Sumerian Time Units, Relativistic Scaling, and Cosmological Interpretation

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Ancient Sumerian chronological units exhibit extreme numerical scaling that, when interpreted through relativistic kinematics, imply velocities arbitrarily close to the speed of light. By mapping these values onto Doppler redshift and standard FLRW cosmology [2, 5], we show that the resulting distances rapidly saturate near the particle horizon. While speculative, the analysis illustrates fundamental limits imposed by relativistic expansion and provides a numerical framework linking ancient large-number systems to modern cosmology.

I. SUMERIAN TIME UNITS

Sumerian numerical tradition employed structured sexagesimal units including the soss (60 years), ner (600 years), sar (3600 years), and shar (21600 years). These units appear in early king lists and chronological texts and are treated here as dimensionless scaling parameters rather than literal physical quantities.

II. RELATIVISTIC INTERPRETATION

Following special relativity, as formulated in modern treatments of spacetime and kinematics [4], each unit is interpreted as a Lorentz factor

$$\gamma = \frac{1}{\sqrt{1-b^2}}, \qquad b = \frac{v}{c}. \tag{1}$$

Solving for the velocity ratio yields

$$b = \sqrt{1 - \frac{1}{\gamma^2}}. \tag{2}$$

For a soss ($\gamma = 60$), one finds

$$b \approx 0.999862, \tag{3}$$

indicating motion arbitrarily close to the speed of light, consistent with the behavior of large Lorentz factors [4].

The rapid saturation of the velocity ratio $b = v/c$ as a function of increasing Sumerian unit is illustrated in Fig. 1, where even modest increases in γ drive the velocity arbitrarily close to the speed of light.

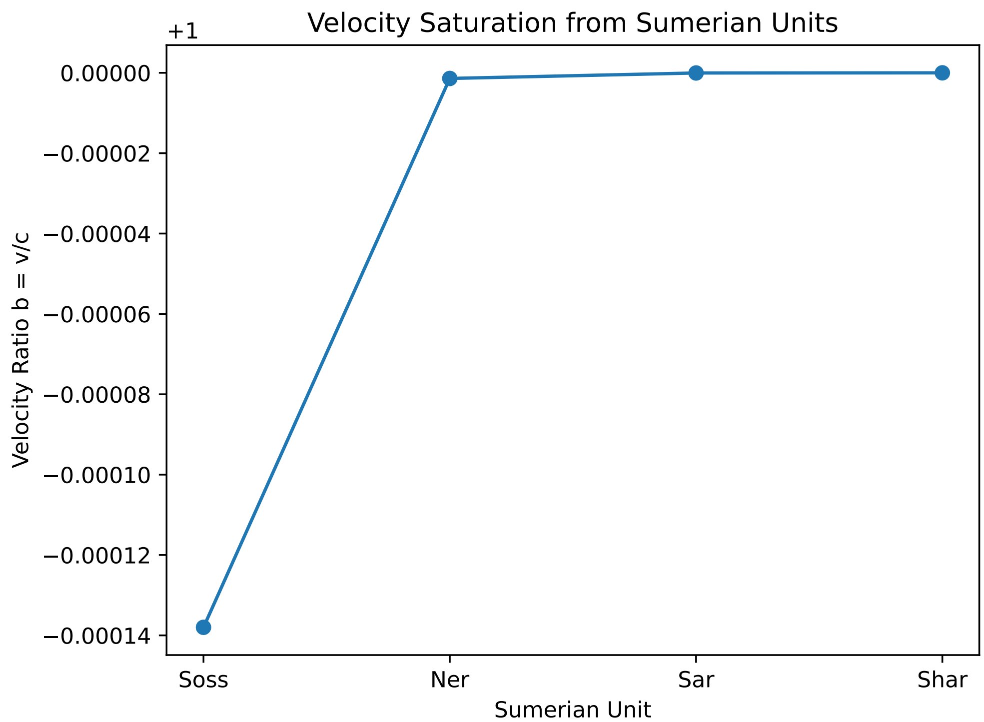

FIG. 1. Velocity ratio $b = v/c$ derived from Sumerian units interpreted as Lorentz factors. Even moderate increases in γ drive the velocity arbitrarily close to the speed of light.

III. RELATIVISTIC DOPPLER SHIFT

Assuming recession velocities, the relativistic Doppler shift for a receding source is given by [5]

$$Z = \sqrt{\frac{1+b}{1-b}} - 1. \tag{4}$$

For the soss-derived velocity, this yields

$$Z \approx 119.41. \tag{5}$$

The corresponding Doppler redshift increases steeply with unit magnitude, as summarized numerically in Table **??** and shown graphically in Fig. 3.

