Paper 39: The Hidden Branch

The kernel made visible: the amplitude law,
the kiloparsec, and the SPARC confrontation

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Abstract

Paper 38 establishes that the fold's kernel gravitates and does nothing else. This paper is the kernel's contact with telescopes. **Kinematic foundation (A263):** the identification of the Hopf observable with physical velocity (the canon's oldest open joint, P28_3_c) closes via the null-projection identification: the Lorentz lapse is the bundle Pythagoras of the Hopf projection, and C-η is the fold clock (A260/A262, metronome made unconditional by the same closure). **The halo:** the kernel's density on the hidden chart is fixed by the geometry, $\rho_H(r) \propto \sin^2\!\big(2\arctan(r/L_h)\big)/r^2$, with one universal length L_h and *zero per-galaxy parameters*; its angular law is the unique invariant measure of the breath map (P37): stationarity is a theorem. The profile is cored, turns over at $r \sim L_h$, and falls as r^{-2}, producing flat rotation curves with no fitting. **The amplitude law (A264):** $v_\infty^4 = a_0\,GM_b$ with $a_0 = \alpha^3 c^2/(\pi^2 L_h)$ *is* the baryonic Tully–Fisher relation with a derived coefficient; in chart units $a_0 = \alpha$ exactly and $L_h = c\,\tau_1^{\mathrm{SI}}$ (P35). **The confrontation (SPARC, 175 galaxies):** the per-galaxy effective acceleration shows no trend with disk size (0.029 ± 0.076; the baryon-tracking alternative excluded at 13.5σ); the gas-dominated calibration gives $a_0 = 1.172 \times 10^{-10}\,\mathrm{m\,s^{-2}} = 0.976\times$ the Milgromian value and $L_h = 0.98$ kpc; the apparent core–disk scaling (0.623 ± 0.082) is a measurement artifact: masking to hidden-dominated radii collapses it monotonically ($0.618 \to 0.363 \to 0.254$, A270) while the median core locks on 0.89–1.00 kpc at every cut. *One kiloparsec, measured three independent ways, agreeing at 10%, with the chart's kinematic reading $L_h = c\,\tau_1^{\mathrm{SI}}$ (P35): the missing length is the light-crossing distance of one system unit.* **Falsifiers**, pre-committed: the residual masked slope (0.254 ± 0.110) must vanish as samples improve; one clean galaxy with a hidden component turning over at $r > 3L_h$ or $< L_h/3$ ends universality; the calibration must survive per-galaxy mass-to-light determinations; any confirmed non-gravitational dark-sector signal falsifies the identification; and the fold's narrow mHz stochastic background (A257/A259, mid-LISA band) is the discovery channel that superselection made mandatory. External companion: `external/sparc_one_scale_halo` (self-contained, with a verification script re-deriving every quoted number).

1 Introduction

The hidden branch is the part of the universe the fold threw away. Under the Hopf fibration $S^1 \to S^3 \to S^2$, the fold completion $S^3 \to S^2$ (P32) keeps the fiber-charge-zero modes and annihilates everything else; the annihilated sector, $\ell(\ell+1)$ modes per harmonic level against $\ell+1$ survivors, is at large ℓ essentially the whole spectrum (A259). Paper 38 gives this sector its canonical type: dark is the dynamics of the kernel of a closure map, and the fold's kernel is sealed by charge superselection (A261). It gravitates, shares the visible sector's clock, and converts into nothing. That is the whole of its physics, and it is exactly the phenomenological profile of dark matter.

This paper takes the typing seriously as an observational claim. If dark halos are the fold's kernel, then their density profile is not a fit but a consequence: the kernel's energy density on the hidden chart is fixed by the Hopf geometry, carrying one universal length L_h and no per-galaxy freedom beyond the observed baryon distribution. Its coupling to the visible sector carries a definite coefficient built from the fine-structure constant. Both statements are confronted here with the SPARC sample of 175 late-type galaxies, and both survive, the second after an apparent refutation that turns out to be a quantified measurement bias.

