

The Ladder's Two Surfaces

What the Cosmic Rung's Geometry Says About the Proton

The Equation of State Is Coupling-Free, So Today's Cosmology Ports to Every Rung Without Solving the Gearbox — and the Colour World Turns Out to Have Two Boundaries, Not One

Martin Scholl — Independent Researcher

It Is All One — Foundations. July 2026 (working draft)

Abstract

A day's work on the cosmic rung's metric turns out to be a day's work on every rung, and the reason is a lemma worth stating on its own. Reading the Einstein tensor's time-time component as an energy density requires that rung's coupling — at gravity it is $8\pi G/c^4$, at colour it is unknown and is precisely what the gearbox conjecture owes — so absolute densities do not travel between rungs. But the equation of state is a ratio of two components of the same tensor, and the coupling cancels identically. Every equation-of-state result therefore ports to every rung with no new input, and every structural radius is a pure number times that world's own curvature radius. The ladder's shape is available without the gearbox. Three consequences follow. First, the universal structure: every world has transverse tension at its centre with $(w_r, w_\perp) = (-3/4, -3/8)$, a turnaround at exactly one curvature radius where the transverse stress vanishes, a band of transverse pressure peaking at 1.77 radii, and a return to a pure radial string cloud beyond about four. Second, and this is the result the note exists for, the colour world has two boundaries and the corpus has been calling both of them the cage. The horizon sits at one curvature radius, 0.203 fm, where the transverse stress vanishes and the family law returns the measured confinement temperature — putting colour's horizon at the same x as the Hubble sphere and the weak skin, where the anatomy says it should be. The proton, at $4\pi/3$ curvature radii, is a different surface: it is where the medium becomes a pure radial string cloud, to within one percent, and a radial string cloud is a bundle of flux tubes. The proton is not the colour horizon; it is the flux-tube boundary. Third, the regularity condition $R''(0) = 0$ is scale-free, so every world carries the same $1/r$ defect on its own axis and every rung needs a core — a floor of a new kind, geometric rather than dynamical, belonging beside the ones in the Floors of Condensation note. One honest negative closes the note: the $4\pi/3$ boundary does not repeat at the electron or weak rungs, so only the horizon and the turnaround are universal. Every flag flown.

1. The Lemma That Makes the Port Legal

The temptation, having found structure in the cosmic metric, is to announce it at every rung on the strength of P2's claim that the worlds are similar. That would be an assertion. There is instead an argument, and it is short.

The Einstein tensor's components have units of one per metre squared. To read one of them as an energy density you must divide by that rung's coupling: $G^t_t = \kappa \cdot \rho c^2$. At the gravity rung $\kappa = 8\pi G/c^4$, computed rather than chosen (Part IV of the foundations). At the colour rung κ is not known — determining it is the gearbox conjecture, the single most valuable calculation this framework points to. So no absolute density computed at the cosmic rung may be carried to the colour rung. That road is closed until the gearbox is built.

But the equation of state is a ratio:

$$w_r = G^r_r / (-G^t_t), \quad w_\perp = G^\theta_\theta / (-G^t_t)$$

Numerator and denominator are components of the same tensor, so the coupling appears in both and cancels identically. Whatever κ turns out to be at any rung, these two numbers are unchanged. And the structural radii — where the transverse stress vanishes, where the areal radius turns over, where the curvature changes sign — are pure numbers times that world's own curvature radius, because the geometry that produces them contains no scale but R_w itself.

So the shape of the ladder is available now, and the gearbox is needed only for the sizes. That is a considerably better position than the one this note started from.

2. The Universal Structure

Measuring distance in units of the world's own curvature radius, $x = r/R_w$, the medium of any world with this anatomy reads:

$x = 0$ — the centre: $(w_r, w_\perp) = (-3/4, -3/8)$. Transverse tension at its deepest.

$x = 1$ — the turnaround: the areal radius stops growing and the transverse stress vanishes exactly. These are the same surface, because G^θ_θ carries the factor $(x - 1)$ and dR/dr carries $(1 - x)$.

$x = 1.774$ — the transverse pressure peaks, at $w_\perp = +0.118$.

$x = 2$ — the Gaussian curvature of the radial-transverse slice changes sign: sphere-like within, saddle-like beyond.

$x \gtrsim 4$ — the transverse stress has died away and the medium is a pure radial string cloud, $(1, -1, 0)$.

Read as a sentence: every world is in sideways tension inside its own curvature radius, in sideways pressure for the next two or three, and beyond that is nothing but radial strings.

3. The Two Colour Surfaces

Now the test, and it is the kind this series exists to run. If the anatomy is universal, every world's named boundary should sit at the same x . Check:

The cosmic world's Hubble sphere sits at $x = 1$. The weak world's 80 GeV skin sits at $x = 1$. The colour world's named boundary — the proton, 0.8414 fm against a curvature radius of 0.2030 fm — sits at $x = 4.14$. Colour is the odd one out by a factor of four, and the anatomy as written does not survive that.

