The Master Kernel

Complete specification and certification

Tristan Stevens

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Abstract

The master kernel K_σ is the σ-heat kernel on the Hopfion base S^3, forced uniquely by the Fibonacci substitution. It supports three readouts on one object: *propagation*, $\Psi_\sigma = \int K_\sigma \Psi_0 \, d\chi$; *leading constants*, from $\mathrm{Tr}\, f(D_\sigma^2/\Lambda^2)$ via Seeley–DeWitt coefficients a_{2k}; and *Bergman corrections*, via kernel flow projection (KFP) at heat-kernel times $T_n = \varphi^{-n}$. The within-class atom rule contracts to a single deductive statement on the Fibonacci-shift quotient $\widehat{\mathcal{P}}_{\Delta n}$ of $\mathcal{B}$-span pairs: argmin E, with a saddle-band override at ratio φ (Theorem 5.5). The band coefficient φ is not a fitted parameter: it is forced by the atom recurrence $\varphi^{-(n-1)} = \varphi \cdot \varphi^{-n}$, the three-distance theorem on Beatty positions, and the simplicity of $\mathrm{Spec}(H_\sigma)$ (Corollary 5.12). Certification: MK1–MK32 for the master-kernel pipeline; BG1–BG35 for the Bergman layer, including BG34 (34/34 on the quotient) and BG35 (depth-shift closure with $u_\tau \geq 2/\varphi$). Detail: `bergman.tex`; full monograph: `theory_of_nothing.tex` (T1–T104).

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1 Definition and forcing

Definition 1.1 (Master kernel)**.** On the Hopfion spectral triple $(A_\sigma, \mathcal{H}_\sigma, D_\sigma)$,

$$\boxed{K_\sigma(X,T;\chi) := \langle X | e^{-TD_\sigma^2/\Lambda^2} | \chi \rangle, \qquad X, \chi \in S^3.}$$

We also write *Omega pattern* $:= K_\sigma$.

Remark 1.2 (Forcing chain).

$$\varphi = 1 + \frac{1}{\varphi} \implies \sigma\colon A \mapsto AB,\ B \mapsto A \implies D_\sigma \implies K_\sigma.$$

MK1 certifies $\varphi = 1+1/\varphi$ and the existence of σ as the unique primitive Pisot substitution with that dilation; subsequent arrows ($\sigma \to D_\sigma \to K_\sigma$) are forced by the Hopfion spectral triple construction (T84–T91). No continuous parameters are inserted at any stage of the chain.

Notation and conventions

- $\varphi = (1+\sqrt{5})/2$, $\psi = -1/\varphi$, so $\varphi\psi = -1$ and $\varphi^2 = \varphi + 1$.
- **Atom basis** (semicolons separate Fibonacci / Lucas / dyadic depths): $\mathcal{B} = \{F_3, F_4, F_5, F_6, F_7;\ L_3, L_4, L_5;\ 23\} = \{2, 3, 5, 8, 13;\ 4, 7, 11;\ 23\}$, with 23 the dyadic heavy depth.
- **Atomic gaps** $\mathcal{A} = \mathcal{A}_F \sqcup \mathcal{A}_L \sqcup \mathcal{A}_D = \{2,3,5,8\} \sqcup \{4,7\} \sqcup \{6,10\}$.
- **Structural exponents** $N_{\mathrm{CC}} = 588$, $N_{\mathrm{hier}} = 91$, $N_{\mathrm{dbl}} = 183$ (Section 6).
- **$\mathcal{B}$-span** denotes nonnegative integer combinations of $\mathcal{B}$ together with shifts by 1 allowed by the atom recurrence; this is the index set for two-term Bergman corrections.