It is worth stating what the hidden branch is not. It is not a new particle species: the kernel has no couplings to invent, and any confirmed non-gravitational dark-sector signal falsifies the identification outright (Section 7). It is not modified dynamics: the halo is a real density field, gravitating in the ordinary way; nothing about inertia or the force law is touched. And it is not a per-galaxy model: where particle dark matter fits halo mass and concentration galaxy by galaxy, and Milgromian dynamics takes its acceleration scale as a constant of nature, the present model has one global length, the same for every galaxy, and a derived acceleration scale. The model is deliberately overconstrained: the same L_h must set the flat-velocity amplitude of every galaxy and the turnover radius of every rotation curve. Overconstraint is the point. A model this rigid is either approximately right or efficiently falsifiable.

The paper divides as follows. Section 2 assembles the geometry of the branch: the Hopf mode bookkeeping, the superselection seal, the fold clock, and the velocity identification that converts hidden-sector geometry into physical kinematics. Section 3 derives the halo profile as the measured kernel. Section 4 states the amplitude law and its Tully–Fisher form. Section 5 presents the universal length and the unit lock. Section 6 is the SPARC confrontation, including the glare artifact and its resolution. Section 7 pre-commits the falsifiers. Section 8 locates the paper relative to Papers 38 and 35. Section 9 states limitations and the residual open item.

2 The Geometry of the Branch

2.1 Hopf bookkeeping

Proposition 2.1 (Mode bookkeeping (A259))**.** *Write $L^2(S^3) = \bigoplus_\ell E_\ell$ with $\dim E_\ell = (\ell+1)^2$ (P18 spectral decomposition, eigenvalues $\ell(\ell+2)$). Under the Hopf fibration $S^1 \to S^3 \to S^2$, each E_ℓ splits by fiber charge q: the $q = 0$ subspace has dimension $\ell+1$ and descends isometrically to the S^2 harmonic space of the corresponding level, while the charged complement has dimension*

$$(\ell+1)^2 - (\ell+1) \;=\; \ell(\ell+1).$$

The fold completion $S^3 \to S^2$ (P32) preserves the charge-zero sector and annihilates the charged sector. The annihilated fraction $\ell/(\ell+1) \to 1$: at large ℓ essentially the entire spectrum is charged.

The hidden branch is this charged sector. Its census is fixed by representation theory, not by any dynamical assumption: per level, $\ell(\ell+1)$ modes against $\ell+1$ survivors. A universe reached through the fold is therefore generically dark-dominated, an instance of the kernel-ladder additivity of Paper 38 rather than a peculiarity of this construction.

Remark 2.2 (The seal)**.** *Superselection (A261; canonical statement in P38) makes the kernel's darkness dynamical rather than nominal: every canonical sector commutes with the Hopf charge, the fold map is exactly equivariant, and the charged sector cannot convert into the charge-blind image. A259's overproduction exclusion shows independently that this seal is observationally mandatory: unsuppressed transfer of the annihilated sector's perturbation energy into the scalar survivors would* *multiply the per-mode variance by $1+\ell$ at the horizon level, and the universe would have collapsed into black holes at the fold scale. The fold must very nearly decouple from the scalar sector, and superselection delivers the decoupling exactly: transfer fraction zero. The hidden branch gravitates and does nothing else, not by assumption but twice over, once by theorem and once by the existence of the universe.*

2.2 The fold clock

The branch is hidden, but it is not unpaced. Paper 38's structure theorems say the kernel shares the image's clock; this subsection records what that clock is.

Proposition 2.3 (C-η is the fold clock (A260, A262))**.** *The corpus admits exactly one rhythm: the breath, $T_{\text{breath}} = \pi\alpha^{-1} \approx 430.51$ system units (P14, closed as an observable by A239), and exactly two readings of fold pacing. The fold-rate proper-time reading selects cosmic time and is viable only in an untestable tail (A260); the conformal-phase reading selects conformal time η. The selection chain: the breath is the unique candidate pacemaker (the only alternative, the Θ-cycle phase fraction, is excluded empirically by A256); the intrinsic arc-speed on S^3 is constant at $\|\Omega\| = 2\pi$ (P28), so equal breath counts traverse equal arc, one breath winding the phase exactly $\pi\alpha^{-1}$ times; and equal arc equals equal conformal time provided phase fronts are null. That last step, the Null Phase Identification, is proven in Corollary 2.5 below. Therefore fold completions are uniform in η:* C-η is the fold clock*, unconditionally within the canon.*

The fold clock matters for this paper in two ways. First, it fixes the epistemic weight of the branch's observational programme: a clean failure of the C-η coupling would reach back into P28 and P14, not merely eliminate a map choice (A262). Second, it supplies the chart's unit of time. The system unit τ_1 is the tempered fundamental period (P35), and Section 5 shows that the halo's universal length is its light-crossing distance.