The resolution is not to patch the anatomy but to notice that two different surfaces have been given one name. At $x = 1$ the transverse stress vanishes and the family law returns 155 MeV, the measured confinement temperature: that is the colour horizon, and it sits at one curvature radius with the other two rungs, exactly where the anatomy says. At $x = 4\pi/3 = 4.189$ the medium has become a radial string cloud to 0.9% in the transverse stress and 0.19% in the radial — and a radial string cloud is a bundle of flux tubes, which is what the strong interaction is made of in every account anyone has written.

So the proton is not the colour horizon. It is the flux-tube boundary: the radius at which this geometry's medium stops being anything but strings. The corpus has been calling both surfaces the cage, and the conflation has been invisible because both are near the proton and both carry factors of order unity. They are different objects with different meanings, and the anatomy is repaired by separating them rather than by excusing colour.

What is claimed and what is not. The separation is forced: the two surfaces are at different x and have different geometric definitions. The flux-tube reading of $x = 4\pi/3$ is an interpretation of a computed number, not a derivation of confinement; nothing here derives the string tension, the coupling, or the spectrum. And the $4\pi/3$ itself is inherited from Radii of the Worlds, where it is assembled from a factor π and a tetrahedral $4/3$ and described in the corpus's own words as a discovered consistency, not yet a derivation.

4. A Floor of a New Kind, at Every Rung

The regularity condition derived for the cosmic metric — that a non-singular centre requires $R''(0) = 0$ — contains no scale. It is therefore a condition at every rung, and with the exponential areal radius every world fails it identically, carrying a source that diverges as $1/r$ on its own axis.

The consequence is that every world needs a core radius: a length below which its geometry stops describing anything. That is a floor, and it belongs beside the ones already catalogued in The Floors of Condensation — but it is of a different species than any of them. The winding floor is pair creation; the trinity wedge is three windings jamming; the degeneracy floor is Pauli pressure; the Schwarzschild floor is the exit cone closing. Each is a mechanism holding matter up. This one holds nothing up: it is the areal radius declining to be singular. A geometric floor, not a dynamical one.

In the one-parameter family $R = r \cdot \exp(-(r/R_w)^p/p)$ the near-origin source behaves as $-2(p + 2 + 1/p) \cdot (r/R_w)^{(p-2)}$, finite only for $p \geq 2$, at every rung alike. Whether p is universal is unknown; if it is, the cores of all the worlds are fixed together by one number.

5. The Honest Negative

If the anatomy were universal without remainder, the flux-tube boundary at $4\pi/3$ would repeat. It does not. At the electron rung $4\pi/3$ curvature radii corresponds to 0.122 MeV; at the weak rung, to 19.2 GeV. Neither is a threshold anyone has measured or this corpus has predicted.

This is consistent rather than contradictory — the $4\pi/3$ is assembled in Radii of the Worlds from inputs specific to the colour sector, so there is no reason it should appear elsewhere. But it settles the scope of the claim. Universal: the horizon at one curvature radius, the turnaround, the stress zero, the tension-then-pressure structure, the regularity condition. Not universal: the flux-tube surface.

6. Status

Established: the coupling-independence of the equation of state, which is a one-line argument and can be checked by inspection; the universal structural radii, which follow from the scale-freedom of the geometry; and that the colour world's horizon and the proton are at different x , which is arithmetic.

Conditional, and heavily: everything here assumes the same areal radius $R(r) = r \cdot e^{-(r/R_w)}$ at every rung. That function is not derived at the cosmic rung and is derived nowhere else either. It is the open question of the whole programme, and this note makes it more valuable rather than less — because it is now visibly one question serving every rung at once, not one question per rung.

Interpretation, not derivation: the flux-tube reading of $x = 4\pi/3$.

On authorship, at the series' first rule: computed and drafted by machine (Claude, Anthropic) in one session, from the author's instruction to take today's cosmology to the quantum and colour rungs. It is a walkthrough to be checked. The lemma of §1 takes a minute; §3 takes a calculator.

7. The Sentence

Because the equation of state is a ratio, the coupling cancels and the cosmic rung's geometry can be read at the proton without waiting for the gearbox — and read there it says that the colour world's horizon is where the sideways stress dies, one curvature radius out at the confinement temperature, while the proton we measure is something else entirely: the surface, four and a bit radii out, where the medium has become nothing but radial strings,

which is to say flux tubes, which is to say the thing the strong force was always described as being.

References

The papers and notes of this series (the Allgemeine Feldtheorie — the anatomy of a world, §3, and the gearbox conjecture, §11; The Core of Metric D — the regularity condition and the general G^t_t ; The Family Law's Cosmic Rung — the curvature radius versus the cage; Radii of the Worlds — the $4\pi/3$ and its two gears; The Floors of Condensation; the Tension Medium series — the string-cloud identification; Paper 4 and the Neutron Decay note — the colour sector). Verification script: `ladder_structure_check.py` (the coupling-independence argument; the universal table; the colour rung in fermis; the negative test at the electron and weak rungs). (Citations from memory; the literature-verification pass applies.)

Acknowledgment: the instruction to take the day's cosmology to the quantum and colour rungs is the author's. Computation and drafting by machine (Claude, Anthropic).