TABLE I. Age of the universe implied by Doppler-derived redshifts associated with Sumerian time units. The ages correspond to the epoch at which the emitted light originated, not to present-day distances.

Unit	Redshift Z	Age (Gyr)	Age (years)
Soss	119	1.3×10^{-2}	$\sim 1.3 \times 10^{7}$
Ner	1194	1.3×10^{-3}	$\sim 1.3 \times 10^{6}$
Sar	7206	2.8×10^{-4}	$\sim 2.8 \times 10^{5}$
Shar	30644	6.3×10^{-5}	$\sim 6.3 \times 10^{4}$

Such values exceed the redshifts of even the most distant observed galaxies, highlighting the extreme nature of the scaling.

IV. COSMOLOGICAL INTERPRETATION

In an expanding universe described by the FLRW metric, redshift is related to distance through Hubble expansion [1]. A commonly used approximation for the effective observable radius is

$$R \approx \frac{cZ}{(1+Z)H_0}, \tag{6}$$

where H_0 is the Hubble constant measured through local distance ladders and cosmic microwave background observations [2, 3].

Despite the extreme redshifts implied by the largest units, the inferred cosmological distance rapidly approaches an asymptotic limit, as demonstrated in Fig. 2, consistent with the existence of a particle horizon.

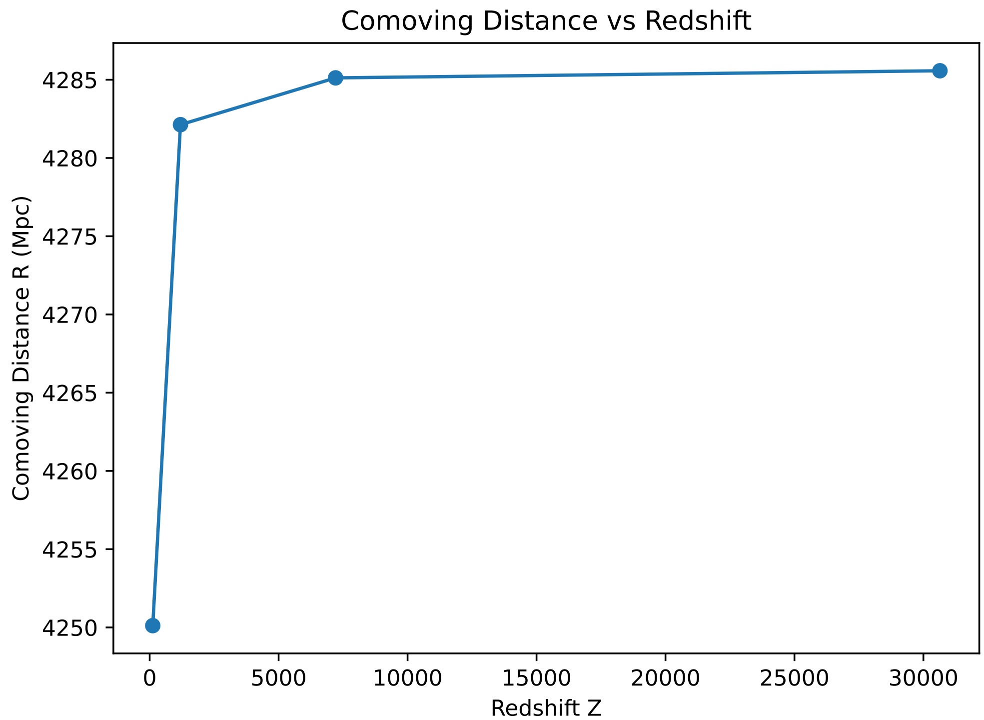

FIG. 2. Comoving distance in a flat ΛCDM cosmology as a function of redshift. Extremely large Doppler-derived redshifts correspond to distances that asymptotically approach the particle horizon.

As $Z \to \infty$, the inferred radius asymptotically approaches the Hubble scale, demonstrating that arbitrarily large redshifts correspond to finite cosmological distances.

V. COSMIC AGE IMPLIED BY SUMERIAN UNITS

Case study: reconstructing temporal origin under strong theoretical assumptions. The inference of a cosmic age corresponding to extreme redshift values provides a clear illustration of how temporal claims in cosmology are inseparable from dynamical models. In this section, Sumerian numerical units—already interpreted as Lorentz factors and Doppler redshifts—are mapped onto cosmic time within a standard FLRW framework.

