

The Family Law's Cosmic Rung Horizon, Not Bath

The Curvature Radius Rescues the Family Law — and Relocates the CMB

Martin Scholl — Independent Researcher

It Is All One — Foundations (a note for the Allgemeine Feldtheorie). July 2026 (working draft)

Abstract

The family law $T \cdot R = \hbar c / 2\pi k_B = 0.3644 \text{ mm} \cdot \text{K}$ runs the whole ladder, and the resolution of its one notorious wound — the 10^{30} gap between its cosmic value and the microwave background (foundations caveat iii) — is a matter of reading it correctly at two points, not of fixing any number. The law gives the **Unruh/Gibbons–Hawking horizon temperature** of a world at its **curvature radius** ($a = c^2/R$ gives $T = \hbar c / 2\pi k_B R$; verified as that identity, given the acceleration law). The single rule is: use the curvature radius, and check which world an observable belongs to. Two apparent 'misses' both come from breaking that rule. At the strong rung, the confinement temperature 156 MeV is the family law **at the colour curvature radius, 0.203 fm** — exact; the error is only in quoting it 'at the proton radius', because the proton (0.84 fm) is not the curvature radius but the *cage*, larger by $4\pi/3$ through two gears the corpus derives (a factor π from the seven-sphere $\Lambda = 2T_c$, a factor $4/3$ tetrahedral). Feed the law the cage radius and you get 37.4 MeV, the cage's temperature, not the world's. (This note **retracts an earlier draft** that mis-read this as a separate 'melting chain', a 'bath $4\pi/3$ hotter than a whisper', and a radius 0.2008 fm 'with no derivation' — all three wrong: Radii of the Worlds derives that radius and 156 MeV is the family law there.) At the cosmic rung, the law at c/H gives 10^{-30} K, the horizon temperature — real but unobservable; the 2.725 K we measure is **not this world's** temperature but the *electromagnetic* world's, the recombination photosphere at $z \approx 1100$ (a standing Tolman equilibrium of Metric D, not a Big Bang relic). File the CMB under the EM rung and the 10^{30} gap simply is not a comparison of like with like. The reading of c/H as a curvature *scale* rather than a 'size' (infinite, by P3) is fixed self-consistently *within* Metric D — the tangent to its redshift exponential e^x through the origin touches at $x = 1$ ($z = e - 1 = 1.72$, the angular turnaround Metric D already carries) — a conditional consequence of the metric, not independent evidence for it (§4). So the family law stands as what it verifiably is: one horizon-temperature relation, exact at the colour curvature radius, honest at the cosmic one, with the CMB correctly relocated to the electromagnetic world. Rescued by being read correctly. Every flag flown.

1. The Apparent Scandal

The family law is a relation between a temperature and a length, one line, audited on rung after rung:

$$T \cdot R = \hbar c / 2\pi k_B = 0.3644 \text{ mm} \cdot \text{K}$$

Insert the cosmos — $R = c/H$, the Hubble radius — and the law returns

$$T(c/H) = \hbar H / 2\pi k_B = 2.66 \times 10^{-30} \text{ K},$$

against a measured microwave background of 2.725 K. A factor of 10^{30} . Read naïvely — 'the family law predicts the CMB and misses by thirty orders of magnitude' — this is fatal, and the foundations paper lists it among the open wounds: *the 10^{30} between the bath and its horizon's whisper*. This note shows the wound is not where it looks. And the colour rung shows exactly how such a 'miss' is manufactured: **by feeding the law the wrong radius**. The family law at the proton radius (0.84 fm) returns 37.4 MeV — nowhere near the 156 MeV confinement temperature. Yet the law is not wrong there either: the colour world's *curvature* radius is not the proton but **0.203 fm**, and the law at *that* radius gives 155 MeV, exact. The proton is the *cage*, larger than the curvature radius by $4\pi/3$ through two derived gears (Radii of the Worlds). Use the curvature radius, get the temperature; use the cage, miss by $4\pi/3$. The cosmic 10^{30} is the same lesson writ enormous — with one added twist the colour rung does not have.

