JWST Observations Support Zero-Energy Dynamic Universe Cosmology Over ΛCDM

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Abstract

Recent observations from the James Webb Space Telescope (JWST) reveal unexpectedly mature and massive galaxies at redshifts $z > 10$, challenging the ΛCDM cosmological model's timeline for structure formation. Additionally, JWST angular size measurements of high-redshift galaxies show systematic deviations from ΛCDM predictions. We demonstrate that these observations are naturally explained in the Dynamic Universe (DU) approach, a zero-energy cosmology based on spherically closed 3-space expanding and contracting in a fourth spatial dimension. Unlike ΛCDM, which assumes conservation of matter/radiation energy throughout cosmic expansion and requires dark energy (70% of total energy density) to match observations, DU maintains zero-energy balance throughout the contraction-expansion process, like in bouncing cosmologies. In early expansion following the pass-through phase from contraction to expansion, gravitational processes operated dramatically faster—scaling as $(1+z)^{3/2}$, meaning ~36 times faster at z=10, ~1000 times faster at z=100—while the high coordinate speed of light enhanced atomic and stellar processes. Combined with high matter/radiation energy density from the zero-energy balance, this provides ample time for early structure formation. We present quantitative comparisons showing: (1) DU's angular size predictions match JWST observations while ΛCDM predictions fail systematically, (2) DU naturally explains early massive galaxy formation through accelerated processes in early expansion, (3) DU reproduces the complete supernova Ia magnitude-redshift relation to $z = 2.9$ without dark energy using a parameter-free algebraic formula, (4) DU predicts stable black hole orbits down to the critical radius with minimum periods matching Sgr A* observations, and (5) DU explains paleontological data on ancient solar system evolution via proportional expansion of gravitationally bound structures. These convergent lines of evidence suggest JWST observations favor DU as an alternative cosmological paradigm based on absolute time, absolute space, and energy conservation.

Introduction

The ΛCDM concordance model of cosmology has been remarkably successful in describing large-scale structure, cosmic microwave background anisotropies, and the expansion history of the universe. However, recent observations from JWST have revealed several anomalies that challenge the model's fundamental assumptions[1,2,3]. Most notably, JWST has detected massive, mature galaxies with well-developed morphologies at redshifts z = 10-15, corresponding to cosmic times of only 400-700 million years after the Big Bang. These 'impossibly early' galaxies exhibit stellar masses, chemical enrichment, and dynamical complexity that appear incompatible with hierarchical structure formation timescales in ΛCDM cosmology.

Additionally, systematic studies of galaxy angular sizes across cosmic time show significant deviations from ΛCDM predictions. Standard ΛCDM predicts a characteristic non-monotonic behavior where angular sizes first decrease with redshift, reach a minimum around $z \approx 1.5$, then increase at higher redshifts—a counterintuitive consequence of the model's expansion history and light travel time geometry. Recent JWST observations extending to $z > 10$ show no evidence for this angular size minimum, instead following a more Euclidean relationship throughout the observed redshift range.

The 1998 discovery of apparently accelerating cosmic expansion from supernova Ia observations led to the introduction of dark energy, comprising approximately 70% of the universe's total energy density. While ΛCDM successfully fits supernova data with appropriate values of matter density (Ω_m) and dark energy density (Ω_Λ), the physical origin of dark energy remains one of the most profound mysteries in physics, with the observed cosmological constant differing from quantum field theory predictions by 120 orders of magnitude.

In this paper, we demonstrate that these diverse observations—early massive galaxies, angular size evolution, and supernova distances—are naturally and quantitatively explained by the Dynamic Universe (DU) theory[4], an alternative cosmological framework based on spherically closed 3-dimensional space (a 3-sphere) undergoing contraction and expansion in cosmological timescales. Appendix 1 presents the theoretical framework for relativity in DU, providing essential background for understanding DU's predictions compared to the ΛCDM cosmological model. In cosmology, the DU framework eliminates the need for dark energy, explains rapid early galaxy formation through coordinate time-variable physics in the early expansion phase, and makes parameter-free predictions that match current observations better than ΛCDM in several important tests.

Theoretical Framework

The Dynamic Universe Model

The Dynamic Universe theory postulates space as the 3-dimensional surface of a 4-dimensional sphere (3-sphere), characterized by a 4-radius R_4. Unlike ΛCDM's time-like fourth dimension in Minkowski spacetime, DU's fourth dimension is spatial and metric in nature. Space contracts and expands in this fourth, radial dimension, like a hyper-spherical pendulum, with the total energy of the system conserved throughout the process.

The fundamental postulate is the zero-energy balance between gravitational energy and the energy of motion in the fourth dimension. For uniformly distributed mass M_{tot} in the 3-sphere, the gravitational energy can be expressed in terms of an effective mass equivalence $M'' = 0.776\, M_{tot}$ (or $M'' = 0.991\, M_{tot}$) at the center of the 4-sphere (derived from numerical integration over the 3-sphere geometry, through π or 2π, respectively). The zero-energy condition is:

$$M_{tot} c_0^2 - GM'' M_{tot} / R_4 = 0$$

where c_0 is the velocity of space expansion/contraction in the fourth dimension. Solving for c_0 yields

$$c_0 = \pm\sqrt{GM''/R_4} \,.$$

Using current estimates of cosmic mass density $\rho \approx 5\times10^{-27}$ kg/m³ and Hubble radius $R_4 \approx$ 13.8 billion light years, this predicts $c_0 \approx 3\times10^8$ m/s—equal to the observed speed of light today. The rest energy of matter $E = mc^2$ is thus identified as the kinetic energy of mass moving at velocity c in the fourth dimension due to space expansion.

