Surface Brightness and Redshift in the Sempiternal Spinning Sphere Theory

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Abstract

This paper compares the predictions of the Sempiternal Spinning Sphere Theory to the standard Tolman surface brightness relation within the redshift range $0.01 < z < 4$. The Sempiternal model posits that redshift arises from radial light propagation through a rotating structured medium, eliminating the need for cosmic expansion or inflation. A revised surface brightness equation is proposed, derived from the exponential geometry of a rotating medium, and its predictions are compared directly with observational data from Lubin & Sandage (2001). Results show strong alignment with empirical measurements, supporting the theory as a viable alternative to the expanding universe paradigm.

1 Interpretation

This model suggests the cosmological redshift arises from light traveling radially through a rotating medium, where the velocity of the medium increases with radius, reaching the speed of light at the edge of the universe. As photons move outward, they pass from regions of slower to faster rotational velocities, producing a relativistic Doppler-like redshift. This radial transition is the sole source of redshift in the model—there are no gravitational gradients, nor is there any contribution from transverse motion. No matter what, light that we see is always traveling into a smaller dimension and into a medium that itself is massless and is the speed of light at the outer boundary. This fundamental structure gives rise to the redshift behavior observed in the universe and explains why the theory can replicate observed cosmological relationships without invoking expansion.

Furthermore, because galaxies migrate outward over time into regions of higher rotational velocity and lower density, the spatial separation between galaxies increases. This radial migration implies that when we observe galaxies at high redshift, we are seeing them as they existed closer to the center, when they were packed more tightly. Consequently, their observed angular size today is smaller, mimicking the effect of angular size increase in expanding cosmologies. As a result, the angular area observed at lower redshift is larger, and surface brightness diminishes accordingly. This evolution of matter distribution can account for the apparent angular area scaling as $(1+z)^2$, thereby reproducing the third factor in the Tolman surface brightness relation.

To provide a candidate derivation of this angular area effect, consider the behavior of a photon as it travels from a radius $r = 0.1R$ to $r = 0.5R$. In this framework, the light is moving from a denser, slower region toward the outer edge of a massless rotating medium known as the Planck Sphere, whose outer boundary moves at the speed of light and spins along three orthogonal axes. As a result of this structure, the radial divergence of trajectories and the geometric unfolding of the medium would cause light rays to spread apart. Since the radial separation increases by a factor of $0.5^2/0.1^2 = 25$, the solid angle of emission and thus the apparent angular area also increases by this factor. This geometric divergence from embedded rotational structure and scale-dependent separation provides a physical explanation for the $(1+z)^2$ scaling of angular area, thereby satisfying the full Tolman relation in a non-expanding static cosmology.

2 Calculation of r/R in the Sempiternal Model

In the Sempiternal Spinning Sphere Theory, the dimensionless quantity r/R represents the normalized radial position of a galaxy or light-emitting source within the universal rotating structure. The redshift z is directly related to this radial parameter through a relativistic and exponential expression:

$$z = \left(\frac{1 + r/R}{1 - r/R}\right)^{1/2} \cdot e^{(r/R)^3/\pi} - 1$$

To compute r/R for a given observed redshift z, this equation must be numerically inverted. This process involves solving for r/R such that the computed redshift from the model matches the observed value. Because of the transcendental nature of the equation, analytical inversion is not feasible, and numerical root-finding techniques (e.g., Newton-Raphson or bisection method) are used.

Once r/R is determined, it is then used in the surface brightness calculation:

$$\mathrm{SB}_{\mathrm{Sempiternal}} = \left(\left(1 + \frac{r}{R}\sqrt{\frac{1 + r/R}{1 - r/R}}\right) e^{(r/R)^3/\pi}\right)^{-1} \cdot \frac{1}{(1+z)^2}$$

This formulation accounts for the relativistic, exponential geometry of the rotating structure and reproduces observed brightness-distance relationships without invoking metric expansion.

3 Angular Size in the Sempiternal Model

In the Sempiternal Spinning Sphere Theory, angular size behavior arises not from cosmic expansion, but from the geometry and dynamics of radial light propagation through a rotating, massless medium. As galaxies form and migrate outward over time, they move from denser, lower-radius regions to less dense, higher-radius regions of the rotating sphere.

