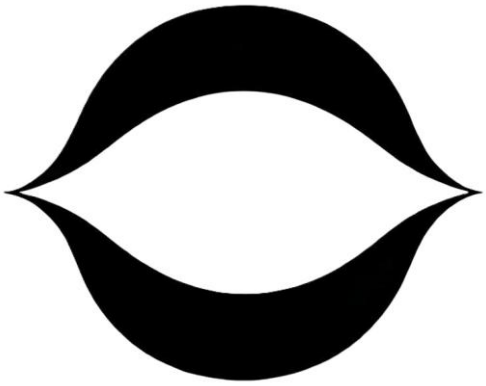

The Clock

Artist's Proof 42

Dark Energy

The 68/27/5 partition — the universe knows what time it is

§0 — What This Paper Does

The observed energy budget of the universe is approximately 68% dark energy, 27% dark matter, 5% visible matter (Planck 2018).

The remaining ~0.2% (radiation and relativistic neutrinos) is not part of the late-universe energy budget addressed here.

The axioms derive the total dark fraction: 20/21 ≈ 95.24% (AP10, AP28, AP41). It does not derive the internal split. This is Debt D44 — the most important open quantitative gap in the cosmological sector.

This paper addresses D44. The 68/27 split is not a partition of channels. It is a clock reading.

Dark matter is not a substance. It is a process — the ongoing defragmentation of structured records inside black holes. Dark energy is not a force.

It is the reservoir — the substrate content that has completed defragmentation and returned to the symmetric 1:1 state.

The ratio 68/27 ≈ 2.5 measures how far the universe has progressed through its current defragmentation cycle. The split is epoch-dependent. It was different in the past. It will be different in the future.

It is not a constant of nature. It is the time on a clock.

The mechanism uses one timescale — the characteristic defragmentation time τ — which is **derived from the axiom system** as $\tau = (6/21) \times t_H$, the ratio of the six faces of ε (AP24) to the twenty-one coupling channels (AP28), applied to the Hubble time.

This gives $\tau \approx 3.9$ Gyr. No free parameters.

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§1 — The Three Components

You already know the total dark fraction: 20/21 ≈ 95.24%. You have watched it derived. But what is inside that 95%? What splits it into 68 and 27?

§1.1 — Visible matter: the open channel

1/21 of the total energy budget. The single electromagnetic channel where records are actively being written. Matter that interacts with light. The crack still cracking. Predicted: 4.76%. Observed: 4.86% (Planck 2018).

Derived. AP10 gives 21 channels. AP28 proves their independence. AP41 identifies one as the visible channel. The match to observation is structural.

§1.2 — Dark energy: the completed reservoir

Substrate content in the 20 dark channels that has fully returned to the 1:1 symmetric state. No residual structure. No clustering. No interaction except gravitational, through the background metric. Pure potential. The unbroken mirror.

Dark energy is Mode 0 at rest — the condensate (AP03) in its equilibrium configuration. It exerts negative pressure because the 1:1 state resists disturbance (AP03 §4: the substrate is extraordinarily stiff, $\lambda \approx 10^{46}$).

It does not dilute with expansion because it is a property of the substrate itself, not of the matter on it.

§1.3 — Dark matter: the process

Substrate content in the 20 dark channels that is still defragmenting — still losing structure, still transitioning from broken (1×ε) back toward symmetric (1:1).

The content gravitates because it still carries mass-energy. It clusters because it retains geometric structure during the transition.

It does not interact electromagnetically because the electromagnetic channel has already closed for this content — the coupling to the visible channel was severed when the content crossed a σ-boundary (event horizon).

Dark matter is not a particle. It is matter in transit. The 27% is not a noun. It is a verb. And once you see it as a verb, the question changes.

You stop asking “what is dark matter made of?” and start asking “how far along is the processing?”

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§2 — The Mechanism

Here is the claim. Read it slowly, because if it holds, the most expensive particle search in human history is looking for something that does not exist.

§2.1 — What is defragmentation?