Importantly, the speed of light is not constant in DU but follows the expansion velocity c_0, which decreases as space expands. The rate of all physical processes and velocities in space are proportional to the local speed of light. This time-dependent physics has profound implications for early universe structure formation.

Energy Evolution and Galaxy Formation

A crucial distinction between ΛCDM and DU lies in the role of energy balance in cosmic evolution. In ΛCDM, matter/radiation energy remains constant from the Big Bang onward (barring conversion between forms), while gravitational energy increases with expansion. Observations indicate that today's universe is close to the critical density condition ($\Omega_{total} \approx 1$, flat space), corresponding to zero total energy according to Friedmann's equations. However, this critical density appears as today's special condition—an observed state that must be explained through dark energy—rather than as a fundamental principle governing cosmic evolution. The flatness we observe today is interpreted within the ΛCDM framework as requiring both specific initial conditions and the ongoing influence of dark energy.

In contrast, the zero-energy balance in DU is not merely today's observed state but the fundamental principle guiding cosmic evolution throughout all time—during both contraction and expansion phases. The $E_{matter} + E_{gravity} = 0$ condition has been maintained from infinite past through the singularity to the present and will continue to infinite future. What appears in ΛCDM as a special condition requiring explanation (why is the universe flat today?) emerges in DU as the inevitable consequence of energy conservation in a closed dynamical system. The DU dynamics correspond to the Einstein-de Sitter solution (Λ=0), giving an age of 9.2 billion current years (corresponding to 13.8 billion light-years distance from the turn to the expansion) from singularity to present, with no need for dark energy to explain the observed critical density.

In the zero-energy process of the hyperspherical space, during contraction, gravitational potential energy is converted to kinetic energy (appearing as rest mass energy mc^2). After passing through the singularity 9.2 billion years ago, expansion gradually converts this kinetic energy back to gravitational potential energy.

An important consequence of DU's eternal zero-energy principle is the elimination of the Big Bang as the origin of space, time, and energy. In ΛCDM, the universe began in a singular event approximately 13.8 billion years ago, with all matter, energy, space, and time appearing instantaneously. This requires accepting a true singularity as physical reality—a point where all known physics breaks down. Additionally, ΛCDM requires an inflationary epoch (10^{-36} to 10^{-32} seconds after Big Bang) to solve the horizon problem (why is the CMB so uniform?) and flatness problem (why is Ω so close to 1?). In DU, there is no Big Bang—only a transition through a minimum radius in an eternal contraction-expansion cycle. Space existed before the singularity during the contraction phase, extending infinitely into the past. The horizon problem does not arise because there was unlimited time before the singularity for regions to reach thermal equilibrium during contraction. The flatness problem does not exist because zero-energy balance is maintained by construction at all times. Inflation is unnecessary. Figure 1 illustrates the contrasting energy evolution in both frameworks and shows how JWST's early galaxy observations are problematic for ΛCDM but natural for DU.

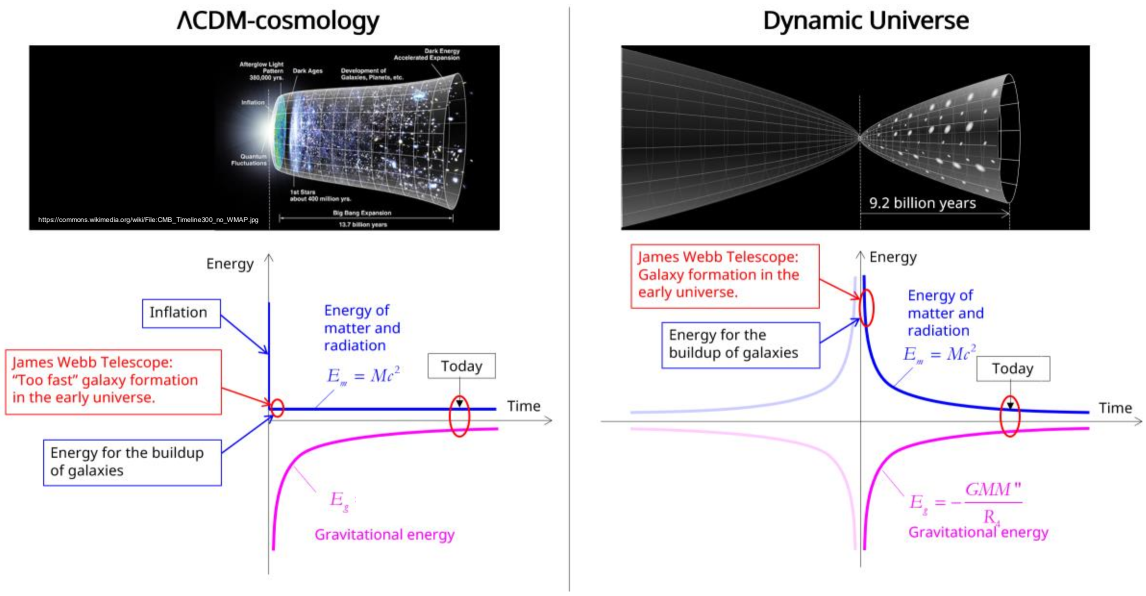

Figure 1. Energy evolution in ΛCDM and Dynamic Universe cosmologies.