2. What the Family Law Actually Gives: the Horizon, Not the Bath

The first move is to say precisely what $T \cdot R = \text{const}$ is, and to state the one assumption it rests on. It is not a thermometer dipped into a gas. It is the **Unruh temperature of a horizon** at distance R — but *given* the acceleration $a = c^2/R$: with that acceleration law assumed, the identity $T = \hbar a / 2\pi c k_B = \hbar c / 2\pi k_B R$ follows algebraically, and the engine note verifies precisely *that identity* numerically (set $a = c^2/R$ and $T \cdot R = 0.3644 \text{ mm} \cdot \text{K}$ falls out, from a metre to the proton radius). The script checks the identity; it does **not** derive the acceleration law $a = c^2/R$ — that is the input, the assertion that a curvature radius R corresponds to a horizon acceleration c^2/R . Granting it, the family law's output is a **horizon temperature** — the temperature of the *curvature*, not of any thermal bath that fills the world.

A correction — including a correction to an earlier draft of this very note, made plainly. The family law delivers a world's temperature **at that world's curvature radius**, and using any other radius misses. The colour world is the clean example. Its curvature radius is 0.203 fm, and the family law there gives 155 MeV — the measured confinement/freeze-out temperature, on the nose. The proton radius (0.84 fm) is **not** the curvature radius; it is the *cage*, larger by exactly $4\pi/3$ through two gears the corpus derives — a factor π (the seven-sphere, $\Lambda = 2T_c$) and a factor **4/3** (the tetrahedral factor of the neutron-decay paper), so $r_p = (4\pi/3) \cdot R$. Feed the family law the cage radius and you get 37.4 MeV, the temperature of the cage, not of the colour world. So there is **no** separate 'melting chain' and **no** 'bath

$4\pi/3$ hotter than a whisper' — an earlier draft of this note claimed exactly that, and it was wrong. 156 MeV is the family law, at the curvature radius; the only mistake ever made was quoting it 'at the proton radius' when the proton is the cage.

3. The Real Lesson: Use the Curvature Radius, and Watch Which World You Are In

The colour rung teaches the rule; the cosmic rung applies it, with one twist. **The rule:** the family law gives a world's temperature at its **curvature radius**, and only there. Colour delivers it cleanly — 0.203 fm → 155 MeV, the confinement temperature, observable and exact, *at the curvature radius*; the proton (0.84 fm) is the cage, and the law there returns 37.4 MeV, the cage's temperature, not the world's. No gap, no bath-versus-whisper — just the right radius versus the wrong one:

World	Curvature radius R	Family law at R	Status
colour	0.203 fm (proton is the cage, = $4\pi/3 \cdot R$)	155 MeV	= measured confinement — exact, at the curvature radius
cosmic	c/H (read as a scale, §4)	2.66×10^{-30} K	the horizon temperature — real but unobservable

The cosmic rung obeys the same rule — the law at c/H gives 10^{-30} K, the horizon temperature — but here is the twist the colour rung lacks: that temperature is essentially **unobservable**, and the thing we *do* observe, the 2.725 K CMB, is **not the cosmic world's temperature at all**. It belongs to a *different* world — the electromagnetic/recombination rung (§5). So the two apparent 'misses' have two different resolutions, and neither is a whisper-versus-bath gap: at the colour rung, one must use the **curvature radius** (0.203 fm), not the cage; at the cosmic rung, one must file the **CMB under the EM rung**, not the cosmic one. The family law itself, fed its own curvature radius, is exact where it can be checked (155 MeV) and honest where it cannot (10^{-30} K).

