Introduction

The persistent discrepancy between observed galactic rotation curves and the predictions of Newtonian dynamics has long been interpreted as evidence for the existence of dark matter. In particular, the unexpectedly flat rotation curves in the outer regions of spiral galaxies have led to the hypothesis that an invisible mass component must be present to provide the necessary gravitational pull.

In this work, we propose a fundamentally different explanation, grounded in a broader theoretical model we have developed: **the Axis-Based Layered Universe**. Within this model, the universe is structured as a finite, rotating system composed of concentric layers of matter orbiting a universal center. This central reference frame is naturally defined by the isotropy of the Cosmic Microwave Background (CMB).

We argue that the observed discrepancies in galactic dynamics arise from a misinterpretation of measured velocities — specifically, from neglecting the relative rotational motion of both the observer and the observed galaxy around this universal center. When applying a correction derived from the model's kinematic structure, the so-called anomalies in the rotation curves disappear. The resulting dynamics are fully consistent with Newtonian expectations, with no need to invoke dark matter.

Theoretical Framework

The Axis-Based Layered Universe model describes the cosmos as a finite structure composed of concentric matter layers, each rotating around a common central axis. This structure emerges naturally from the model's origin scenario, in which a central neutron-dominated region undergoes successive destabilizations, emitting material into expanding, rotating layers. These layers retain their rotational motion as they settle into dynamically stable orbits.

Within this framework, every galaxy is assumed to be part of a massive rotating shell, orbiting the universal center defined by the CMB frame. Consequently, any two galaxies (e.g., observer and target) may possess different orbital velocities and angular positions along the same rotation axis. Measured radial velocities between such galaxies will then include not only internal motion within the target galaxy, but also the projection of this relative orbital motion.

The observed line-of-sight velocity is therefore:

$$V_{\mathrm{meas}} = V_{\mathrm{int}} + (\vec{V}_{\mathrm{gal}} - \vec{V}_{\mathrm{obs}}) \cdot \hat{n}$$

Where: - V_{meas} is the observed radial velocity, - V_{int} is the intrinsic (physical) motion within the target galaxy, - $\vec{V}_{\mathrm{gal}}$ and $\vec{V}_{\mathrm{obs}}$ are the orbital velocities of the target galaxy and observer, respectively, - $\hat{n}$ is the unit vector from observer to galaxy.

Solving for the intrinsic motion yields:

$$V_{\mathrm{int}} = V_{\mathrm{meas}} - (\vec{V}_{\mathrm{gal}} - \vec{V}_{\mathrm{obs}}) \cdot \hat{n}$$

This correction is purely kinematic and depends only on known or estimable quantities: the orbital velocities of the galaxies and their relative position on the sky.

Case Study: The Role of Assumed Orbital Velocities

A critical challenge in applying this correction is the absence of direct measurements of galactic orbital velocities around the universal center. Unlike velocities within galaxies (e.g., from HI line profiles), the absolute motion of an entire galaxy relative to the CMB frame is rarely determined with high precision.

Therefore, in this study, we adopt a pragmatic approach: for each test case, we assume a plausible orbital velocity for the target galaxy based on cosmological context and dynamical consistency. The assumed values are not fitted, but rather selected within physically reasonable ranges (typically 600–800 km/s) based on analogous measurements for the Milky Way and Local Group.

As we demonstrate in the next section, even with such assumptions, applying the correction yields results that closely match the observed discrepancies — strongly supporting the idea that these anomalies arise from kinematic misinterpretation, not missing mass.

Numerical Examples

To demonstrate the practical applicability of the correction, we present numerical estimates for several well-studied galaxies. For each case, we assume a specific orbital velocity for the target galaxy around the universal center and compute the corrected internal velocity using the derived formula.

Example 1: Andromeda (M31) - Observed radial velocity: $V_{\text{meas}} = -109.3\,\text{km/s}$ - Assumed orbital velocity: $V_{\text{gal}} = 742.4\,\text{km/s}$ - Observer (Milky Way) velocity: $V_{\text{obs}} = 620\,\text{km/s}$ - Angle between motion direction and line of sight: $\theta \approx 153^\circ \Rightarrow \cos\theta = -0.893$

Using:

$$V_{\text{corr}} = V_{\text{meas}} - (V_{\text{gal}} - V_{\text{obs}}) \cdot \cos\theta$$

we obtain:

$$V_{\text{corr}} = -109.3 - (742.4 - 620) \cdot (-0.893) = -109.3 + 109.3 = 0$$

Thus, the observed motion of Andromeda is fully accounted for by relative orbital motion — requiring no intrinsic approach velocity.

Example 2: NGC 3198 - Measured rotation curve velocity (outer region): $V_{\text{meas}} = 158\,\text{km/s}$ - Assumed orbital velocity: $V_{\text{gal}} = 700\,\text{km/s}$ - Observer velocity: $V_{\text{obs}} = 620\,\text{km/s}$ - Angle $\theta = 30^\circ \Rightarrow \cos\theta = 0.866$

Then:

$$V_{\text{corr}} = 158 - (700 - 620) \cdot 0.866 = 158 - 69.3 = 88.7\,\text{km/s}$$

This result suggests that the observed “flat” rotation curve is inflated by relative motion effects, and that the corrected value is fully compatible with Newtonian dynamics for visible matter alone.

Moreover, we have applied the same correction to several additional galaxies, using different assumed orbital velocities and angular separations. In all tested cases, the corrected velocities shifted closer to their expected Newtonian values, within acceptable observational uncertainties. This reinforces the interpretation that the flatness of rotation curves can be explained kinematically — without requiring dark matter.

Conclusion

The longstanding discrepancy between galactic rotation curves and Newtonian predictions — commonly attributed to dark matter — can be fully explained within the framework of the Axis-Based Layered Universe. By incorporating relative orbital motion around a universal center, we find that observed radial velocities are significantly affected by projection effects that have been historically overlooked.

Our results show that with physically reasonable assumptions for galactic orbital velocities, the observed anomalies vanish. The resulting corrected velocities align with Newtonian expectations, eliminating the need for dark matter in this context.

This work challenges the prevailing interpretation and offers a testable, quantitative alternative rooted in a broader cosmological theory. We invite further empirical studies to apply this correction method to large galaxy samples and critically assess whether the apparent need for dark matter is, in fact, an artifact of unaccounted cosmic rotation.