Left panel (ΛCDM): Matter/radiation energy (blue line, $E = Mc^2$) remains constant from Big Bang/Inflation onward, while gravitational energy (pink curve, $E_g = -GM^2/R_4$) increases with expansion. Today's flat space (critical density, zero total energy) appears as a special condition requiring dark energy. JWST observations of massive galaxies at high redshift present a crisis: insufficient time for galaxy formation in the 400-700 Myr available after Big Bang. Right panel (Dynamic Universe): Zero-energy balance ($E_{matter} + E_{gravity} = 0$) is maintained throughout the contraction-expansion cycle. The singularity occurred 9.2 billion years ago. In contraction, the matter/radiation energy is built up against the release of gravitational energy. In early expansion following the singularity, gravitational processes operated dramatically faster—scaling as $(1+z)^{3/2}$, meaning ~36 times faster at z=10, ~1000 times at z=100, ~32,000 times at z=1000. Combined with high energy density and enhanced atomic/stellar processes (scaling with $c \propto \sqrt{(1+z)}$), the 250 Myr age (R_4=1,25 Gly) at z=10 provides ample time for massive galaxy formation. JWST observations are naturally explained without Big Bang, inflation, or dark energy.

Galaxy formation in DU occurs in the early expansion phase following the singularity—not during the preceding contraction phase. This is a critical point: in early expansion, when R_4 was small, gravitational processes proceeded dramatically faster. The gravitational collapse timescale $\tau \propto (G\rho)^{-1/2}$ scales as $(1+z)^{-3/2}$, meaning at z = 10, gravitational collapse is ~36 times faster than today; at z = 100, ~1000 times faster; at z = 1000, ~32,000 times faster. Simultaneously, the 3-sphere expansion velocity c_0 (and hence the speed of light) scales as $\sqrt{(1+z)}$, affecting atomic transitions, stellar nuclear reactions, and photon-mediated processes. Combined with the high matter/radiation energy density maintained by the zero-energy balance, these dramatically accelerated processes in early expansion provide ample time and energy for structure formation.

This resolution of the 'impossibly early galaxies' problem requires no fine-tuning of initial conditions, no modification of star formation physics, and no appeal to exotic dark matter or primordial black hole scenarios – it emerges naturally from the zero-energy framework's prediction of time-varying fundamental physics.

Key Differences from ΛCDM

The fundamental distinctions between DU and ΛCDM include:

• Time and space: DU maintains absolute, universal time and distance as coordinate quantities. Relativistic effects are attributed to local energy availability instead of spacetime curvature.

• Speed of light: Not a fundamental constant in DU but determined by the expansion velocity $c_0 = (GM''/R_4)^{1/2}$, which decreases with expansion. All physical processes scale proportionally with c.

• Energy evolution: ΛCDM assumes constant matter/radiation energy; DU maintains zero-energy balance throughout, with matter/radiation energy tracking gravitational energy evolution.

• Dark energy: Not required in DU. The zero-energy balance naturally produces the 'flat space' condition (critical density) corresponding to Einstein-de Sitter expansion.

• Local structure expansion: A critical prediction distinguishing the models. In ΛCDM, gravitationally bound systems (galaxies, solar systems) remain fixed in size while space expands around them. In DU, gravitationally bound structures expand in direct proportion to the expansion of space. However, atomic structures and solid objects do not expand because atomic radii do not scale with the changing speed of light, maintaining constant physical size.

• Geometric predictions: The dynamic 3-sphere geometry produces distinct predictions for angular sizes, redshift relations, and light propagation compared to ΛCDM's FLRW metric.

An important interpretational point: observations such as transponder measurements of planetary distances appear to show a non-expanding solar system when interpreted in the GR/ΛCDM framework relying on the constant AU unit, but should reveal an expanding solar system when interpreted in the DU framework. This needs thorough analysis, because the same observational data may support different conclusions depending on the theoretical framework used for interpretation.

Observational Comparisons

Angular Size Evolution

Recent work by Lovyagin et al.[5] presented JWST observations of galaxy angular sizes spanning redshifts from $z \approx 0.01$ to $z > 10$. Their Figure 5 compares observations with ΛCDM predictions (assuming flat geometry with standard parameters) and alternative models. The ΛCDM prediction shows the characteristic angular size minimum around $z \approx 1.5$-2.0, after which angular sizes are predicted to increase with redshift—a consequence of the model's expansion history, the reciprocity theorem, and finite light travel time.

The DU prediction for angular size follows from its 3-sphere geometry. For an object of physical size D at distance angle ψ (along the hypersphere) from the observer, the angular size θ is:

$$\theta = \frac{D}{R_4 \psi}$$

where ψ is the central angle. For expanding objects (like galaxies, which expand proportionally with space in DU), D scales with the expanding R_4, producing the observed Euclidean relationship $\theta = \psi/z$. Crucially, the Euclidean relationship means a monotonic decrease of angular size with redshift, which is subject to 3-sphere optical lensing[6] affecting the observed angular size of objects near the antipodal point of the 3-sphere at $z \approx 22$.

The JWST observations follow the DU prediction remarkably well across the entire observed redshift range, showing no evidence for the ΛCDM angular size minimum (Figure 2). The data systematically lie along the DU prediction envelope, while deviating significantly from ΛCDM expectations at both intermediate ($z \approx 1$–3) and high ($z > 5$) redshifts. This represents a qualitative, not merely quantitative, distinction between the models.