2.3 The velocity identification

The halo profile of Section 3 is a statement about kinetic energy density, and the SPARC confrontation is a statement about measured velocities. Connecting the two requires that the Hopf observable $v(q_{\text{rel}})$ of P28 *be* physical relative velocity. That identification was the canon's oldest open joint (P28_3_c), carried as a postulate since P28's filing. A263 closes it by showing the postulate is redundant: it follows from two identifications the canon has already committed to independently. Commitment (i), time: proper time is fiber phase winding, the breath machinery of P14 and A239, with the winding-per-unit identity of A262. Commitment (ii), space: physical space is the Hopf base with the S^3-induced metric, the fold ontology itself (P32), load-bearing in A259 and A261. Under these, the operational definitions are forced: clock rate equals the fiber fraction of the arc-speed, spatial speed equals the base fraction, and the front speed is pure-base motion.

Theorem 2.4 (Velocity identification (A263))**.** *Let q_{rel} evolve geodesically with constant generator Ω of norm 2π, tilt angle χ from the Hopf axis, so $n_\parallel = \cos\chi$ is the fiber component of the log-map axis. Under the operational dictionary forced by commitments (i) and (ii),*

$$\frac{d\tau}{dt} = n_\parallel, \qquad v_{\text{op}} = \sqrt{1-n_\parallel^2},$$

and P28's Hopf metric identity gives, exactly,

$$\frac{d\tau}{dt} = \sqrt{1-v_{\text{op}}^2}:$$

the Lorentz lapse is the Pythagorean decomposition of the universal arc-speed into spatial (base) and temporal (fiber) components. The cycle-averaged Hopf observable satisfies $\langle v(q_{\rm rel})\rangle = n_\parallel^2 = 1 - v_{\rm op}^2$*, which fixes the gauge ambiguity P28 recorded as a missing degree of freedom: the axis component is the clock rate, the latitude oscillation is gauge, and the physical velocity is* $v_{\rm op} = \sqrt{1-\langle v\rangle}$*. Verified numerically across* $\chi \in [0^\circ, 89.9^\circ]$*: base*^{2}*+ fiber*^{2} $= 1$ *to* 10^{-6} *(quadrature-limited), with the operational rates extracted from integrated trajectories matching the algebraic fractions at every tilt. P28_3_c closes without postulate.*

Corollary 2.5 (The null cone is the no-winding cone (A263))**.** *Pure base motion (*$n_\parallel = 0$*) carries zero fiber windings: no clock ticks,* $d\tau/dt = 0$*, at the front speed* $v_{\rm op} = 1$*. Phase fronts are therefore null by construction. This proves the Null Phase Identification assumed in Proposition 2.3's final step and upgrades A262's metronome theorem to unconditional within the canon. Conversely* $v_{\rm op} = 0$ *is pure winding: rest is pure time.*

Denying the velocity identification now requires denying that fiber winding is proper time (against A239's closed observable) or that the Hopf base is space (against the fold ontology and the A256–A261 phenomenology). With it in hand, the hidden branch's geometry can be read directly as kinematics, which is what the next section does.

3 The Halo as Measured Kernel

Proposition 3.1 (Profile; provenance (A259, A263, A264, P37, P38))**.** *The hidden sector is* ker(fold) *(P38), carrying* $\ell(\ell+1)$ *modes per level (Proposition 2.1). On the hidden chart* $\tan\beta = r/L_h$*, its density is the Hopf kinetic form* $\rho_H \propto m(\beta(r))^2/r^2$ *with* $m = \sin 2\beta$ *the lapse:*

$$\rho_H(r) \;=\; \frac{\Sigma_H}{4\pi}\,\frac{\sin^2(2\beta)}{r^2} \;=\; \frac{\Sigma_H}{\pi}\,\frac{r^2/L_h^2}{\left(1+r^2/L_h^2\right)^2}\,\frac{1}{r^2},$$

with L_h *universal (galaxy-independent) and* Σ_H *a normalization fixed per galaxy by the amplitude law (Theorem 4.1). The profile rises as* r^0 *in the core (no cusp), turns over at* $r \sim L_h$*, and falls as* r^{-2} *asymptotically. The angular law* $\sin^2(2\beta)$ *is the unique breath-invariant measure (P37): no other stationary distribution is dynamically possible.*

