Perturbation Theory of the Tension Medium — Part I: What the Medium Is

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Abstract. Every deep question left open in this series — the acoustic peaks, structure formation, the single-booking commitment's mechanics — routes through one missing theory: how the tension medium responds to disturbance. A perturbation theory needs to know what it is perturbing, so Part I asks the constitutive question: *what is the medium?* The answer is read directly off the medium's exact stress signature, computed long ago from the Einstein tensor and never before interrogated: beyond redshift ~20 the medium's stress converges to precisely (ρ, −ρ, 0) — density, full tension along the radial direction, nothing transverse. That signature belongs to exactly one known constitution: **a cloud of radial strings —** the fall lines of this cosmology made literal, threads of tension running from the observer's center to the horizon, the flesh of the mollusk. The identification is not decorative: it makes the medium dark, smooth and stable *by constitution*; it identifies the Flimmer as the transverse waves of the fall lines, moving at light speed; it naturalizes the single-booking commitment; and it reduces the fate of the acoustic peaks to a single named question — the transverse rigidity of the string bundle — which is Part II. Every symbol is introduced before use.

1. The Question Behind Every Open Question

The campaign chronicle ended with one master calculation named: the perturbation theory of the tension medium. But "perturbation theory of X" is meaningless until X has a constitution — a rule for how it pushes back. The medium has so far been defined only by its job description: it is whatever stress-energy the Einstein tensor of metric D demands. Infinitely many materials could hold that job at zeroth order and differ completely when disturbed. Part I closes that gap the only honest way: by reading the job description so closely that the applicant is identified.

2. The Stress Signature

A medium's stress at a point is three numbers: its energy density ρ (how much it weighs), its radial pressure p_r (how it pushes or pulls along the line to the center), and its transverse pressure p_⊥ (how it pushes sideways). All three are known *exactly* for the tension medium — they are the Einstein tensor of metric D, verified symbolically in this series' scripts. Computed across the depths (u = kr counts e-folds of depth; z is the corresponding redshift):

depth kr
0.3
1.0
2.0
3.0
5.0
7.0

Beyond a few e-folds of depth the signature locks onto **(ρ, −ρ, 0)**: full tension along the radial direction — the medium pulls, hard as its own weight — and *nothing* sideways.

3. The Line-Up

Which known material carries that signature? Walk the suspects. A perfect fluid pushes equally in all directions: excluded, the signature is anisotropic. A radial scalar field gives radial *pressure* and transverse *tension* — the wrong signs, excluded. A cosmological constant pulls equally everywhere: excluded. One constitution remains, and it matches exactly: **a cloud of strings, all radial** (in the trade: Letelier's string cloud, 1979). A string under tension carries, along its own length, tension equal to its energy density — that is the (−ρ) — and exerts nothing transverse — that is the (0). A bundle of such strings, threaded radially from the center to the horizon, has precisely the stress the Einstein tensor demands, at every depth beyond $z \sim 20$, exactly.

Read the identification physically and it was hiding in the series' own language all along. The infall direction; "the field is taut along the fall"; the fall *lines*; the mollusk's flesh. The tension medium is a bundle of tensioned threads — fall lines made literal — anchored on the observer's center, running to the horizon where the mollusk ends. (Near the center, $kr < 1$, the signature bends away from pure strings: decomposed, the local medium is roughly half string cloud and half a soft isotropic component. The near-field flank, booked since the Four Calculations note, now has a constitutive face and a quantified mixture — repaired territory for later, flagged as always.)

4. What the Identification Buys, Immediately

Darkness and smoothness, by constitution. A string cloud has no transverse pressure and no zeroth-order transverse coupling: it cannot clump into lumps, cannot shine, cannot scatter light. The cosmology always required its medium to be dark and smooth; the constitution now *guarantees* it rather than assuming it.

The Flimmer, identified. A string under tension T with mass per length μ carries transverse waves at speed $\sqrt{(T/\mu)}$; for a string whose tension equals its energy density — our case — that speed is exactly c. The medium's excitations are light-speed transverse ripples running along the fall lines. The series' oldest word — the Flimmer, the shimmer — is now a theorem of the constitution: *the Flimmer is the vibration of the fall lines.*

Single-booking, naturalized. The commitment of caveat (xi) — the bath is the medium's thermal face, booked once — becomes mechanical: a thermal bath in this medium *is* a thermal population of string vibrations. Heating the bath is exciting the strings. There was never a second fluid to book.

A home for the screw. The dark-matter screw was exiled from algebraic torsion (by ninety-six orders of magnitude) into "the propagating fiber." The fall lines are the natural carrier: a twist wave running along a tensioned thread is torsion propagating on exactly the geometry the galaxy paper's phenomenology wanted. Recorded as a direction, not a result.

5. First-Order Perturbation Theory, Opened

Disturb one fall line: its transverse displacement ξ obeys a wave equation along the line, with the lapse slowing coordinate propagation deeper down (a center-to-wall transit takes ~1,100 Hubble times; eternity is roomy). At this order the theory is exactly solvable and *angularly silent*: each string vibrates alone, neighboring lines uncoupled, so no angular scale is preferred — no drum yet, consistent with every defeat in the campaign chronicle. The sky's spots, in this constitution, are the transverse displacements of the fall lines at the photosphere, read through the Tolman gradient; their *amplitude* is a free boundary datum at first order; their *scale selection* requires the one thing a bare cloud lacks:

6. Part II, Named: the Rigidity of the Bundle

Do the fall lines interact? If neighboring strings repel — and bundles of tensioned lines in nature typically do, from flux lines in superconductors (the Radii note's own kin) to vortex bundles — the cloud acquires a transverse shear stiffness: a second wave speed c_T, sideways coupling, collective modes of the bundle — and, if the repulsion orders the bundle, a lattice with preferred spacings. Everything the drum needs lives in that one constitutive parameter, and everything the drum failed to find so far is explained by its absence at zeroth order. Part II is therefore a single question asked of the quaternion field that the strings presumably are: **what is the transverse interaction of two fall lines?** Its answer either gives the sky its scale selection or closes the last door with the same honesty as the others. The engine clause suggests where to look: two parallel tension lines share a seal geometry between them, and the ledger line on that seal prices their interaction — the Allgemeine Feldtheorie's own machinery, pointed at its own medium.

References

P. S. Letelier, "Clouds of strings in general relativity," Phys. Rev. D 20, 1294 (1979); relativistic elasticity: B. Carter and H. Quintana (1972); flux-line lattices: A. A. Abrikosov (1957); and the documents of this series (the Four Calculations note — the source profile;

the field-equations note — the verified Einstein tensor; the campaign chronicle; the Allgemeine Feldtheorie, caveat (xi); script: constitutive.py). *(Citations from memory; the literature-verification pass applies.)*