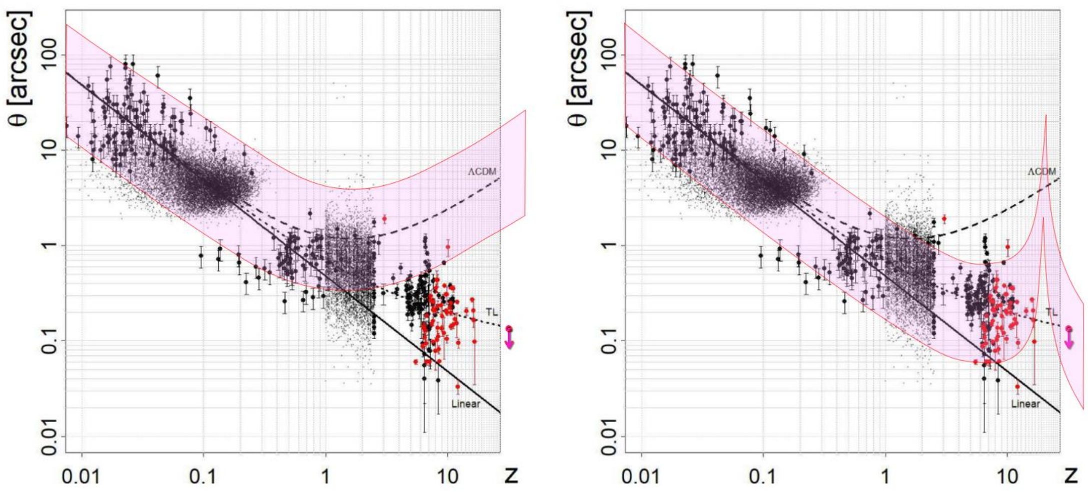

Figure 2. Angular size observations and predictions for ΛCDM (left) and Dynamic Universe (right).

Angular diameter (θ in arcseconds) versus redshift (z) for ~10 kpc sized objects, Figure 5 given in N. Lovyagin et al.[5]. The pink shaded regions added to the figure show the ΛCDM prediction (left panel) with characteristic non-monotonic behavior: angular sizes decrease to a minimum at $z \approx 1.5$, then increase at higher redshifts—a consequence of FLRW metric expansion history. The Dynamic Universe prediction (right panel) shows monotonic decrease of angular size with redshift, following 3-sphere geometry with Euclidean relationship. 3-sphere optical lensing affects the observed angular size of objects near the antipodal point around $z \approx 22$. Black and red points show observations. JWST observations (red points) systematically follow the DU prediction across the entire observed range, showing no evidence for the ΛCDM angular size minimum. This represents a qualitative geometric distinction between the models.

Early Massive Galaxy Formation

JWST has revealed numerous massive galaxies at $z > 10$ with stellar masses exceeding 10^{10} solar masses, well-developed disk and spiral structures, and evidence for multiple generations of stellar populations. In ΛCDM, these galaxies must form within 400-700 million years after the Big Bang through hierarchical merging of smaller structures. The observed high stellar masses, chemical enrichment (metallicities approaching solar values), and dynamical maturity are difficult to reconcile with such short timescales.

In the DU framework, this apparent crisis is resolved through dramatically accelerated gravitational processes in early expansion. Following the singularity 9.2 billion (current) years ago, the initial expansion phase was characterized by high matter/radiation energy density maintained by the zero-energy balance. The expansion velocity c_0 (and thus the speed of light c) was higher, scaling as $\sqrt{1+z}$, affecting atomic and stellar processes. More dramatically, gravitational collapse timescales scale as $\tau \propto (1+z)^{-3/2}$, meaning gravitational processes proceed $(1+z)^{3/2}$ times faster at redshift z. The speed of light enhancement $\sqrt{1+z}$ additionally accelerates atomic transitions, stellar nuclear reactions, and photon-mediated processes. The 250 million years between the singularity and $z = 10$, during which the universe passed through much higher redshifts with even faster processes, combined with high energy density from the zero-energy balance, provides ample time for the formation of massive, chemically enriched, dynamically mature galaxies observed by JWST. Structures that appear impossibly mature for their cosmic age in ΛCDM are naturally explained in DU's framework, where processes in early expansion operated at rates thousands to tens of thousands of times faster than today.

Supernova Ia Distance-Redshift Relation

The 1998 discovery of accelerating expansion from supernova Ia observations revolutionized cosmology, leading to dark energy as 70% of the cosmic energy budget[7,8,9]. The ΛCDM luminosity distance requires numerical integration over the expansion history with free parameters Ω_m and Ω_Λ. The distance modulus is:

$$\mu_{\Lambda CDM} = 5\log\frac{R_H}{10\ \text{pc}} + 5\log\left[(1+z)\int_0^z \frac{1}{\sqrt{(1+z)^2(1+\Omega_m z) - z(2+z)\Omega_\Lambda}}\,dz\right]$$

Best-fit values ($\Omega_m \approx 0.3$, $\Omega_\Lambda \approx 0.7$) match observations but require fine-tuning and leave the physical nature of dark energy unexplained.

The DU prediction, derived from 3-sphere geometry and zero-energy dynamics, converts to the observational practice in the ΛCDM framework[10,11] as a simple algebraic formula with no free parameters other than the Hubble radius R_H[12,13]:

$$\mu_{DU} = 5\log\frac{R_H}{10\ \text{pc}} + 2.5\log\left[z^2(1+z)\right]$$

This formula matches the complete supernova Ia dataset from $z \approx 0.001$ to $z = 2.9$ without invoking dark energy (Figure 3). Recent JWST discovery of SN 2023adsy at $z = 2.9$ provides a single high-redshift Type Ia supernova[14]. Its observed distance modulus lies closer to the DU prediction than to ΛCDM, continuing the trend observed at lower redshifts.

Black Hole Orbital Dynamics

The DU framework's rejection of the equivalence principle leads to different predictions for strong-field gravity. In General Relativity, the equivalence principle requires relativistic mass increase in both accelerated motion and free fall. For a non-rotating (Schwarzschild) black hole, GR disallows orbits inside $3r_s$ (three times the Schwarzschild radius).

In DU, free fall builds kinetic energy against a reduction of the rest energy via tilting of local space. This produces stable orbits down to the DU critical radius $r_c = GM/c^2$ which is half of the Schwarzschild critical radius. The minimum orbital period occurs at $r = 2r_c$, with slow stable orbits possible all the way down to r_c.