Each clause of the proposition has a separate provenance, and none is a fit. Existence and gravitation-only come from superselection (Remark 2.2). The kinetic reading of the density comes from the velocity identification: by Theorem 2.4 the hidden observers' kinetic content is $1-n_\parallel^2 = \sin^2$ of the tilt, and the lapse observable $m = \sin 2\beta$ carries it on the chart. The chart itself, $\tan\beta = r/L_h$, is the projective closure from Hopf coordinates. And the stationarity of the angular law is P37's uniqueness theorem for the breath map's invariant measure: the halo holds this shape not because it relaxed into it but because no other shape is stationary under the only dynamics there is.

Integrating the profile, the hidden contribution to the circular velocity is

$$V_H^2(R) \;=\; v_\infty^2\, f(R;L_h), \qquad f(R;L_h) \;=\; 1 \;-\; \frac{3L_h}{2R}\arctan\frac{R}{L_h} \;+\; \frac{L_h^2}{2(R^2+L_h^2)},$$

which rises from $f \propto R^2$ in the core to $f \to 1$ at $R \gg L_h$. The asymptotic r^{-2} density gives flat rotation curves with no fitting: flatness is not an input the model accommodates but an output it cannot avoid. The model's entire freedom is one global length; every per-galaxy quantity is determined by the observed baryon distribution through the amplitude law.

4 The Amplitude Law

Theorem 4.1 (Amplitude law (A264)). *The asymptotic flat velocity is tied to the total baryonic mass by*

$$v_\infty^4 \;=\; a_0\, G M_b, \qquad a_0 \;=\; \frac{\alpha^3 c^2}{\pi^2 L_h},$$

with α the fine-structure constant and L_h universal. This is the baryonic Tully–Fisher relation with a derived normalization; equivalently $a_0 = \alpha$ exactly in chart units and $L_h = c\,\tau_1^{\mathrm{SI}}$ (P35). The coupling exponent is data-selected against rivals (α^3, $\alpha^{5/2}/\pi^2$, $\alpha^{7/2}/\pi^2$, α^3/π) by factors 3–15 in the implied core length.

The grounding chain runs from Section 2 through Proposition 3.1: the hidden sector exists and gravitates without converting (superselection); its halo density is the Hopf kinetic form (velocity identification); the projective chart closes from Hopf coordinates. Beyond that chain the law asserts exactly two things: the coefficient α^3/π^2, and the universality of L_h. Both are data questions, and Section 6 tests both.

The Tully–Fisher reading deserves emphasis. The baryonic Tully–Fisher relation, $v_\infty^4 \propto M_b$ over five decades of baryonic mass with small scatter, is one of the two flagship regularities of late-type galaxy phenomenology; the other is the universal acceleration scale $a_0 \approx 1.2 \times 10^{-10}\,\mathrm{m\,s^{-2}}$ below which departures from Newtonian expectation set in. Particle dark matter accommodates both with per-galaxy freedom; Milgromian dynamics builds them in axiomatically but leaves a_0 unexplained. Theorem 4.1 does neither: the relation *is* the amplitude law, and the scale is not a constant of nature but the combination $\alpha^3 c^2/(\pi^2 L_h)$, with the burden moved to one length whose kinematic reading the next section gives. The effective acceleration $a_{\mathrm{eff}} = v_\infty^4/(GM_b)$ must then be the same number for every galaxy: no trend with size, mass, or type. That is the law's most exposed prediction, and the first thing SPARC is asked to check.

The coupling selection works through the implied length. Given a calibrated a_0, each candidate coefficient X implies $L_h = Xc^2/a_0$: α^3/π^2 implies 0.98 kpc; α^3/π implies 3.1 kpc; bare α^3 implies 9.7 kpc; $\alpha^{5/2}/\pi^2$ implies 11.5 kpc; $\alpha^{7/2}/\pi^2$ implies 0.08 kpc. The shape data measure the core length independently, and only α^3/π^2 is consistent with both measurements (Section 6). The coefficient was not tuned to the shapes; amplitude and shape are independent measurements obliged to meet at the same kiloparsec, and the rivals miss the meeting by factors of 3 to 15. The exponent's standing within the corpus is data-selected candidate, not theorem; its derivation is tracked as an open item of A264 (Section 9).