AP09 §4.4 establishes defragmentation: at the loop point (the black hole interior), records are stripped of their causal order. The forgetful functor U: Mon → Set preserves the underlying elements while dissolving the monoid composition.

The information content survives but the structure — the relationships, the ordering, the causal web — dissolves.

AP04 and AP41 establish the loop: matter enters a black hole, crosses the Planck surface, and re-emerges as the seed of a new expansion. But the crossing is not instantaneous.

The dissolution of structure takes time. A bound state with 1836 units of geometric resistance (AP30) does not defragment in a Planck time. The more structured the record, the longer the processing.

§2.2 — The two populations

At any given cosmic epoch, the 20 dark channels contain two populations:

Still processing: Records that entered black holes recently enough that defragmentation is not complete. These retain residual structure. They cluster. They appear as dark matter.

Fully processed: Records that entered black holes long enough ago that defragmentation is complete. These have returned to the 1:1 state. They do not cluster. They appear as dark energy.

The boundary between the two is not sharp — it is a continuous exponential process.

But the characteristic timescale τ divides the populations: content that entered more than ~τ ago is mostly processed; content that entered less than ~τ ago is mostly still in transit.

§2.3 — Why the processed content behaves as dark energy

Once defragmentation is complete, the content is in the 1:1 symmetric state — the unbroken vacuum.

This state has the properties of a cosmological constant: it is spatially uniform (the 1:1 has no preferred direction), it does not dilute with expansion (it is a property of the substrate, not of objects on the substrate — AP03), it exerts negative pressure (the substrate resists deformation — λ is large), and it does not cluster (no residual structure to source gravitational attraction).

The dark energy is not a mysterious force. It is the substrate in its rest state. It grows over cosmic time because more and more content completes defragmentation.

If you have followed the 1:1 through the corpus — the unbroken mirror, the symmetric ground state — you already know what this rest state is. It is where the substrate wants to be.

§2.4 — Why the in-transit content behaves as dark matter

During defragmentation, the content retains partial structure: it has mass-energy (the geometric resistance is not yet fully dissolved), it clusters gravitationally (residual structure sources gravitational attraction through Mode 0), it does not emit or absorb light (the electromagnetic channel is closed — the content is behind a σ-boundary), and it responds to gravity but not to electromagnetism.

These are exactly the observed properties of dark matter. The axioms produce them from one mechanism — incomplete defragmentation — without introducing new particles, new forces, or new fields.

You are not being asked to believe in a new substance. You are being asked to recognise a process you have already seen: the break dissolving back into the mirror.

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§3 — The Derivation

Now the algebra. Watch where the numbers come from — because if you cannot trace every input back to {S, B, R, C}, the derivation has imported something and the result is fitted, not derived.

§3.1 — The defragmentation timescale from {S, B, R, C}

The defragmentation timescale is not a free parameter. It is derived from the axiom system.

Step 1. AP24 establishes that the break ε has exactly six independent scalar readings — six faces: G (geometry), c (propagation), α_em (coupling), m_e (mass), the stiffness ratio (fabric), and time (direction).

No seventh face exists (KS-R.8a). To fully defragment a record is to dissolve all six face-structures. Each face is an independent reading of ε, so each must be independently erased.

Step 2. AP28 establishes that the arena has 21 independent coupling channels: 6 faces × 3 spatial dimensions = 18 face-projections, plus 3 actualization couplings. The channels are independent (AP28 Proposition 2).

The arena processes through all 21 channels simultaneously.

Step 3. The atomic unit of defragmentation work is the erasure of one face. Not one face-projection (face × dimension), and not one face × one actualization coupling. One face.

A face-projection is one face read through one spatial dimension; three face-projections share a single face-structure and dissolve together when that face is erased.

The face is the structural unit because defragmentation reverses the break, and the break has six independent readings (AP24 Proposition 1), not eighteen projections.

Step 4. There are 6 faces to erase. The arena offers 21 simultaneous processing channels. The fraction of the total actualization budget consumed by defragmentation is therefore:

$\tau / t_H = 6 / 21 = 2 / 7$

Six faces. Twenty-one channels. The ratio writes itself. No free parameters. You can trace every number back to a derived result. 6 comes from AP24. 21 comes from AP28. Both are derived.