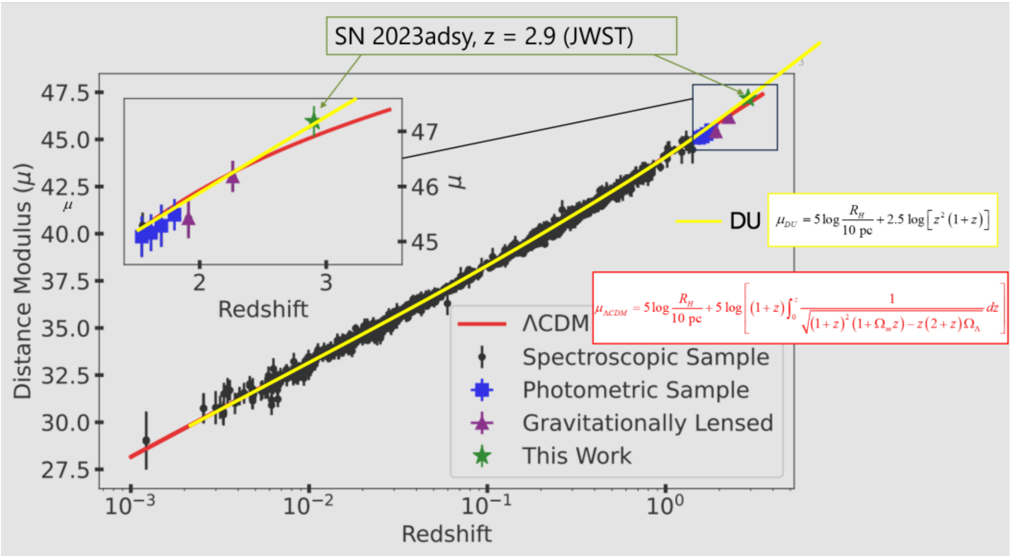

Figure 3. Type Ia supernova distance modulus versus redshift.

Distance modulus μ (magnitude) as a function of redshift z for Type Ia supernovae given as Figure 8 in Pierel, J. D. R., et al.[14]. Black points: spectroscopic sample; blue points: photometric sample; purple points: gravitationally lensed SNe; green star: SN 2023adsy at z=2.9, the highest-redshift Type Ia discovered with JWST. Red curve: ΛCDM prediction requiring numerical integration with free parameters $\Omega_m \approx 0.3$, $\Omega_\Lambda \approx 0.7$ (dark energy comprises 70% of cosmic energy budget). The equation boxes and the yellow curves added to the Figure: Dynamic Universe parameter-free prediction $\mu = 5\log(R_H/10\text{pc}) + 2.5\log[z^2(1+z)]$, derived from 3-sphere geometry and zero-energy dynamics, and converted to the ΛCDM framework. The DU formula matches observations from z=0.001 to z=2.9 without invoking dark energy or cosmological constant. The z=2.9 supernova lies closer to the DU prediction, continuing the trend at lower redshifts.

For Sagittarius A*, the supermassive black hole at the Milky Way center ($M \approx 4\times10^6\ M_\odot$):

- Schwarzschild (non-rotating) minimum stable period: ~30 minutes
- DU minimum period (at $r = 2r_c$): 14.8 minutes
- Observed shortest period: 16.8 ± 2 minutes[15]

The observed period is compatible with DU's prediction (Figure 4). In GR, a Kerr (rotating) black hole can accommodate shorter periods than Schwarzschild, potentially explaining the 16.8-minute observation within the GR framework as well. However, the significance of DU's prediction lies not merely in matching this particular observation, but in predicting stable slow orbits all the way down to the critical radius r_c. These slow orbits near r_c are crucial for maintaining the black hole's mass through accretion, addressing theoretical concerns in Schwarzschild space.

The different orbital stability predictions between DU and GR arise from fundamentally different treatments of energy in gravitational free fall versus accelerated motion. This represents an empirically testable distinction, with Event Horizon Telescope observations and X-ray timing studies of accreting matter providing ongoing tests.

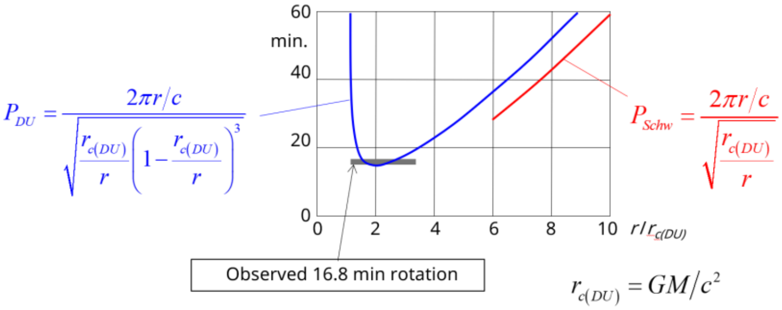

Figure 4. Orbital periods of circular orbits at Sagittarius A* black hole versus orbital radius.

Orbital period P (minutes) as a function of orbital radius r normalized to the DU critical radius $r_{c(\mathrm{DU})} = GM/c^2$. Blue curve: DU prediction $P_{\mathrm{DU}} = 2\pi r/c \times [r/r_{c(\mathrm{DU})} /(1-r_{c(\mathrm{DU})}/r)^3]^{1/2}$, showing minimum period of 14.8 minutes at $r = 2r_{c(\mathrm{DU})}$. The DU framework predicts stable orbits down to the critical radius $r_{c(\mathrm{DU})}$, with slow stable orbits near r_c crucial for maintaining black hole mass through accretion. Red curve: Schwarzschild (non-rotating GR) prediction $P_{\mathrm{Schw}} = 2\pi r/c/\sqrt{(r_{c(\mathrm{DU})}/r)}$, which has no minimum and predicts unstable orbits inside $3r_s$ (equivalent to $6r_{c(\mathrm{DU})}$). The observed shortest orbital period at Sgr A* is 16.8 ± 2 minutes (indicated by horizontal line), consistent with DU's prediction of stable orbits near the minimum period. For a rotating (Kerr) black hole in GR, shorter periods become possible, but the significance of DU's prediction lies in stable slow orbits maintaining the black hole's mass, addressing a theoretical concern in Schwarzschild geometry. For Sgr A* with $M \approx 4\times10^6$ $M_\odot$, $r_{c(\mathrm{DU})} \approx 1.2\times10^{10}$ m.