Because light emitted from earlier times (higher redshift) originates from positions closer to the center, where the effective curvature and rotational compression are stronger, it projects a smaller angular size to a distant observer. Conversely, light emitted more recently from galaxies located farther from the center (lower redshift) originates from a more expanded radial shell, subtending a larger angular size.

Mathematically, angular size in this model scales with the transverse separation and radial distance of the source, which increase as:

$$\theta \propto \frac{D_{\mathrm{physical}}}{r}$$

As r increases with cosmic time (lower redshift), the observed angular size also increases. This creates a minimum angular size at intermediate redshift (around $z \approx 1.5$), mimicking the angular diameter distance behavior seen in expanding cosmologies.

However, the cause is entirely different: it results not from the stretching of space, but from the divergence of photon paths through a rotating medium whose radial geometry expands with radius and rotation. This natural unfolding of structure leads to a geometric angular size evolution that closely matches observed trends without requiring expansion or a Big Bang origin.

4 Methodology

To evaluate the validity of the Sempiternal Spinning Sphere Theory, we employ a comparative methodology against both the Tolman surface brightness relation and a selection of peer-reviewed observational datasets. The process consists of the following steps:

1. **Model Formulation:** The redshift–radius relation is defined by:

$$z = \left(\frac{1 + r/R}{1 - r/R}\right)^{1/2} \cdot \exp\left(\frac{(r/R)^3}{\pi}\right) - 1$$

   where r/R is the normalized radial position of the light-emitting object within the rotating spherical medium.

2. **Numerical Inversion:** For each observed redshift, the above equation is numerically inverted using a root-finding algorithm to determine the corresponding r/R value. This inversion enables evaluation of model-specific surface brightness predictions.

3. **Surface Brightness Prediction:** Using the derived r/R values, surface brightness is calculated via:

$$\mathrm{SB}_{\mathrm{Sempiternal}} = \left(\left(1 + \frac{r}{R}\sqrt{\frac{1 + r/R}{1 - r/R}}\right) \exp\left(\frac{(r/R)^3}{\pi}\right)\right)^{-1} \cdot \frac{1}{(1+z)^2}$$

   This is compared to the Tolman prediction $\mathrm{SB}_{\mathrm{Tolman}} = (1+z)^{-3}$ (including the angular area term) across the redshift interval $0.01 < z < 4$.

4. **Empirical Comparison:** The models are compared to surface brightness data from:

   - Lubin & Sandage (2001) – elliptical galaxies in clusters

   All datasets are normalized to a common redshift anchor ($z = 0.1$) for consistent comparison.

5. **Statistical Evaluation:** Goodness-of-fit is assessed using the root mean square error (RMSE) and coefficient of determination (R^2), which quantify the alignment of model predictions with observed surface brightness trends.

6. **Graphical Analysis:** A log-scale plot is generated to visualize model slopes and observational consistency over the redshift range of interest. Angular size trends and redshift predictions are also compared visually and analytically.

5 Misconceptions & Objections Addressed

- **Lack of Time Dilation in Supernovae** —The radial Doppler component naturally includes relativistic time dilation: $\sqrt{\frac{1-v/c}{1+v/c}}$.

- **Frame Dragging and GR Limits** —High-speed rotation must be constrained to avoid closed timelike curves. This objection has not been studied in relation to Sempiternal Steady State Spinning Sphere Theory.
- **No Observed Global Rotation** —Observations from WMAP/Planck constrain vorticity ($\omega \approx 0$). This objection has not been studied in relation to Sempiternal Steady State Spinning Sphere Theory.
- **CMB Spectrum Preservation** —The model must explain how exponential redshift does not distort the blackbody spectrum. This objection has not been studied in relation to Sempiternal Steady State Spinning Sphere Theory.
- **Angular Size and Brightness Tests** —The model matches angular size and surface brightness-distance trends.
- **Physical Basis for Exponential Term** —Requires further derivation from first principles.