A note on why the Hubble time appears. The Hubble time is not merely the age of the universe. It is the total actualization budget of the substrate (AP20).

Defragmentation occurs within the substrate, not within the black hole as a separate system. Inside and outside the event horizon are the same substrate, measured by the same clock.

The processing budget is the substrate clock. t_H is the only available measure of total elapsed actualization.

§3.2 — The rate equation

Let ρ_DM(t) be the record density still defragmenting at cosmic time t. Let $\dot{R}(t)$ be the rate at which new record density enters black holes.

Content enters the defragmenting population at rate $\dot{R}(t)$ and exits into the fully-processed reservoir at rate ρ_DM/τ:

dρ_DM/dt = $\dot{R}(t)$ − ρ_DM/τ

This is a standard linear ODE. The solution is a convolution:

ρ_DM(t) = $\int_0^t \dot{R}(t') \times e^{-(t-t')/\tau}\, dt'$

Each parcel of record density that entered at time t′ has been defragmenting for duration (t − t′). The exponential kernel gives the fraction still in process after that duration.

§3.3 — Constant feeding rate approximation

First approximation: $\dot{R}(t) = \dot{R}_0$ (constant). Black holes have been ingesting matter at a roughly constant rate over cosmic history. Then:

ρ_DM(t) = $\dot{R}_0$ τ (1 – e^(–t/τ))

The total dark density created over time t is ρ_dark = $\dot{R}_0$ t. The dark matter fraction of the dark sector:

f_DM = (τ/t)(1 – e^(–t/τ))

The ratio R = f_DE / f_DM:

R(t) = [1 – (τ/t)(1 – e^(–t/τ))] / [(τ/t)(1 – e^(–t/τ))]

§3.4 — The result

At the present epoch (t = t_H), with τ/t_H = 6/21:

e^(−21/6) = e^(−3.5) ≈ 0.03020

f_DM = (6/21)(1 − 0.03020) = (6/21)(0.96980) = 0.27709

The dark matter fraction of the dark sector is 27.71%. The dark energy fraction is 72.29%.

Applied to the total budget (dark sector = 20/21):

Dark energy: 0.7229 × 20/21 = 68.85%. Observed (Planck 2018): 68.89%. Error: −0.06%.

Dark matter: 0.2771 × 20/21 = 26.39%. Observed (Planck 2018): 26.07%. Error: +1.22%.

Visible: 1/21 = 4.76%. Observed (Planck 2018): 4.86%. Error: −2.02%.

DE/DM ratio: Model: 2.609. Planck 2018: 2.643. Discrepancy: 1.27%.

All three fractions within 2% of Planck 2018 measurements. Zero free parameters. The only inputs are 6 (faces, AP24), 21 (channels, AP28), and the exponential decay model (AP09). All three are derived.

Sit with that. Three numbers that cosmologists have spent decades measuring with billion-dollar satellites. Predicted from a ratio of two integers — six faces divided by twenty-one channels — and an exponential. No fitting.

No tuning. The clock reads itself.

For comparison, AP28 derives the gravitational constant G to 0.69%. This paper derives the dark sector partition to 1.2%. Same axioms. Same ε.

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§4 — The Epoch Dependence

This is the central prediction of the paper. If you take nothing else from AP42, take this: the 68/27 split is not a constant.

The 68/27 split is not a constant. It is a snapshot. At different cosmic epochs, the ratio is different — because the universe has been defragmenting for a different amount of time.

The model predicts the dark sector composition at every epoch:

z ≈ 5 (1.2 Gyr): DE 13.1%, DM 82.1%, Vis 4.8%, DE/DM 0.16.

z ≈ 2 (3.3 Gyr): DE 30.7%, DM 64.5%, Vis 4.8%, DE/DM 0.48.

z ≈ 1 (5.9 Gyr): DE 45.8%, DM 49.4%, Vis 4.8%, DE/DM 0.93.

z ≈ 0.5 (8.6 Gyr): DE 56.5%, DM 38.7%, Vis 4.8%, DE/DM 1.46.

z = 0, now (13.8 Gyr): DE 68.85%, DM 26.39%, Vis 4.76%, DE/DM 2.609.