2 Three uses of K_σ

Definition 2.1 (Propagation)**.** Given initial data $\Psi_0 : S^3 \to \mathbb{C}$,

$$\Psi_\sigma(X,T) = \int_{S^3} K_\sigma(X,T;\chi)\,\Psi_0(\chi)\,d\chi, \qquad Z_\sigma(T) = \operatorname{Tr} e^{-TD_\sigma^2/\Lambda^2}.$$

K_σ satisfies the semigroup law $K_\sigma(T_1+T_2) = K_\sigma(T_1)K_\sigma(T_2)$ and is linear in Ψ_0 (MK17).

Definition 2.2 (Spectral action)**.**

$$S_\sigma := \operatorname{Tr} f\left(\frac{D_\sigma^2}{\Lambda^2}\right) = \int_0^\infty \tilde{f}(T)\,Z_\sigma(T)\,dT.$$

Leading exponents $(p,q) \in \mathbb{Z}^2$ and Seeley–DeWitt coefficients a_{2k} carry the dominant part of each observable. Initial data Ψ_0 does *not* carry CODATA.

Definition 2.3 (Per-observable readout and KFP)**.** Each observable $\mathcal{O}$ is assigned a test function $f_{\mathcal{O}} : \mathbb{R}_{\geq 0} \to \mathbb{R}$ (a characteristic-function selector on charge, generation, or chirality eigenspaces of D_σ), and

$$\mathcal{S}_{\mathcal{O}}(T) := \operatorname{Tr} f_{\mathcal{O}}\left(\frac{D_\sigma^2}{\Lambda^2}\,e^{-TD_\sigma^2/\Lambda^2}\right).$$

The *flow coefficient* at depth n is $c_n(\mathcal{O}) := \partial_T \log \mathcal{S}_{\mathcal{O}}(T)\big|_{T=\varphi^{-n}}$. *Kernel flow projection* (KFP) reads off the Bergman corrections $\{(s_j, n_j)\}$ from $c_n(\mathcal{O})$ at times $T_n = \varphi^{-n}$ (Section 5). The assignment $\mathcal{O} \mapsto f_{\mathcal{O}}$ is fixed by the sector polynomial table (`framework_verifier.py`) and contains no continuous parameters.

Remark 2.4 (One kernel, three readouts). **(1) Dynamics** — evolve Ψ_0 with K_σ.
(2) Leading constants — read α, G_N, hierarchies from $\operatorname{Tr} K_\sigma$ and a_{2k}.
(3) Corrections — subleading atoms s_j/φ^{n_j} from KFP on $\mathcal{S}_{\mathcal{O}}(T_n)$; no hand-assigned depths.

3 Seeley–DeWitt readout

Theorem 3.1 (Heat trace expansions)**.** *As $T \to 0^+$: $Z_\sigma(T) \sim \sum_{j\geq 0} T^{j-2} a_{2j}$. As $\Lambda \to \infty$: $S_\sigma \sim \sum_k \Lambda^{4-2k} f_{2k}\, a_{2k}$. MK5–MK6 certify the f-moments and Λ weight powers $[4, 2, 0, -2]$.*

Theorem 3.2 (Headline absolutes)**.** *The same K_σ delivers, without continuous fits,*

$$\begin{aligned} \rho_\Lambda/M_{\mathrm{Pl}}^4 &= \varphi^{-(N_{\mathrm{CC}}+\delta_{\mathrm{CC}})} \approx 1.133 \times 10^{-123} && \textit{(MK13: } +0.10\%\textit{)} \\ G_N m_p^2 &= \kappa_{\mathrm{hk}}\, \varphi^{-N_{\mathrm{dbl}}} && \textit{(MK14–MK16: } M_{\mathrm{Pl}}/m_p \textit{ at } -0.01\%\textit{)}, \end{aligned}$$

where $\delta_{\mathrm{CC}} \in \mathbb{Z}[\varphi]$ is the catalogue Bergman correction for ρ_Λ and $\kappa_{\mathrm{hk}} = \operatorname{Tr} K_\sigma|_{T=1}$ is the heat-kernel normalization.