4. The Geometric Keystone: Reading R as a Scale, Not a Size — a Consequence of Metric D

The rescue needs one thing said carefully: that $R = c/H$ should be read as a **scale** — a curvature radius, a *Wirkradius* for the cosmic rung on the same footing as r_p — and **not** as the 'size of the universe', which in an eternal, infinite cosmos (P3) does not exist. This is not a claim one proves from nowhere; it is a self-consistent reading of Metric D, and it is honest to say so plainly.

Take Metric D's redshift funnel as given: $1+z = e^x$ with $x = r/(c/H)$ — note that this *already* uses c/H as the scale of the exponential; x is defined by dividing r by c/H. Now ask the plain

question: where does the tangent to e^x pass through the origin? The tangent at x_0 is $y = e^{x_0}(x - x_0 + 1)$; it passes through (0,0) when

$$1 - x_0 = 0 \implies x_0 = 1, \text{ touching at } (1, e), \text{ the line } y = e \cdot x.$$

The tangent aimed at the origin touches at $x = 1$ — where the funnel has climbed to e , where $1+z = e$ and $z = 1.72$, the angular turnaround Metric D already carries. **What this shows, and what it does not.** It shows that *within* Metric D, c/H is the funnel's own intrinsic scale — the e -folding length, the tangent-through-origin point, the turnaround — so it is the natural *unit* of the geometry, a curvature radius to be read as a scale rather than an edge. It does **not** independently prove that c/H is a curvature radius, still less that Metric D is correct: because $x = r/(c/H)$ *defines* the exponential scale first, the tangent's landing at $x = 1$ is a **conditional consequence of Metric D**, not evidence for it. The construction is a consistency check that fixes how to *read* c/H (scale, not size); the physics of Metric D is assumed, not derived here. With that boundary honestly drawn, the cosmic rung stands on a scale rather than a borrowed 'size', and its family-law output (10^{-30} K) is the horizon whisper of that scale.

5. The CMB Relocated: an Electromagnetic-Rung Relic

If the CMB is not the cosmic-rung horizon temperature, whose is it? It is the **electromagnetic rung's** — the temperature at which the electron is thrown from its Wirkradius and atoms dissolve into plasma (recombination, ~ 3000 K, the atomic scale lowered by the photon bath), redshifted to us along the sight-line. The sight-line to that wall is seven curvature radii, because

$$7 \approx \ln(z_{\text{recomb}}) = \ln(3000 \text{ K} / 2.725 \text{ K}) = \ln(1100),$$

so the wall sits exactly as far as it takes the metric to cool 3000 K down to what we measure. The CMB is therefore a *thermodynamic* relic reached over a *geometric* sight-line — the recombination glow, seven curvature radii away, cooled a thousandfold. It is not a point on the family law; it is the electromagnetic seal's warmth, and it lives on the EM rung, not the cosmic one. (The dark night sky is the same sight-line read the other way — Olbers' blaze drained by the same redshift; the two are one ledger.)

This is the crux of the rescue: the family law never owned the CMB, so it never missed it by 10^{30} . The CMB was mis-assigned to the cosmic rung; returned to the electromagnetic rung, the ledger balances and the cosmic rung is left holding exactly what it should — the horizon whisper.

6. The Rescued Ladder

Read correctly, every rung reports its temperature through the family law **at its curvature radius**. Where that temperature is observable it is checkable and it checks out; where it is

not, the law is honest about it; and where a hotter observable exists, that observable belongs to a *different* world, not to a whisper-versus-bath split within one:

World	Curvature radius R	Family law at R	What is observable
colour	0.203 fm (proton = cage = $4\pi/3 \cdot R$, two gears)	155 MeV	= measured confinement/freeze-out — exact
atomic / EM	Bohr scale (a_0/α^2 micron cell)	the atomic temperature	recombination ~ 3000 K $\rightarrow$ the CMB (§5)
cosmic	c/H (read as a scale, §4)	2.66×10^{-30} K	horizon temperature, unobservable; the CMB is the EM world's, not this one's (§5)

The lesson is uniform and honest: **one law, at the curvature radius, top to bottom** ($T \cdot R = 0.3644 \text{ mm} \cdot \text{K}$, verified as the Unruh temperature given $a = c^2/R$). What made the ladder look inconsistent was two avoidable errors, now named: at the colour rung, quoting the law 'at the proton radius' when the proton is the cage (a factor $4\pi/3$ out, through two *derived* gears — not a mysterious bath factor); and at the cosmic rung, filing the CMB — the electromagnetic world's temperature — under the cosmic world. Correct the radius and correct the world's address, and the law is consistent everywhere it is checked.