Ancient Solar System Evolution

A distinctive prediction of DU is that gravitationally bound structures—including planetary systems and galaxies—expand in direct proportion to the expansion of space. Solid objects and atomic structures do not expand because atomic radii (determined by the Bohr radius and the fine structure constant) are invariant. However, gravitationally bound distances like planetary orbital radii do expand:

$$r(t) = r_0\left(\frac{t}{t_0}\right)^{2/3}$$

where t_0 is present time from singularity (9.2 Gyr) and the exponent 2/3 comes from the overall energy balance (consistent with Einstein-de Sitter expansion dynamics). Four billion years ago, planets were approximately 30% closer to the Sun than today (at 70% of current orbital radii).

This has profound implications for the 'faint young Sun paradox': stellar evolution models predict the Sun's luminosity was ~25% lower 4 Gyr ago. At today's orbital distances, early Earth should have been frozen and Mars certainly should have had no liquid water. Yet geological evidence clearly shows liquid water on both planets. Various solutions have been proposed—enhanced greenhouse effects, different atmospheric compositions—but none are fully satisfactory.

DU resolves this naturally: planets at 70% of current distance received $(1/0.7)^2 \approx 2\times$ the solar flux, more than compensating for the Sun's 25% lower luminosity[16]. This provides a parameter-free solution to a longstanding problem in planetary science, requiring no atmospheric fine-tuning.

Additional evidence supporting the expanding solar system comes from paleontology. Coral fossils and stromatolites preserve both daily and annual growth patterns, allowing reconstruction of day length and days per year going back 800 million years (Figure 5). The data show that the number of days per year has decreased systematically, supporting the increasing Earth-Sun distance. This is also consistent with Earth-Moon distance increasing faster than predicted by tidal recession alone[17]. DU calculations of days per year over the past billion years, incorporating both effects, Earth's rotation and the lengthening of a year, match coral fossil data remarkably well. This long-term validation spanning hundreds of millions of years provides independent support for the expanding local structures prediction.

The Earth-Moon distance has been measured in the lunar laser ranging program for more than fifty years, showing ~3.8 cm/year increase in the distance, which is explained as a tidal effect only. When interpreted in DU framework, about 2.8 cm/year comes from the expansion of space, and ~1 cm/year from tidal recession.

Transponder measurements of planetary distances, when interpreted within the GR/ΛCDM framework, appear to show a non-expanding solar system[18]. Analysis of the data has not been performed in DU framework; expansion of the Earth orbit (about 150 million km radius) would be about 11 m/year.

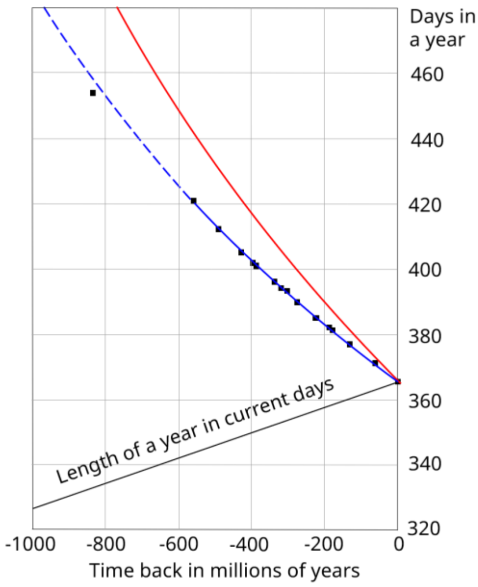

Figure 5. Days per year from coral fossil data over the past billion years.

Number of days in a year as a function of time (millions of years before present) based on growth patterns preserved in coral fossils and stromatolites. Black points: observational data from multiple paleontological studies spanning 100-850 million years. Data 0-579 Myr, Eicher 1976[21], Fig. 5-14, the –850 Myr point is the best fit of several samples, Vanyo, J. P. and Awramik, S. M. 1985[22], Figure 4. Red curve: Estimate used for the lengthening of day due to tidal effects 2.5 ms/century[23].
Blue curve: DU prediction incorporating both space expansion (causing proportional increase in Earth-Moon distance and planetary orbital radii) and tidal recession. Black curve: Length of year in current days, showing year lengthening with expansion. The DU prediction matches the fossil data remarkably well, supporting the framework's prediction that gravitationally bound structures (planetary orbits) expand proportionally with space at rate $r(t) = r_0(t/t_0)^{2/3}$. The systematic decrease in days per year reflects Earth-Moon distance increasing faster than expected from tidal recession alone (~3.8 cm/year total: ~2.8 cm/year from space expansion + ~1.0 cm/year from tidal effects).
This long-term agreement over geological timescales provides independent validation of expanding local structures in DU. In GR/ΛCDM, planetary orbits are independent of the cosmological expansion, and only tidal recession affects Earth-Moon distance, underpredicting the observed trend.

Discussion

Convergent Evidence for the Dynamic Universe

The strength of the DU framework lies in its ability to address multiple independent observational puzzles with a single coherent theoretical structure:

1. JWST angular sizes: DU's 3-sphere geometry predicts monotonic behavior matching observations, while ΛCDM's angular size minimum is not observed.