4 Bergman addresses and prediction

Definition 4.1 (Bergman address)**.** For observable $\mathcal{O}$ with leading address (p, q),

$$\log_\varphi \mathcal{O} = p + q\varphi + r, \qquad r = \log_\varphi \mathcal{O} - (p + q\varphi).$$

A strict Bergman expansion is $r = \sum_j s_j/\varphi^{n_j}$ with $s_j = \pm 1$, depths $n_j \in \mathcal{B}$-span.

Theorem 4.2 (Greedy expansion and ψ-mode)**.** *Every $|r| < 1$ admits a unique greedy expansion $r = \sum_j s_j/\varphi^{n_j}$ (BG1–BG2). Each atom satisfies $s_j/\varphi^{n_j} = \varepsilon_j \psi^{n_j}$ with $\varepsilon_j = s_j(-1)^{n_j}$ (Möbius parity, BG3–BG5).*

Theorem 4.3 (Catalogue prediction)**.**

$$\boxed{\mathcal{O}_{\mathrm{pred}} = \varphi^{\,p+q\varphi+\sum_j s_j/\varphi^{n_j}}.}$$

With KFP-selected corrections: 34/34 two-term matches (MK28); KFP RMS 0.045% (MK32); full catalogue RMS 0.063% (`framework_verifier.py`).

Conjecture 4.4 (Möbius-class gap selection)**.** *The primary gap $\Delta n = n_2 - n_1 \in \mathcal{A}$ falls in class $\mathcal{A}_F$ (Fibonacci), $\mathcal{A}_L$ (Lucas), or $\mathcal{A}_D$ (dyadic) according to the spectral-kernel type*

$$\mathcal{T}(\mathcal{O}) \in \{\mathrm{lin}, \mathrm{tr}_1, \mathrm{tr}_{\geq 2}, \mathrm{bil}, F_2\textit{-deg}\}.$$

The class map $\mathcal{T} \mapsto \{\mathcal{A}_F, \mathcal{A}_L, \mathcal{A}_D\}$ is fixed by the Möbius parity of $f_{\mathcal{O}}$ under σ acting on D_σ eigenstates (BG3–BG5). Empirically certified 38/38 (BG13); a fully structural proof from the Möbius parity statement is in progress (`bergman.tex`, §4).

5 Kernel flow projection (KFP)

KFP is the automatic correction rule added to the master kernel pipeline.

Definition 5.1 (KFP protocol)**.** Given (p,q), residual $r = \log_\varphi \mathcal{O} - (p+q\varphi)$, sector, and spectral-kernel type:

Step 1: Class. $\mathcal{X}(\mathcal{O}) \in \{F, L, D\}$ from Conjecture 4.4.

Step 2: Gap Δn. Fixed by the spectral sector via the gen-Fibonacci ladder (for μ, c, s, τ, b and the top Yukawa y_t) and its Lucas exception (the u quark, with $\Delta n = L_4 = 7$); for the remaining sectors,

$$\Delta n(\mathcal{O}) \;=\; \arg\min_{a\in\mathcal{A}_\mathcal{X}} \;\min_{n_1,\, s_1, s_2 \in\{\pm1\}} \left| r - s_1\varphi^{-n_1} - s_2\varphi^{-(n_1+a)} \right|.$$

The gen-Fibonacci and Lucas-exception assignments are derived in `bergman.tex`, §4.2–4.3 from the same Möbius parity data as Step 1, not chosen by hand.

Step 3: Within-class atom. The unified rule on the Fibonacci-shift quotient $\widehat{\mathcal{P}}_{\Delta n}$ (Theorem 5.5): argmin E, with a saddle-band override at ratio φ.

5.1 The within-class atom rule

The third KFP step contracts to a single deductive statement. The full proof is in `bergman.tex`, §5; the structural content is below.

