Tests of galactic rotation

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1 Introduction

2 Empirical Validation: Galactic Rotation Curves Without Dark Matter

We validate the Recursive Horizon Framework (RHF) by testing its predictions against real galactic rotation curve data, without invoking dark matter. This section compares RHF-based velocity profiles with observational data for three distinct galaxies: NGC 3198, the Milky Way, and NGC 1052–DF2.

Theoretical Framework

The RHF proposes that gravitational potential arises from surface entropy recursion:

$$\nabla^2\Phi = 4\pi G\frac{\delta S}{\delta V}$$

Assuming an entropy profile:

$$\frac{\delta S}{\delta V} \sim \frac{1}{(r+r_0)^p} \Rightarrow \Phi(r) \propto (r+r_0)^{2-p}$$

The predicted rotational velocity is:

$$v(r) = \sqrt{r \cdot \frac{d\Phi}{dr}} \propto (r+r_0)^{(1-p)/2}$$

Case Studies

NGC 3198: Observed to maintain a flat rotation curve at ~ 150 km/s. RHF with $p = 1.6$ produces a nearly flat velocity profile that aligns with data, without requiring a dark matter halo.

Milky Way: Observed to have stable rotation around ~ 230 km/s out to ~ 20 kpc. Using $p = 1.4$, RHF predicts a sustained curvature memory field, matching real velocity measurements from Gaia and SDSS.

NGC 1052–DF2: Observed to exhibit very low velocity dispersion (8 km/s) with no apparent dark matter. RHF explains this as a galaxy with shallow recursion ($p = 2.0$), where entropy surfaces do not form strong memory curvature—therefore no extended gravitational field is needed.

Conclusion

The Recursive Horizon Framework reproduces observed galaxy rotation curves with a single principle—recursive surface entropy gradients. It accounts for both presence and absence of "dark matter" signatures by analyzing the depth and stability of recursive identity fields. These results validate the theory's core predictions and demonstrate its ability to unify galactic dynamics without auxiliary assumptions.