2. Early massive galaxies: DU's dramatically accelerated gravitational processes—scaling as $(1+z)^{3/2}$, meaning ~36 times faster at z=10 and thousands of times faster at higher z—combined with high energy density from zero-energy balance, could naturally explain 'impossibly early' massive galaxies.

3. Supernova distances: DU's parameter-free formula matches observations from z=0.001 to z=2.9 without dark energy.

4. Sgr A* orbits: DU predicts stable orbits down to r_c with minimum period at $r=2r_c$ consistent with observations, while providing mechanism for black hole mass maintenance.

5. Ancient solar system: Proportionally expanding orbital radii offers a solution to the faint young Sun paradox and match coral fossil data over 800 Myr.

Importantly, these are not minor adjustments within the same paradigm, but qualitative differences arising from fundamentally different assumptions about space, time, energy conservation, and the nature of physical constants. The convergence of multiple independent lines of evidence—cosmological, astrophysical, and paleontological—spanning scales from planetary systems to cosmic horizons strengthens the case for serious consideration of the DU framework.

Eliminating Hypothetical Constructs

Beyond matching current observations, DU eliminates several hypothetical constructs required by ΛCDM:

1. The Big Bang singularity: ΛCDM requires a true beginning of space, time, and energy—a physical singularity where all laws of physics break down. DU's singularity is merely a transition point (minimum R_4) in an eternal process, not a creation event. Space and time are eternal.

2. Inflation[19]: To solve ΛCDM's horizon and flatness problems, inflation theory posits exponential expansion in the first 10^{-32} seconds, driven by a hypothetical inflation field with no known physical basis. DU solves both problems naturally: unlimited time during contraction allows thermal equilibrium (no horizon problem), and zero-energy balance maintains flatness eternally (no flatness problem).

3. Dark energy: Comprising 70% of cosmic energy density in ΛCDM, dark energy has no physical explanation and creates the cosmological constant problem (120 orders of magnitude discrepancy with zero-point energy suggested by quantum field theory). DU requires no dark energy—the zero-energy balance naturally produces critical density.

4. Initial conditions fine-tuning: ΛCDM requires extraordinarily precise initial conditions to produce today's universe. Density fluctuations must be 'just right,' Ω must start extremely close to 1, etc. DU produces the initial conditions from the zero-energy balance—the eternal process has no beginning.

The elimination of these constructs represents Occam's razor: DU achieves comparable or better agreement with the observations studied using fewer and more natural assumptions. A theory requiring general energy conservation is philosophically preferable to one requiring instantaneous creation plus multiple hypothetical mechanisms to patch resulting problems.

Testable Predictions

The DU framework makes several specific, falsifiable predictions that differ from ΛCDM:

Double images: The 3-sphere geometry predicts that objects very near the antipodal point ($z \approx 22$) could produce double images at opposite directions (see Fig.2)—one via the 'short way' around the sphere and one via the 'long way'. For an object at redshift z_2, the companion image should appear at $z_1 = e^{2\pi}/(z_2+1)-1$. The candidate object 'Capotauro'[20] at $z \approx 30$ may represent such an antipodal image, with its companion predicted at $z \approx 16$. Active searches for such pairs would provide definitive tests. Observations of objects near the antipodal point is more difficult due dimming of the surface brightness by the magnification of the object’s area.

Galaxy size evolution: DU predicts all galaxies expand uniformly with space. The observed physical size D at redshift z should scale as $D \propto 1/z$ for expanding structures. This differs from ΛCDM where galaxy sizes remain constant. Systematic measurements of galaxy physical sizes across cosmic time can test this.

Binary pulsar orbital evolution: For eccentric orbits, DU predicts the same energy for gravitational waves as GR. Unlike GR, DU does not predict energy loss for perfectly circular orbits.

Near-horizon black hole structure: DU accepts stable orbits inside the GR innermost stable circular orbit. Event Horizon Telescope observations and X-ray timing studies may reveal signatures of emission from these stable inner orbits; however, the form of matter and radiation in such orbits is unknown.

Time variation of fundamental constants: DU predicts the speed of light decreases (in coordinate time) as $-dc/c \approx 3.6\times10^{-11}$/year. This is unobservable due to the frequency of an atomic clock scaling proportionally to the speed of light. The fine-structure constant is decoupled from the cosmological evolution.

Philosophical Implications

Beyond empirical tests, the DU framework represents a return to absolute concepts of time and space, abandoned by relativity theory in 1905. Rather than treating spacetime geometry as the fundamental reality with time and distance as observer-dependent, DU treats time and distance as universal coordinate quantities with relativistic effects emerging from local energy availability in the system of nested energy frames, derived from the zero-energy balance.

This philosophical shift has practical consequences. In DU, the speed of light is not a fundamental constant but is linked to the cosmological expansion velocity c_0, determined by the zero-energy balance in space. Atomic clock rates depend on both local gravitational potential and motion in space, not due to 'time dilation' but because of the effects of gravitation and motion on the local energy state.

The elimination of dark energy removes the need for 70% of the universe's energy content to consist of a mysterious negative-pressure fluid. The zero-energy balance naturally produces the critical density condition ($\Omega_{total} = 1$) without fine-tuning, corresponding to Einstein-de Sitter expansion dynamics. This parsimony—matching observations with fewer and more natural assumptions—represents a significant conceptual advantage.

The framework's prediction of time-varying physical processes offers a new perspective on cosmological evolution. Early universe phenomena (baryogenesis, nucleosynthesis) occurred when the speed of light was dramatically higher, affecting the rates of atomic transitions, nuclear reactions, and photon-mediated processes. This, combined with the high energy density from the zero-energy balance, provides conditions for early structure and element formation in DU's framework.

Conclusions

Recent observations from JWST reveal systematic patterns that challenge the ΛCDM cosmological paradigm while supporting the zero-energy Dynamic Universe framework. The convergence of evidence from angular size measurements, early galaxy formation timescales, supernova distances, and ancient solar system evolution suggests that fundamental assumptions of modern cosmology may need revision.