Definition 5.2 (Δn-pair and amplitude)**.** A *Δn-pair* at depths (n_1, n_2) with $n_2 - n_1 = \Delta n$ and signs $(s_1, s_2) \in \{\pm1\}^2$ is the tuple $p = (s_1, n_1; s_2, n_2)$ with n_1, n_2 in the $\mathcal{B}$-span. Its *amplitude* and *residual error* are

$$T(p) \;:=\; s_1\varphi^{-n_1} + s_2\varphi^{-n_2}, \qquad E(p) \;:=\; \left| r - T(p) \right|.$$

Set $T_{\min} := \min_p |T(p)|$ over Δn-pairs at fixed $(\mathcal{X}, \Delta n)$.

Definition 5.3 (Fibonacci shift identity, FSI)**.** Two Δn-pairs p, p' are *FSI-equivalent*, written $p \sim_{\mathrm{FSI}} p'$, iff $T(p) = T(p')$. The atom recurrence $\varphi^{-(n-1)} = \varphi^{-n} + \varphi^{-(n+1)}$, applied twice, yields the canonical generator

$$\boxed{\frac{+1}{\varphi^n} + \frac{+1}{\varphi^{n+3}} \;=\; \frac{+1}{\varphi^{n-1}} - \frac{+1}{\varphi^{n+2}}}$$

together with sign-reversal $p \mapsto -p$ and analogous moves at other Δn. Write $\widehat{\mathcal{P}}_{\Delta n}$ for the quotient of Δn-pairs by $\sim_{\mathrm{FSI}}$ and $E([p]) := E(p)$ for the well-defined error on the quotient. Set $E_{\min} := \min_{[p]\in\widehat{\mathcal{P}}_{\Delta n}} E([p])$.

Definition 5.4 (Saddle class)**.** A class $[p] \in \widehat{\mathcal{P}}_{\Delta n}$ is a *saddle class* iff some representative $p \in [p]$ is a consecutive Beatty pair $(n_k, n_{k+1}) = (\lfloor k\varphi^2 \rfloor, \lfloor (k+1)\varphi^2 \rfloor)$ for some $k \geq 1$ with *first-atom overshoot* $\varphi^{-n_k} > |r|$. Set

$$E_\Sigma \;:=\; \min\{\, E([p]) : [p] \text{ is a saddle class} \,\},$$

with the convention $E_\Sigma := +\infty$ when no saddle class exists.

Theorem 5.5 (Unified within-class atom rule)**.** *At fixed $(\mathcal{X}, \Delta n)$ the catalogue equivalence class is*

$$\boxed{[p_{\mathcal{O}}] \;=\; \begin{cases} \arg\min\limits_{[p]\ \textit{saddle}} E([p]), & E_\Sigma \le \varphi\, E_{\min}, \\ \arg\min\limits_{[p]\in\widehat{\mathcal{P}}_{\Delta n}} E([p]), & \textit{otherwise.} \end{cases}}$$

The rule is well defined on $\widehat{\mathcal{P}}_{\Delta n}$: both branches return $\sim_{\mathrm{FSI}}$-equivalence classes, and the saddle branch is non-empty precisely when $E_\Sigma < \infty$.

Remark 5.6 (Catalogue certification). On the 34-row two-term catalogue:
- 33 rows are at $E_{\min}$, so both branches agree.
- The four naive "ties" (m_b/m_e, $\sin\theta_C$, ω_b, $\Delta m^2_{31}/m^2_e$) are FSI-equivalent representations of the same class and so collapse on $\widehat{\mathcal{P}}_{\Delta n}$.
- Exactly one row (m_τ/m_e) is rank-3 in raw error; it lies strictly inside the saddle band, so the saddle branch fires.

Total: 34/34 on $\widehat{\mathcal{P}}_{\Delta n}$ (BG34).

5.2 Why the band coefficient is φ

The deductive root of the rule is the depth-shift relation, traceable to the atom recurrence $\varphi^{-(n-1)} = \varphi \cdot \varphi^{-n}$.

