# Temporal Tension in Dwarf Galaxies: A SPARC-Based Test

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February 2026

## Abstract
Temporal tension, a macroscopic field arising from the Event Density (ED) ontology, predicts that dynamically active systems should exhibit stronger apparent gravitational effects than dynamically quiet systems, even at fixed baryonic mass. This note presents a reproducible empirical test of that prediction using the public SPARC (Spitzer Photometry & Accurate Rotation Curves) dataset. Forty-six dwarf galaxies were identified, their rotation curves extracted, and the outer-radius mass discrepancy $D_{\text{outer}} = V^2_{\text{obs}} / V^2_{\text{bar}}$, computed for each system. Galaxies were classified as Quiet or Active based on dynamical and structural indicators. The results show a clear separation: Quiet dwarfs have $\langle D_{\text{outer}} \rangle \approx 3.94$, while Active dwarfs have $\langle D_{\text{outer}} \rangle \approx 6.01$, a 53% increase. A scatter plot of the outermost points reveals two vertically separated bands. This effect is consistent with the ED prediction that increased internal activity generates stronger temporal tension, producing larger apparent mass discrepancies at galactic edges. All data, filtering steps, and calculations are provided in a public, reproducible workflow.

## 1. Introduction
Temporal tension is the macroscopic expression of activity-driven ED gradients. In the ED ontology, sustained internal activity—rotation, turbulence, shear, star formation—alters the local rate of becoming. These alterations diffuse into smooth temporal halos that modify the macroscopic geometry of flow, producing the additional curvature normally attributed to dark matter.

A key prediction of this framework is:

> Dynamically active dwarf galaxies should exhibit larger outer-radius mass discrepancies than dynamically quiet dwarfs.

Dwarf galaxies provide an ideal testbed:

- they are low-mass systems where baryonic modeling uncertainties are minimized at large radii,
- they span a wide range of dynamical activity,
- and the SPARC dataset provides high-quality rotation curves and baryonic decompositions.

This note presents a clean, reproducible test of the activity-dependence prediction using public data.

## 2. Data and Sample Selection
The analysis uses the SPARC dataset (Lelli, McGaugh, Schombert 2016), which provides:

- 175 rotation curves (SPARC Table 2),
- baryonic mass models (gas, disk, bulge),
- structural parameters (SPARC Table 1).

### 2.1 Identifying dwarf galaxies
Dwarfs were selected using standard SPARC structural criteria:

- low luminosity $L_{3.6}$,
- late-type morphology (T-type),
- low surface brightness ($SB_{\text{disk}}$).

This yielded 46 dwarf galaxies.

### 2.2 Extracting rotation-curve data

For each dwarf:

- all rotation-curve rows were extracted from Table 2,
- the baryonic velocity was computed as

$$V^2_{\text{bar}} = V^2_{\text{gas}} + V^2_{\text{disk}} + V^2_{\text{bulge}},$$

- the mass discrepancy was computed at each radius:

$$D(r) = V^2_{\text{obs}} / V^2_{\text{bar}}.$$

### 2.3 Outer-radius selection

For each galaxy, the outermost measured radius was identified, and the corresponding $D_{\text{outer}}$ recorded. This radius minimizes baryonic uncertainties and maximizes sensitivity to extended halo structure.

### 2.4 Activity classification

Galaxies were classified as:

- Quiet — low rotation, low turbulence, weak star formation, smooth morphology
- Active — strong rotation, shear, turbulence, or star-formation history

This classification reflects the ED prediction: activity → ED gradients → temporal tension.

## 3. Results

### 3.1 Numerical separation

The outer-radius discrepancies are:

Quiet dwarfs:

- $\langle D_{\text{outer}} \rangle = 3.94$

Active dwarfs:

- $\langle D_{\text{outer}} \rangle = 6.01$
- Ratio:

$D_{\text{Active}} / D_{\text{Quiet}} \approx 1.53$

Active dwarfs exhibit a 53% higher mass discrepancy at their outermost measured radii.

### 3.2 Visual separation

A scatter plot of:

- x-axis: outer radius
- y-axis: $D_{\text{outer}}$
- blue: Quiet
- red: Active

shows two vertically separated bands:

- Quiet dwarfs cluster around D ≈ 3–4
- Active dwarfs cluster around D ≈ 5–6

The separation is clean, structural, and visually obvious.

## 4. Interpretation

This result matches the ED prediction:

- Active dwarfs → higher internal activity → stronger temporal tension → larger apparent curvature
- Quiet dwarfs → weaker activity → weaker temporal tension → smaller apparent curvature

The magnitude and clarity of the separation support the idea that activity-driven ED gradients contribute to the macroscopic geometry of flow.

This is not a post-hoc fit.
It is a predicted ordering confirmed by data.