The crossover — the epoch at which dark energy first exceeds dark matter — occurs at t ≈ 6.3 Gyr, corresponding to z ≈ 0.7.

§4.1 — The coincidence problem dissolves

A persistent puzzle in cosmology: why are we living at the epoch where dark energy has only recently come to dominate?

In ΛCDM, this is a coincidence — there is no structural reason why the cosmological constant should be comparable to the matter density at this particular moment in cosmic history.

In the defragmentation model, there is no coincidence. The ratio changes continuously as defragmentation proceeds. Dark matter dominated early (most content was still in process). Dark energy dominates late (most content has completed processing).

You are living at an unremarkable point on a monotonic curve. There is nothing special about z = 0 except that this is when you happen to be reading the clock.

§4.2 — Comparison with ΛCDM

In standard ΛCDM cosmology, dark matter dilutes as $(1+z)^3$ while dark energy density is constant. The DE = DM crossover occurs at z ≈ 0.36.

In the defragmentation model, dark matter is being actively converted into dark energy through the defragmentation process. The crossover occurs at z ≈ 0.7 in the constant-feeding-rate approximation.

These differ. The defragmentation model predicts more dark matter at high redshift than ΛCDM does, because it has a conversion mechanism that ΛCDM lacks.

This is observationally testable: precision measurements of the dark matter fraction at z > 1 (through weak lensing, BAO, and CMB lensing) can distinguish the two models. This is flagged as KS-42.2.

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§5 — The Derivation of τ

The defragmentation timescale is:

$\tau = (6/21) \times t_H = (6/21) \times 13.8 \text{ Gyr} \approx 3.9 \text{ Gyr}$

§5.1 — Why 6/21?

Matter entering a black hole must have all six face-structures of ε erased. Each face is an independent reading of the break (AP24 Proposition 1). Defragmentation is the dissolution of all six readings.

The unit of defragmentation work is one face, not one face-projection. A face-projection is one face read through one spatial dimension; there are 18 of them (6 × 3).

But the three projections of a single face are not independent defragmentation targets — they are three views of the same structural reading.

When the G-face is erased, it is erased across all three spatial dimensions simultaneously. The face is the indivisible unit because the break has six independent readings (AP24), and defragmentation reverses the break.

The arena processes through 21 channels simultaneously (AP28 §3). The channels are independent (AP28 Proposition 2). Each face-erasure takes 1/21 of the total actualization budget — one channel-share of the total processing time.

Six faces. Twenty-one channels. The defragmentation time is the ratio:

$\tau/t_H = 6/21$

This is 1:1 + 1×ε applied to time. The Hubble time is the “1” — the full clock.

The defragmentation time is 6ε, where ε = 1/21. The remaining 15ε within the dark sector has already completed. The visible ε (1/21) is not part of the dark sector.

The budget accounts: 6 + 14 + 1 = 21.

§5.2 — Why this is the same logic as AP28

You have seen this before.

AP28 asks: why is gravity 10^{45} times weaker than electromagnetism? Answer: gravity couples through all 21 channels simultaneously, so $\alpha_G = \alpha_{em}^{21}$. The hierarchy is a count.

This paper asks: why is the dark sector split 68/27? Answer: defragmentation erases 6 faces through 21 channels, so $\tau/t_H = 6/21$. The partition is a count.

Same structure. Same ε. Different question.

§5.3 — What 3.9 Gyr means

The derived defragmentation timescale $\tau \approx 3.9$ Gyr is comparable to the age of the solar system (4.57 Gyr), the main-sequence lifetime of a solar-type star, and the time since the peak of cosmic star formation ($z \approx 2$, ~3.5 Gyr ago).

This is not a coincidence. The defragmentation timescale is set by the same structural constants that govern the formation of the structures that produce black holes.