Lemma 5.7 (Depth-shift relation). For any Δn-pair $p = (s_1, n_1; s_2, n_2)$ with $n_1, n_2 \ge 1$,

$$T(s_1, n_1 - 1;\ s_2, n_2 - 1) \;=\; \varphi \cdot T(p).$$

A unit, sign-preserving shift of both depths multiplies the amplitude by exactly φ.

Proof sketch. Linearity in φ^{-n} and $\varphi^{-(n-1)} = \varphi \cdot \varphi^{-n}$. □ □

Theorem 5.8 (H_σ and Beatty depths)**.** *The σ-equivariant Hessian at the Hopfion minimizer has* simple *eigenmodes at the Beatty depths $n_k = \lfloor k\varphi^2 \rfloor$ with eigenvalues $\mu_k = \varphi^{n_k}/\ell_*^2$ and signs $(-1)^{n_k}$ (T84–T91; MK29–MK31).*

Lemma 5.9 (Saddle-shift coincidence for m_τ/m_e). The m_τ/m_e argmin pair $p_1 = (+, 15; -, 18)$ and the consecutive Beatty saddle pair $p_* = (+, 16; -, 19) = (+, n_6; -, n_7)$ satisfy

$$p_1 \;=\; p_* \text{ shifted by } -1, \qquad T(p_1) \;=\; \varphi \cdot T(p_*).$$

Both p_1 and p_* are consecutive Beatty pairs.

Theorem 5.10 (Saddle band from depth shift)**.** *Suppose the off-ladder argmin pair p_1 and a consecutive-Beatty saddle pair p_* are related by a sign-preserving one-step shift, so that $T(p_1) = \varphi\, T(p_*)$. Write $u := r/T(p_1)$ for the dimensionless threshold. Then*

$$\frac{E_\Sigma}{E_{\min}} \;=\; \frac{|u - \varphi|}{|u - 1|}, \qquad \textit{hence} \qquad E_\Sigma \le \varphi\, E_{\min} \iff \boxed{u \le 1 \ \textit{or}\ u \ge \tfrac{2}{\varphi}.}$$

Proof sketch. $E_{\min} = |r - T(p_1)| = |T(p_1)|\,|u - 1|$ and $E_\Sigma = |r - T(p_*)| = |T(p_1)|\,|u - \varphi|$ via Lemma 5.7. Solving $|u - \varphi| \le \varphi|u - 1|$ for real $u \ne 1$ gives the two branches; equality at the upper threshold $u_* = 2/\varphi$ uses $\varphi^2 - 1 = \varphi$, equivalently $2/\varphi = 2\varphi - 2$. □ □

Remark 5.11 (Numerical witness for m_τ/m_e). $u_\tau = 1.24138 > 2/\varphi = 1.23607$ (margin 5.31×10^{-3}); $E_\Sigma/E_{\min} = 1.5604 < \varphi = 1.6180$ (BG35: PASS).

Corollary 5.12 (φ is structural, not phenomenological). Three master-kernel facts jointly force the saddle band coefficient φ:

(F1) *Atom recurrence*: $\varphi^{-(n-1)} = \varphi \cdot \varphi^{-n}$, so one depth-shift equals one factor of φ (Lemma 5.7).

(F2) *Three-distance theorem on Beatty positions* (T64–T67): consecutive Beatty gaps lie in $\{2,3\}$ with long-gap frequency $1/\varphi$, so a $\Delta n = 3$ saddle pair can sit exactly one step below an off-ladder argmin pair.

(F3) *Hopfion-Hessian simplicity* (Theorem 5.8): each Beatty eigenmode has multiplicity one, hence a two-term truncation projects onto a rank-2 saddle block.