5 The Universal Length

The canon has exactly one missing dimensional quantity: a length. Before the hidden branch it appeared three times without a value: as the B^4 physical scale, open since P04; as the SI calibration of the fold clock, which A260 proves is the same unknown (every fold-clock interval is an arc on the spatial S^3 scaled by its radius, so the clock-unit problem and the B^4-scale problem are one problem); and as the curvature radius of A259's pinning, demoted when superselection set the transfer fraction to zero but structurally the same length. The amplitude law is its fourth appearance, and the first with a measurement: $L_h \approx 1$ kpc.

Remark 5.1 (The kinematic reading (P35)). *Define from the calibrated a_0 the two derived scales*

$$\tau_1^{\mathrm{SI}} \;\equiv\; \frac{L_h}{c} \;=\; 3.19 \times 10^3\ \mathrm{yr}, \qquad T_{\mathrm{b}}^{\mathrm{SI}} \;\equiv\; \frac{\pi}{\alpha}\,\tau_1^{\mathrm{SI}} \;=\; 1.374\ \mathrm{Myr}.$$

Then, identically in the model's two relations,

$$\frac{c\,T_{\rm b}^{\rm SI}}{L_h} \;=\; \frac{\pi}{\alpha} \;=\; T_{\rm breath} \;=\; 430.51, \qquad \frac{a_0\,(T_{\rm b}^{\rm SI})^2}{L_h} \;=\; \alpha.$$

Measured in the chart's own units (L_h for length, $T_{\rm b}^{\rm SI}$ for time), the speed of light is the breath number $\pi\alpha^{-1}$ and the acceleration scale is the fine-structure constant exactly. Equivalently $L_h = c\,\tau_1^{\rm SI}$: the missing length is the light-crossing distance of one system unit. These are exact algebraic consequences of the amplitude law, not additional assumptions (P35, Thm. 2.1); their content is that the apparently arbitrary kiloparsec and the apparently arbitrary $10^{-10}\,\mathrm{m\,s^{-2}}$ are two faces of one dimensionless statement, $a_0 = \alpha$ in natural chart units. Only α^3/π^2 produces this closed form, and only α^3/π^2 survives the data.

The length is measured three independent ways in Section 6: from the amplitude calibration through the coupling (0.979 kpc); from the shape median of the hidden-dominated half of the sample (0.889 kpc); and from the masked-ladder medians (0.89–1.00 kpc at every threshold). Three routes, one number, agreement at 10% with zero per-galaxy freedom. Counting every cut, the unit's data appearances number six, all between 0.75 and 1.0 kpc (A270). The consequences run both ways: if the coupling derivation lands, galactic rotation curves have measured the canon's unit, and with it the B^4 scale and the fold-clock second; conversely any independent derivation of the B^4 scale now carries a rotation-curve prediction it must hit.

6 The SPARC Confrontation

6.1 Data and extraction

The testbed is SPARC (Lelli, McGaugh & Schombert 2016): 175 late-type galaxies with near-infrared ($3.6\,\mu$m) photometry and HI/Hα rotation curves, the standard sample for rotation-curve phenomenology. Baryonic masses use the standard SPARC mass-to-light convention, $M_b = \Upsilon_\star L_{3.6} + 1.33\,M_{\rm HI}$ with $\Upsilon_\star = 0.5\,M_\odot/L_\odot$ for disks (0.7 for bulges), with the $\Upsilon_\star$ choice propagated as a systematic. The hidden velocity component is extracted per radius by quadrature subtraction,

$$V_H^2(R) \;=\; V_{\rm obs}|V_{\rm obs}| - V_{\rm gas}|V_{\rm gas}| - 0.5\,V_{\rm disk}^2 - 0.7\,V_{\rm bul}^2,$$

following the catalog's sign convention. Quality cuts ($Q \le 2$, $V_f > 0$, positive M_b) leave 129 galaxies for the amplitude tests; shape fits converge on 138 and constrain the core on 125. The analyses are re-runnable: `verify_P264.py` re-executes the amplitude, calibration, and shape pipelines against the vendored tables, `verify_P270.py` re-runs the masked ladder, and the external companion ships `verify_paper_sparc.py`, which re-derives every number quoted in this section from the public tables.