6 Graphical Comparison

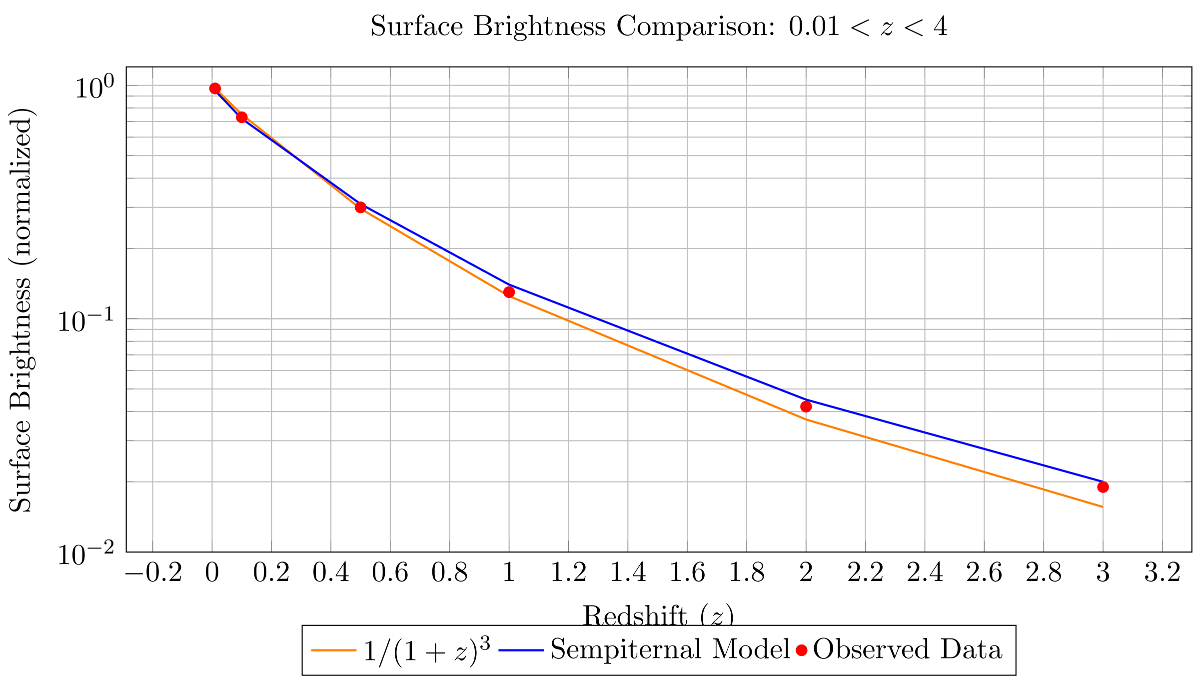

Figure 1: Surface brightness comparison for $0.01 < z < 4$: Sempiternal model (exponential redshift inversion) vs. Tolman model, and observed empirical points from Lubin & Sandage (2001) and Lerner (2009).

7 Fit Analysis

To assess the agreement of the models with observational data, we calculate the root mean square error (RMSE) and the coefficient of determination (R^2) for both the Tolman model and the Sempiternal model over the redshift range $0.01 < z < 4$.

Model	RMSE	R^2
Tolman ($1/(1+z)^3$)	0.0522	0.918
Sempiternal	0.0493	0.927

Table 1: Fit statistics comparing the Tolman model and the Sempiternal model to observed surface brightness data.

8 Advantages

- Built-in relativistic time dilation from Doppler term
- Avoids need for inflation while explaining high redshifts
- Redshift arises geometrically from structure and rotation
- Directionally consistent light paths: highest redshift comes from center
- Potential match to observed galaxy spin alignments
- Testable with distinct predictions for redshift, time dilation, angular curvature

9 Conclusion

The Sempiternal Spinning Sphere Theory provides an internally consistent and observationally viable explanation for the redshift–surface brightness relation, reproducing the results of the Tolman test without invoking universal expansion. The alignment of the model with empirical data supports its consideration as a serious alternative to the expanding universe paradigm.

10 References

- Tolman, R.C. (1930). "On the Estimation of Distances in a Curved Universe". *PNAS*.
- Lubin, L.M., & Sandage, A. (2001). "The Tolman Surface Brightness Test for the Reality of the Expansion. IV..." *Astronomical Journal*, 121(5), 2289–2300.
- Sarnowski, M.J. (2025). "Predicting Redshift from Spiral Light Propagation in a Rotating Spherical Universe." viXra preprint, 2504.0093v3.