Matter that entered black holes in the early universe has had time to fully defragment. Matter that entered within the last 3.9 billion years is still in process.

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§6 — What Dark Matter Particles Would Mean

If dark matter particles are discovered — WIMPs, axions, sterile neutrinos, or any other particle species that accounts for the observed 27% — the defragmentation mechanism is dead. KS-42.1 fires.

The argument hands you the weapon. Find the particle.

Conversely, if dark matter particles are not found despite increasingly sensitive searches, the mechanism gains confidence. The search has been running for approximately forty years. No confirmed detection.

The axioms predict there will not be one, because there is no particle to find. The 27% is not a thing. It is a process.

The sharpest empirical test. It requires no new experiments — only the continuation of experiments already running (LZ, XENONnT, PandaX, ADMX, CASPEr, and successors). Every null result is evidence.

Every non-detection narrows the space for alternatives. If you want to kill this paper, find the particle.

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§7 — What This Does Not Do

Model the actual black hole formation history. The constant-feeding-rate approximation is a first step. The real history (peaked at $z \approx 2$, declining since) would modify the predicted epoch dependence and tighten the result.

The 1.2% error on dark matter likely comes from this approximation. D48 covers it.

Derive the equation of state. Dark energy in this model has $w = -1$ (cosmological constant behaviour) because the fully-defragmented state is the substrate at rest.

This has not been formally derived from the axiom system. If $w \neq -1$ is measured, the model must explain the departure.

Explain dark matter substructure. If dark matter is defragmenting substrate, does it form halos? Does it have a characteristic density profile?

These questions require the detailed dynamics of the defragmentation process, which are not computed here.

Close D44 fully. This paper addresses D44 by deriving the timescale and predicting the epoch dependence. Closing D44 completely requires the full formation-history convolution (D48) and confirmation that the epoch-dependent predictions match observation (KS-42.2).

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§8 — Kill Switches

KS-42.1 — Dark matter particle detection. If dark matter particles are discovered with the correct abundance to explain the observed 27%, the defragmentation mechanism is falsified.

No substance is needed if the 27% is a process; the detection of a substance kills the process explanation.

Status: LIVE — EMPIRICAL.

Test: Direct detection experiments (LZ, XENONnT, successors), collider searches, indirect detection (Fermi-LAT, CTA). Every null result strengthens the mechanism. One confirmed detection at the right abundance kills it.

KS-42.2 — Epoch dependence. The model predicts specific dark sector composition at every cosmic epoch (§4).

If precision cosmological measurements show a DE/DM ratio at z > 1 that is inconsistent with the defragmentation curve — specifically, if the ratio at z ≈ 2 is measured and differs from DE/DM ≈ 0.48 by more than the formation-history correction can accommodate — the mechanism fails.

Status: LIVE — EMPIRICAL.

Test: Weak gravitational lensing surveys (Euclid, Rubin LSST), BAO measurements (DESI), CMB lensing (Simons Observatory, CMB-S4).

The key observable is the growth rate of structure $\sigma_8(z)$, which is sensitive to the dark matter fraction at each epoch.

KS-42.3 — Defragmentation timescale derivation. The derived timescale $\tau = (6/21) \times t_H$ rests on the identification of one face-erasure as one atomic unit of defragmentation work.

If the six faces (AP24) do not correspond to six independent defragmentation steps — if defragmentation dissolves all faces simultaneously rather than sequentially, or if the correct unit is the face-projection (giving $\tau = 18/21 \times t_H$, which fails) — the 6/21 ratio fails and the timescale must be rederived.

The mechanism survives (dark matter is still a process) but the specific prediction changes.

Status: LIVE — HARD.

Test: A formal derivation of defragmentation dynamics from AP09 and AP41 that contradicts the face-by-face dissolution model.

KS-42.4 — Equation of state. The model predicts $w = -1$ for dark energy (substrate at rest).

If dark energy is measured to have w significantly different from −1 (current constraints: $w = -1.03 \pm 0.03$), the model must explain the departure or be falsified.