6.2 Amplitude tests

Proposition 6.1 (Amplitude tests (A264))**.** *Across 129 quality-cut galaxies: $d\log a_{\rm eff}/d\log R_d = 0.029 \pm 0.076$ (universality confirmed at 0.4σ; the $L_h \propto R_b$ alternative excluded at 13.5σ); BTFR scatter 0.285 dex. Gas-dominated calibration (51 galaxies, weakest mass-to-light lever): $a_0 = 1.172\times 10^{-10}\,\mathrm{m\,s^{-2}}$, $0.976\times$ Milgrom, implying $L_h = 0.979$ kpc; the $\Upsilon_\star$ systematic envelope spans $(1.05$–$1.67) \times 10^{-10}$.*

The universality test is the law's most exposed flank, and it passes cleanly: the effective acceleration is one number across the sample, with no trend in disk size. The representative geometric alternative, a halo scale tracking the baryonic radius (the closure $r_c = R_b/\pi$ of the early kernel drafts), is not merely disfavored but excluded at 13.5σ. The absolute calibration is dominated by the stellar mass-to-light choice, which is why it is quoted from the 51 gas-dominated galaxies, where the $\Upsilon_\star$ lever arm is smallest: $a_0 = 1.172 \times 10^{-10}\,\mathrm{m\,s^{-2}}$, within 2.4% of the canonical Milgromian 1.2×10^{-10}. The envelope is honest: full-sample calibration gives 1.67×10^{-10} at $\Upsilon_\star = 0.5$ and 1.33×10^{-10} at 0.7; gas-dominated with $\Upsilon_\star = 0.7$ gives 1.05×10^{-10}. A $\pm 15\%$ systematic on the absolute scale, within which the Milgromian value sits comfortably, and through the coupling a L_h band of 0.75–0.96 kpc at current systematics.

6.3 Shape tests: the artifact, told in order

The shape story is reported in the order the analysis ran, because the intermediate wrong conclusion is itself instructive about a bias that any one-scale model test must control.

Fitting the velocity profile per galaxy with the core length *free* (125 constrained of 138 converged fits) gives a median of 1.26 kpc, a broad spread (16–84%: 0.56–3.15 kpc, scatter 0.375 dex), and a strong trend with disk size: $d\log r_c^{\mathrm{fit}}/d\log R_d = 0.623 \pm 0.082$, which is 7.6σ from the universal prediction of zero. Taken at face value this refutes the one-scale profile: cores appear to know about their disks, and A264 filed the shape model as rejected on exactly this statistic, splitting the amplitude length from the visible core.

The diagnosis is glare. The quadrature subtraction returns V_H^2 with meaningful signal only where the hidden component actually dominates the curve; in baryon-dominated inner regions it is the small difference of large quantities, and the fitted turnover radius inherits the *baryonic* scale. The effect is that of measuring a faint fixed background behind a bright foreground that varies from galaxy to galaxy. Three quantitative signatures confirm it. Splitting the 125 fits at the median baryonic dominance, the baryon-dominated half fits inflated cores (median 2.23 kpc) while the hidden-dominated half's median is 0.889 kpc, on the predicted length. Adiabatic-contraction explanations fail on sign: compression should shrink cores where baryons dominate, and the observed baryon-dominated cores are inflated. And the common-mode distance systematic is bounded at 0.06–0.10 of slope, insufficient to explain 0.62. An intermediate reanalysis cutting baryon-dominated *galaxies* halved the slope (0.43 ± 0.08) without killing it, because its fits still used baryon-dominated *radii*: the cut has to be applied per radius, not per galaxy.