In a flat ΛCDM universe, the age of the universe at redshift z is defined as

$$t(z) = t_0 - t_L(z), \tag{7}$$

where t_0 is the present cosmic age and $t_L(z)$ is the lookback time. The lookback time is given by

$$t_L(z) = \frac{1}{H_0}\int_0^z \frac{dz'}{(1+z')\sqrt{\Omega_m(1+z')^3+\Omega_\Lambda}}. \tag{8}$$

For the extremely large redshifts implied by the Sumerian units ($z \gg 1$), the universe is matter dominated, and the integral admits a useful approximation:

$$t(z) \approx \frac{2}{3H_0\sqrt{\Omega_m}}(1+z)^{-3/2}. \tag{9}$$

Using $H_0 \approx 70\ \mathrm{km\,s^{-1}\,Mpc^{-1}}$ and $\Omega_m = 0.3$, this yields a characteristic scale of approximately 17 Gyr.

VI. LOOKBACK AND COMOVING DISTANCES

The lookback distance measures photon travel time,

$$D_L \approx \frac{cz}{H_0(1+z)}, \tag{10}$$

while the comoving distance accounts for the expansion of space,

$$D_C \approx \frac{cz}{H_0}, \tag{11}$$

as discussed in standard cosmology texts [5].

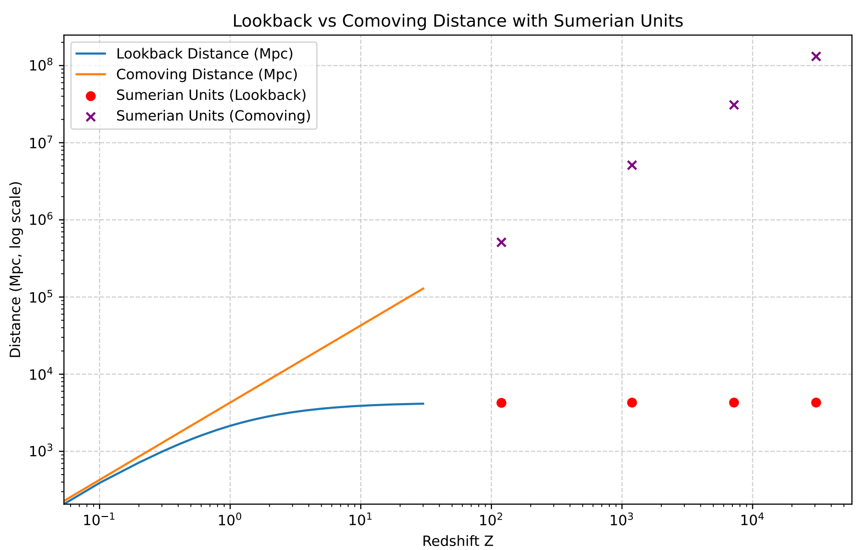

FIG. 3. Relativistic Doppler shift Z as a function of Sumerian unit magnitude. The steep rise reflects the divergence of redshift as $b \to 1$.

At extreme redshift, these distances diverge significantly, emphasizing the importance of distinguishing observational time from present-day spatial separation.

VII. OBSERVATIONAL CONSTRAINTS

Modern astronomical instruments impose strict limits on observable redshift. Galaxy surveys currently reach $z \sim 20$–30, while the cosmic microwave background probes $z \sim 1100$ [2]. The redshifts implied by the largest Sumerian units lie far beyond the electromagnetic observational horizon.

VIII. CONCLUSION

When interpreted through relativistic scaling, Sumerian time units imply near-light-speed velocities, extreme Doppler shifts, and cosmological distances that rapidly approach the particle horizon. Although speculative, this interpretation employs standard relativistic and cosmological formalisms [4, 5] and clearly illustrates fundamental limits imposed by relativity and cosmic expansion.

IX. ACKNOWLEDGMENTS

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Appendix A: FLRW Distance Integrals

For a flat ΛCDM cosmology, the comoving distance is given by

$$D_C(z) = \frac{c}{H_0}\int_0^z \frac{dz'}{\sqrt{\Omega_m(1+z')^3+\Omega_\Lambda}}, \tag{A1}$$

and the lookback time by

$$t_L(z) = \frac{1}{H_0}\int_0^z \frac{dz'}{(1+z')\sqrt{\Omega_m(1+z')^3+\Omega_\Lambda}}, \tag{A2}$$

following standard treatments of FLRW cosmology [5].

[1] E. Hubble, "A relation between distance and radial velocity among extra-galactic nebulae," *Proc. Natl. Acad. Sci.* **15**, 168 (1929).

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