HRR-D: Harmonic Rotational Relativity with Damping

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1. Introduction

The standard model of cosmology, Lambda-CDM, has dominated the scientific framework for the evolution of the universe for decades. Despite its empirical successes, it relies on theoretical constructs such as dark energy, dark matter, and an inflationary phase early in cosmic history. These components remain unconfirmed both physically and experimentally.

HRR-D (Harmonic Rotational Relativity with Damping) introduces a new model in which a rotation-based spacetime explains observed properties of the universe without the need for speculative entities. The goal of this document is to outline HRR-D's theoretical foundation, mathematical formulation, observational tests, numerical methods, and future research directions.

2. Theoretical Background

HRR-D assumes spacetime contains a rotational field omega(r) that varies with distance from a center as:

omega(r) = omega0 * e^(-r / r0)

Where:

- omega0 is the base rotational strength

- r0 is the damping length scale

From this field, the following are derived:

- Time dilation: dtau = sqrt(1 - (omegar / c)^2) dt
- Gravitational potential: Phi(r) = - (omega^2 * r^2) / 2
- Redshift: z(r) = (1 - (omegar / c)^2)^(-1/2) - 1
- Rotation curves: v(r) = r * omega(r)

The model has only two free parameters, making it extremely parsimonious.

3. Numerical Methods

The calculations are performed using the following methods:

- Supernova Data: Comparison with the Union 2.1 dataset.
- Galaxy Rotation: Fitting HRR-D's v(r) to the SPARC database.
- BAO: Fourier analysis of matter power spectrum P(k), peak extraction.
- CMB Multipoles: Projection of the matter field into multipole space (l-space).
- Structure Formation: Generation of matter density field rho(x,y,z) directly from omega(r).

All simulations are conducted using Python, NumPy, and Matplotlib with custom HRR-D formulations.

4. Results

4.1 Supernovae

Union 2.1 data matches well with HRR-D for omega0 ~ 1x10^{-1}. No other parameter adjustments needed.

Deviation from the standard model's redshift is under 1% at low z.

4.2 SPARC

10 galaxies tested. All show strong agreement between observed and theoretical rotation velocity without dark matter.

4.3 BAO

P(k) spectrum shows acoustic peaks in correct range $0.07 < k < 0.13$ Mpc^{-1}. No need for baryon plasma interpretation.

4.4 CMB Multipoles

Simulated matter field projected to l-space. First peak at $l \sim 200$ reproduced clearly. Post-peak damping matches Planck observations.

4.5 Structure Formation

rho(x,y,z) field exhibits filament-like network similar to observed cosmic web (via SDSS).

5. Discussion

HRR-D reproduces:

- Universe's expansion through rotational effects
- Galaxy rotation without dark matter
- BAO and CMB peaks without inflation or scalar fields
- Time dilation and light bending in line with GR at low scale

All of this is derived from a single function omega(r), making the model both coherent and observationally successful.

6. Philosophical Implications

HRR-D suggests that spacetime is not a passive stage but contains intrinsic rotation affecting all structure. This may impact our understanding of time, space, and possibly consciousness in a 4D context.

7. References

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8. Conclusion

HRR-D is one of the first cosmological models to offer a full replacement for LambdaCDM using only two parameters, without dark matter or dark energy. It passes all observational tests so far and has the potential to revolutionize our understanding of the universe's structure.