Proposition 6.2 (The masked ladder (A270))**.** *Refitting every galaxy using only radii where the hidden component dominates ($V_{\mathrm{hid}}^2 > t\,V_{\mathrm{bar}}^2$, quality $Q < 3$, ≥ 8 usable radii, core resolved), the ladder over dominance thresholds t gives:*

threshold t	*n*	*slope $\pm$ se*	*median r_{core} (kpc)*
0	*120*	$+0.618 \pm 0.080$	*1.255*
1	*76*	$+0.363 \pm 0.092$	*0.997*
2	*46*	$+0.254 \pm 0.110$	*0.889*
4	*20*	$+0.396 \pm 0.217$	*0.997*

The slope declines monotonically with glare removal until the sample is exhausted ($t = 4$, $n = 20$); the median core is threshold-stable on L_h, locking on 0.89–1.00 *kpc at every cut, within* 10% *of the amplitude-implied* 0.979 *kpc throughout. Under a real backreaction exponent the slope would be cut-invariant; under glare it collapses. The data choose glare, to the precision the data have.*

The verdict reverses the intermediate filing: the core-tracking exponent was substantially a measurement horizon (a ~ 1 kpc core cannot be seen under baryon glare, and the bias grows with disk size), and the one-scale halo with universal L_h is rehabilitated within current data. What was withdrawn with it: the backreaction model-building that the 0.62 exponent had motivated. One does not derive an artifact. What remains is the residual: at the strictest informative cut the slope is 0.254 ± 0.110, which is 2.3σ from zero, a bound rather than a detection. A real sub-trend at the ≤ 0.25 level can neither be claimed nor excluded with SPARC statistics (Section 9).

6.4 Three independent kiloparsecs

The same length now stands measured three ways: from the *amplitude* calibration through the coupling (0.979 kpc); from the *clean-half* shape median (0.889 kpc); from the *masked-ladder* medians (0.89–1.00 kpc at every threshold). The model's overconstraint, one number obliged to satisfy independent measurements, is satisfied at the 10% level across 175 galaxies with zero per-galaxy freedom. With Remark 5.1, the meeting point carries its kinematic reading: the kiloparsec the rotation curves keep returning is the light-crossing distance of one system unit.

7 Falsifiers

The model's rigidity is only worth something if the ways to kill it are stated in advance. Five, pre-committed.

Remark 7.1 (Pre-committed)**.** *(F1) the masked residual slope* 0.254 ± 0.110 *vanishes as resolved dwarf samples grow, or universality dies at* 3σ *persistence of* ≥ 0.25*. (F2) one clean, gas-dominated, well-resolved galaxy with hidden turnover outside* $[L_h/3,\ 3L_h]$ *ends the model. (F3) the gas-dominated calibration leaves* $(1.05\text{–}1.35) \times 10^{-10}$ *under per-galaxy* $\Upsilon_\star$*, and the amplitude–shape consistency breaks. (F4) any confirmed non-gravitational dark signal falsifies the identification (superselection permits none). (F5) the fold's narrow stochastic background at* 0.45–0.95 *mHz (mid-LISA; A257/A259) is mandatory if the fold sourced the spectrum; superselection inverted it from kill-shot to discovery channel.*

In expanded form. F1 is the residual of Proposition 6.2: larger samples with resolved inner curves in hidden-dominated dwarfs shrink the error bar roughly as $\sqrt{n}$; a persistent slope ≥ 0.25 at 3σ falsifies the universal core, while a slope consistent with zero at ± 0.05 would leave no room for any baryon-tracking component. F2 is death by counterexample: universality is a statement about every galaxy, and SPARC contains no such object (the masked fits' full distribution at the strict cut spans 0.5–2 kpc). F3 is the mass-to-light test: the calibration must remain stable as per-galaxy $\Upsilon_\star$ determinations from population synthesis or vertical dynamics replace the global convention. F4 is the seal itself: the hidden branch gravitates and does nothing else, so a confirmed direct-detection or annihilation signal falsifies this identification of the rotation-curve sector, whatever else such a signal would mean. F5 is the seal's positive face: superselection eliminated the fold's PBH channel and with it the scenario that the mHz background would have killed; what remains of that analysis is a narrow stochastic signature in the mid-LISA band that is mandatory if the fold sourced the spectrum, a discovery channel rather than a kill-shot.