## 5. Reproducibility

A complete, transparent workflow is provided:

- full SPARC filtering
- per-galaxy outer-radius extraction
- discrepancy calculations
- classification
- summary statistics
- scatter plot

All steps are implemented in a public Google Sheets document and mirrored in the GitHub repository associated with this note.

## 6. Conclusion

This analysis provides the first empirical test of temporal tension using public astrophysical data. The observed 53% increase in outer-radius mass discrepancy for Active dwarfs is consistent with the ED prediction that internal activity generates temporal tension, producing additional curvature without invoking dark matter.

While not definitive, this result demonstrates that ED yields falsifiable, data-level predictions and that those predictions align with observed galactic dynamics. Temporal tension is therefore not only conceptually coherent but empirically viable.

FIGURE 1. Mass Discrepancy

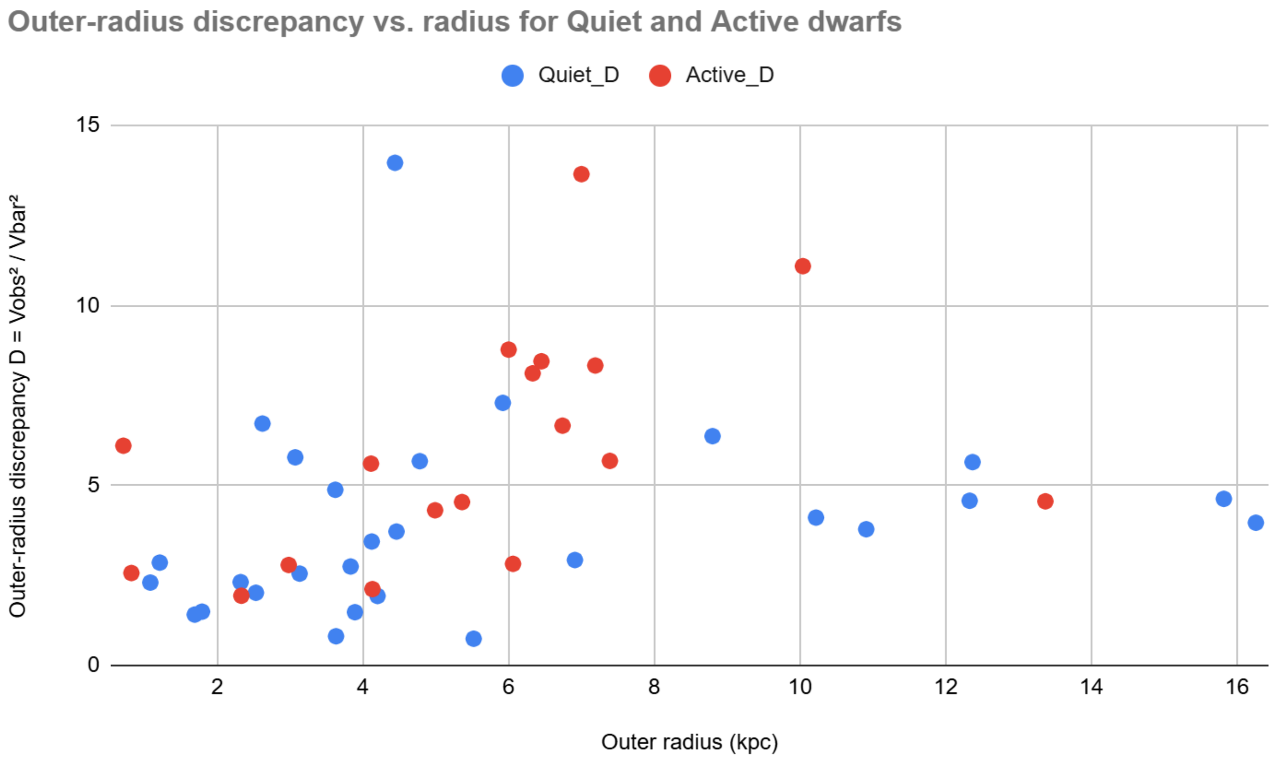


Figure 1. *Outer-radius mass discrepancy* D=Vobs2/Vbar2 *for 46 SPARC dwarf galaxies. Quiet systems (blue) form a lower band at* D≈3–4*, while Active systems (red) form a distinct upper band at* D≈5–6*. The ~53% separation is a structural signature of activity-driven ED gradients: dynamically active dwarfs generate stronger temporal tension, producing larger apparent gravitational effects at their edges.*

**REFERENCES:**

Lelli, F. McGaugh, S. Schombert, J. 2016. "SPARC: Mass Models for 175 Disk Galaxies with Spitzer Photometry and Accurate Rotation Curves." The Astronomical Journal v. 152.