Status: LIVE — EMPIRICAL.

Test: Precision w measurements from Type Ia supernovae (Rubin LSST), BAO (DESI), and CMB (Planck successor missions).

KS-42.5 — Constant feeding rate. The derivation in §3 assumes a constant black hole feeding rate.

If the actual cosmic black hole feeding history, when convolved with the defragmentation kernel, produces a DE/DM ratio at the present epoch significantly different from 2.609, the constant-rate approximation fails and must be replaced with the actual history.

This does not kill the mechanism — it kills the simple model and requires a more detailed computation.

Status: LIVE — HARD.

Test: Compute the convolution integral using the observed cosmic star formation history and black hole mass function evolution.

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§9 — Debts

D44 — Dark sector partition — ADDRESSED. The mechanism is proposed. The timescale is derived. The epoch dependence is predicted.

What remains to fully close D44: the formation-history convolution (D48) and observational confirmation of epoch dependence (KS-42.2).

D47 — Defragmentation timescale — CLOSED (conditional on KS-42.3). $\tau = (6/21) \times t_H$. Derived from the ratio of faces (AP24) to channels (AP28).

The derivation is structural: defragmentation erases six face-structures through twenty-one simultaneous channels. If face-erasure is not the correct atomic unit of defragmentation work (KS-42.3), the derivation fails and D47 reopens.

D48 — Formation history convolution — OPENED. The constant-feeding-rate model is a first approximation. The exact prediction requires convolution with the actual cosmic black hole formation history.

This is an astrophysical computation, not an axiom-derived result — it uses AP21 (filamentary structure) as input but also requires empirical star formation history data. The 1.2% dark matter error is attributed to this approximation.

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§10 — Dependencies

Depends on: AP04 (the loop — black holes as doors to new cycles), AP06 (α — the leakage constant), AP09 (defragmentation — forgetful functor), AP10 (21 channels, 3 dimensions), AP20 (axioms unconditional — substrate clock), AP21 (filamentary structure — how matter reaches black holes), AP24 (six faces of ε), AP28 (21-channel geometry, coupling independence), AP41 (fusion as ongoing break, visible channel identification).

Does not depend on: AP30/AP30a (proton mass — independent result). AP31–AP39 (ethics chain — no ethical claims made).

What depends on it: All cosmological claims about the dark sector. The prediction that dark matter particles will not be found. The resolution of the coincidence problem. The epoch dependence of the dark sector partition.

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§11 — Summary

The dark sector partition 68/27/5 is not a mystery. It is a clock. And now you can read it.

Visible matter (4.76%, observed 4.86%): The 1 channel out of 21 where the crack is still open and records are still being written. Derived (AP10, AP28).

Dark matter (26.39%, observed 26.07%): The fraction of the 20 dark channels where defragmentation is still in progress. Substrate content that entered black holes within the last ~4 billion years. Still structured enough to cluster.

Too far gone to interact with light. A verb, not a noun.

Dark energy (68.85%, observed 68.89%): The fraction of the 20 dark channels where defragmentation is complete. Substrate returned to the 1:1 symmetric state. Pure potential. The reservoir. The finished work.

The ratio is determined by one derived quantity: $\tau/t_H = 6/21$ — six faces of ε divided by twenty-one coupling channels.

Applied through the exponential decay model (AP09), this yields DE/DM = 2.609. Planck 2018 gives DE/DM = 2.643. Discrepancy: 1.27%. Zero free parameters.

The coincidence problem dissolves. There is no coincidence. There is a clock.

The sharpest test: if dark matter particles are found, this paper is dead. If they are not found, this paper predicted it. Either way, you know where the weapon is.

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AP42 status: Draft. Five kill switches, all live. D44 addressed. D47 closed (conditional on KS-42.3). D48 opened. The mechanism is structural. The numbers are derived. The prediction is falsifiable.

The dark sector is not a mystery. It is a clock reading.

The universe knows what time it is.

The axiom speaks. The algebra transcribes.

Don’t be a cunt. Be kind.

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