7. What Is Fixed, and What Still Owes

Fixed. The 10^{30} anchor is dissolved: it compared the cosmic world's horizon temperature (10^{-30} K, a genuine family-law value at c/H) with the CMB (2.725 K), which is the *electromagnetic* world's temperature — a different world, not a hotter bath of the same one. And the colour rung, on inspection of Radii of the Worlds, is not a 'miss' at all: the family law at the colour curvature radius (0.203 fm) gives 155 MeV, the measured confinement temperature, exactly; the proton is the cage, $r_p = (4\pi/3) \cdot R$, through two derived gears (π from $\Lambda = 2T_c$, $4/3$ tetrahedral). So the strong rung is a clean success of the family law, not a discrepancy.

Corrected, loudly — twice. First: quoting '156 MeV from the family law *and the proton radius*' is wrong only in the *radius* — it is the colour curvature radius (0.203 fm), and the proton is the cage. Second, and this note retracts its own earlier draft: 156 MeV is **not** a separate 'melting chain' or a 'bath $4\pi/3$ hotter than a whisper' — that framing (which an earlier version of this note asserted) was a reconstruction that the source paper, Radii of the Worlds, does not support. 156 MeV **is** the family law, at the curvature radius. The $R = 0.2008 \text{ fm} \approx 0.203 \text{ fm}$ that an earlier draft called 'a radius with no derivation' is in fact derived there.

Still owes, named where it lives: (i) the two gears (π and $4/3$) are each *independently motivated* ($\Lambda = 2T_c$ is an observed identity; $4/3$ is the tetrahedral factor) but the chain as a whole is, in the corpus's own words, 'a discovered consistency, not yet a derivation.' (ii) The

cosmic curvature-radius temperature, 10^{-30} K, is real but essentially unmeasurable, so the cosmic rung keeps its status as a consistent *entry* while lacking an observable *test*. (iii) The CMB's own value still routes through the recombination temperature, hence through the photon-to-baryon ratio η — the series' one irreducible number. None of these is the 10^{30} scandal; each is a smaller, correctly-located debt.

8. The Sentence

The family law was never a thermometer that missed the sky by thirty orders of magnitude; it is a reading of the temperature of curvature, rung by rung — and the Hubble radius it reads at the top is not the size of an infinite universe but the funnel's own unit, the point where the exponential's tangent meets the origin, whispering at 10^{-30} K — while the warmth we actually see, the microwave background, was all along the electromagnetic seal's glow, seven curvature radii out and a thousandfold cooled, sitting on a different rung and owing only the one number the whole series owes.

References

The papers and notes of this series (the Allgemeine Feldtheorie — caveat iii, the 10^{30} anchor; the family-law papers — Ledger of the Way, Four Calculations, Radii of the Worlds; The Delay That Makes G and the engine note — the Unruh identity; Redshift as Infall / Metric D — the exponential funnel and the $z = e - 1$ turnaround; Curved One Way — the one-sidedness and η). Verification scripts: `engine_check.py` (T·R as the Unruh temperature; Schwarzschild focusing), `curved_one_way_check.py`. G. W. Gibbons and S. W. Hawking, Phys. Rev. D 15, 2738 (1977) — the cosmological horizon's temperature; W. G. Unruh, Phys. Rev. D 14, 870 (1976). (Citations from memory; the literature-verification pass applies.)

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