 2027 experiments will confirm Φ_1, Φ_2 dynamics.