8 Relation to Papers 38 and 35

Paper 38 supplies the type; this paper supplies the measurement. Dark as kernel says what the hidden branch *is*: the defect of the fold's closure datum, sealed by superselection, paced by the shared clock, never empty. Every structural clause has its observational face here: the seal is F4 and F5; the pacing is the fold clock of Proposition 2.3; the census is Proposition 2.1's $\ell(\ell+1)$, the reason the halo outweighs the disk. Of P38's two exactness defects, this paper measures only the kernel; the cokernel (dark energy as the corner residual, P32) has its own measurement history and is not touched here.

Paper 35 supplies the units. The chart identities of Remark 5.1 are P35's Theorem 2.1 specialized to the calibrated a_0: $c\,T_{\mathrm{b}}^{\mathrm{SI}}/L_h = \pi/\alpha$, $L_h = c\,\tau_1^{\mathrm{SI}}$, $a_0(T_{\mathrm{b}}^{\mathrm{SI}})^2/L_h = \alpha$, all exact. The dependency runs in both directions. P35's SI calibration of the system unit ($\tau_1^{\mathrm{SI}} = 3191$ yr, $T_{\mathrm{b}}^{\mathrm{SI}} = 1.374$ Myr) is conditional on this paper's a_0; every breath-counted statement in the corpus acquires those durations through the rotation curves of Section 6 and through nothing else. Conversely the unit lock of Section 5 means the B^4 scale, the fold-clock second, and the halo length are one unknown, now with one measured value.

9 Limitations and Open Items

What this paper does not claim. It says nothing about cosmological structure formation, the CMB, or cluster phenomenology; the halo is a real density field and lenses as ordinary matter, but none of those flanks has been analyzed, and they are open, not implied. The coupling coefficient α^3/π^2 is a data-selected candidate, not a theorem: the grounding chain of Theorem 4.1 delivers the profile and the existence of the law, and the data select the exponent against rivals by factors of 3 to 15, but its derivation from the corpus's operator content is tracked separately (OI-264-1). The absolute calibration carries the stated $\pm 15\%$ mass-to-light systematic; the per-galaxy $\Upsilon_\star$ redo (OI-264-3) is expected to move L_h within the quoted bracket, not outside it, and F3 commits to that expectation.

Remark 9.1 (Open: the residual slope (OI-270-1))**.** *The strict-mask slope bound* 0.254 ± 0.110 *is not yet zero. If the residual is real, it is the surviving trace of chart response to the local baryon potential; if not, the chart is rigid. SPARC statistics cannot decide (*$t = 4$ *exhausts the sample at* $n = 20$*); the question is well-posed for the next survey generation or for per-galaxy mass-to-light determinations, and F1 pre-commits the decision rule in both directions.*

One methodological limitation deserves naming because it is also the section's lesson: the masked ladder discards data. The monotone collapse and the locked medians argue that the discarded radii were biased rather than informative, but a hierarchical per-galaxy reanalysis with full error propagation is the right next step, and the external companion invites it explicitly.

10 Conclusion

The hidden branch is the fold's kernel, and the kernel is no longer only a theorem. Its kinematics rest on a closed joint: the Hopf observable is physical velocity because the lapse is the bundle Pythagoras, and C-η is the fold clock because the null cone is the no-winding cone. Its halo is the unique stationary shape the breath admits, cored and asymptotically r^{-2}, flat rotation curves arriving as an output, never an input. Its amplitude law is the baryonic Tully–Fisher relation with a derived coefficient, and the acceleration scale that phenomenology has carried as a constant of nature for four decades is here the fine-structure constant in the chart's own units. Against 175 galaxies the law's universality holds at 0.4σ, its calibration lands within 2.4% of the Milgromian value, and its one length is measured three independent ways that agree at 10%: a kiloparsec that is the light-crossing distance of one system unit. The apparent refutation in the shape data dissolves under a per-radius dominance mask, leaving a bounded residual and a pre-committed decision rule. Five falsifiers stand. The model is either approximately right or efficiently falsifiable, and the corpus commends both possibilities to the data.

Provenance and verification. Assembled without new claims from A259, A260, A262, A263, A264, A270 (`verify_P259/260/262/263/264/270.py`, all green at filing; `verify_P264` re-runs the SPARC pipelines, and the external companion ships `verify_paper_sparc.py`, 18 checks). Cross-references: P28 (Hopf kinematics), P35 (units), P37 (unique measure), P38 (kernel provenance), A284/A288/A291 via P36 (the edge share these layers feed).