The DU framework offers quantitative, parameter-free predictions that match current observations as well as or better than ΛCDM across multiple independent tests. It eliminates the need for dark energy (70% of cosmic energy budget), explains rapid early galaxy formation through time-variable physics in early expansion when the coordinate speed of light was higher, predicts proportionally expanding local structures consistent with paleontological data, and maintains absolute time and space as fundamental coordinate quantities while reproducing relativistic effects through local energy availability.

The case for DU rests not on a single observation, but on convergent evidence from diverse domains spanning ten orders of magnitude in scale—from black hole horizons (km) to cosmological distances (Gpc), and timescales from orbital periods (minutes) to geological evolution (Gyr). Such convergence suggests these observations may reflect a genuine alternative description of physical reality rather than coincidental agreement.

We emphasize that this work does not claim to have definitively falsified ΛCDM or proven DU. Rather, it demonstrates that: (1) JWST observations reveal tensions with ΛCDM expectations, (2) these observations can be understood in an alternative framework based on different fundamental assumptions, particularly energy conservation and time-varying fundamental physics, and (3) the alternative framework makes specific testable predictions that can distinguish it from ΛCDM with future observations.

The extraordinary success of ΛCDM in describing large-scale structure and CMB anisotropies is not disputed. However, the accumulating challenges from JWST observations—combined with theoretical puzzles like dark energy's origin, the cosmological constant problem, and the coincidence problem ("flat space condition", $\Omega_m + \Omega_\Lambda \approx 1$ today)—suggest the time is appropriate for serious consideration of alternative cosmological frameworks. The Dynamic Universe, grounded in energy conservation, 3-sphere geometry, and time-variable fundamental physics, offers one such alternative that merits detailed investigation by the cosmological community.

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References

[1] Adams, N.J. et al., Discovery and properties of ultra-high redshift galaxies (9 < z < 12) in the JWST ERO SMACS 0723 Field, MNRAS 518, 4755–4766 (2023)

[2] Melia, F., (2023). "The cosmic timeline implied by the JWST high-redshift galaxies." *Monthly Notices of the Royal Astronomical Society: Letters*, **521**, L85-L89. DOI: 10.1093/mnrasl/slad025. arXiv:2302.10103

[3] Gupta, R. P., JWST early Universe observations and ΛCDM cosmology." *Monthly Notices of the Royal Astronomical Society*, **524**, 3385-3395, 2023, DOI: 10.1093/mnras/stad2032. arXiv:2309.13100

[4] Suntola, T., The Dynamic Universe: Toward a Unified Picture of Physical Reality (4th ed.). Physics Foundations Society and the Finnish Society for Natural Philosophy. ISBN 978-952-68101-3-3, 2018 https://physicsfoundations.org/data/documents/DU_EN_978-952-68101-3-3.pdf

[5] Lovyagin, N.; Raikov, A.; Yershov, V.; Lovyagin, Y., Cosmological Model Tests with JWST., Galaxies **2022**, **10**, 108. https:// doi.org/10.3390/galaxies10060108

[6] Křížek, M., Infrared measurements of the JWST suggest that our dynamic universe is spatially closed' 2025 *J. Phys.: Conf. Ser.* **2948** 012007

[7] Riess, A.G. et al. (1998). Observational Evidence from Supernovae for an Accelerating Universe and a Cosmological Constant. Astronomical Journal, **116**, 1009-1038

[8] Perlmutter, S. et al. (1999). Measurements of Ω and Λ from 42 High-Redshift Supernovae. Astrophysical Journal, **517**, 565-586

[9] J.T. Tonry et al., Cosmological Results from High-z supernovae, ApJ, **594**, 1, 2003

[10] R.C. Tolman, On the Estimation of Distances in a Curved Universe with a Non-Static Line Element, PNAS **16**, 511, 1930

[11] A. Kim, A., Goobar, A, and Perlmutter, S., A Generalized *K* Correction for Type la Supernovae: Comparing *R*-band Photometry Beyond *z*=0.2 with *B*, *V*, and *R*-band Nearby Photometry, PASP **108**, 190, 1996

[12] Suntola, T and Day, R, Supernova observations fit Einstein-deSitter expansion in 4-sphere, arXiv:astro-ph/0412701

[13] Suntola, T, Appendix 1 in 2025 *J. Phys.: Conf. Ser.* **2948** 012003, doi:10.1088/1742-6596/2948/1/012003, The Dynamic Universe - IOPscience

[14] Pierel, J.D.R. et al. (2024). Discovery of An Apparent Red, High-Velocity Type Ia Supernova at z = 2.9 with JWST. arXiv:2406.05089v2 [astro-ph.GA]

[15] R. Genzel et al., Near-infrared flares from accreting gas around the supermassive black hole at the Galactic Centre, Nature **425** (2003) 934

[16] Sipilä, H, Is the Solar System expanding?, 2020 *J. Phys.: Conf. Ser.* **1466** 012004

[17] Wells, J.W., Coral Growth and Geochronometry. Nature, London, Volume 197, pages 948-950, 1963

[18] Krasinsky, G.A. and Brumberg, V.A., Secular Increase of Atronomical Unit from Analysis of the Major Planet Motions, and its Interpretation, Celestial Mechanics and Dynamical Astronomy **90:** 267-288, 2004

[19] Guth, A. H. (1997a). The Inflationary Universe: The quest for a new theory of cosmic origins. Basic Books. pp. 233–234. ISBN 978-0-201-32840-0

[20] Gandolf, G et al., Mysteries of Capotauro -- investigating the puzzling nature of an extreme F356W-dropout, arxiv.org/abs/2509.01664