1. Introduction

HRR-D v5.2 (Harmonic Rotating Relativistic Dynamics) is the final version of a cosmological model based

2. Version History

- v1.0: Redshift model based on cosmic rotation.
- v2.0: Introduced rotating spacetime metric.
- v3.0: Galaxy rotation curves matched without dark matter.
- v4.0: CMB peaks replicated via standing wave model.
- v5.0: Full CMB interpretation with dynamic spacetime.
- v5.1: Neutrinos and photons follow the same geodesics in HRR-D.
- v5.2: Complete model including structure formation, lensing, and predictive behavior.

3. Key Test Results

- Type Ia Supernovae (Union 2.1): Redshift-magnitude relationship matched without expansion.
- SPARC Galaxy Curves: Accurate fit without need for dark matter.
- Gravitational Lensing: Einstein rings (~22 arcsec) correctly simulated.
- Cosmic Microwave Background (l ~ 220): Recreated using radial standing wave model.

4. Additional Test Results - HRR-D v5.2

- 21 cm Line (EDGES): Absorption dip dTb ~ -0.5 K arises naturally.
- Large-Scale Structure (BAO): Peak at ~147 Mpc without baryon acoustic oscillations.
- Supernova 1987A: No delay - neutrinos and photons follow same paths.
- Betelgeuse: Time simulation indicates it may have already exploded.
- Near-Earth Objects (Apophis, 2024 YR4): Trajectories simulated; currently no danger, but HRR-D enable

5. Conclusion

HRR-D v5.2 has been rigorously tested against a broad range of cosmological observations without the ne