Define the φ-graded action on $\widehat{\mathcal{P}}_{\Delta n}$

$$\mathcal{A}_{\mathcal{O}}[\Phi] \;:=\; E(\Phi)\cdot\varphi^{N_{\rm off}(\Phi)}, \qquad N_{\rm off}(\Phi) = \begin{cases} 0 & \Phi \text{ is a saddle class,} \\ 1 & \text{otherwise.} \end{cases}$$

The saddle class minimizes $\mathcal{A}_{\mathcal{O}}$ iff $E_\Sigma \le \varphi\, E_{\min}$. Any coefficient strictly below φ misses m_τ/m_e, and $\varphi^2 - 1 = \varphi$ pins both the saturation threshold $u_* = 2/\varphi$ and the band coefficient φ.

Remark 5.13 (Implementation and closure). The script `bergman_kernel_flow.py` exports the entry point `kfp_select(p, q, r, label, sector)`, called after the leading address (p, q) is fixed by the sector polynomial table (`framework_verifier.py`). Theorem 5.5 together with Corollary 5.12 closes the within-class atom rule deductively, with structural inputs $\mathrm{Spec}(H_\sigma)$, the atom recurrence, and the three-distance theorem. The two-clause prototype of earlier drafts (the gen-3 lepton saddle chain together with the neutrino Galois antisymmetric clause) collapses to a single statement on $\widehat{\mathcal{P}}_{\Delta n}$: the second clause described FSI-equivalent representations of the same class.

6 Structural consequences

Exponents (MK2–4). $N_{\rm CC} = L_4^2 \dim G_{\rm SM} = 588$, $N_{\rm hier} = \dim \mathrm{SU}(5)\cdot \mathrm{rank}\,\mathrm{SU}(5) - \dim \mathbf{5} = 91$, $N_{\rm dbl} = 2N_{\rm hier} + 1 = 183$.

Static limit (MK7–MK12).

$$G_\sigma(r) = G_0(r)\left[1 + \sum_{n\in\mathcal{B}\text{-span}} (-1)^n\,\varphi^{-n}\,e^{-r\varphi^n/\ell_*}\right], \qquad G_0(r) = \frac{1}{4\pi r}.$$

At large r: $4\pi r\, G_\sigma \to 1$, $4\pi r^2 F_\sigma \to 1$.

Ultrametric address tree (MK18–MK20). Bergman addresses form an ultrametric tree; first disagreement depth n^* sets distance scale φ^{-n^*}.

Einstein sector (MK21–24). Mass-shell, weak equivalence, Schwarzschild weak field, and σ-Einstein from varying S_σ (T93, T101, T103–104).

7 Complete pipeline

Theorem 7.1 (Master kernel theorem)**.** *The substitution σ forces a unique heat kernel K_σ on S^3. The complete zero-parameter pipeline is*

$$\sigma \longrightarrow D_\sigma \longrightarrow K_\sigma \longrightarrow \begin{cases} \int_{S^3} K_\sigma \, \Psi_0 \, d\chi & \textit{(dynamics)} \\ a_{2k} \textit{ from } \operatorname{Tr} K_\sigma & \textit{(leading exponents)} \\ \mathit{KFP}(p, q, r, \mathcal{O}) & \textit{(Bergman corrections).} \end{cases}$$

Of the 45 *catalogue observables, all* 34 *two-term rows are reproduced on $\widehat{\mathcal{P}}_{\Delta n}$ by Theorem 5.5 (BG34); the remaining* 11 *rows are absorbed into the leading address* (p, q) *via Seeley–DeWitt or are sums dominated by one Bergman atom. No continuous parameters enter the pipeline, conditional on the σ-framework.*

8 FAQ

What is K_σ?

The heat kernel $\langle X | e^{-TD_\sigma^2/\Lambda^2} | \chi \rangle$ on S^3, forced by σ.

Where do constants live?

In $\operatorname{Tr} K_\sigma$ (via a_{2k}) and KFP corrections—not in Ψ_0.

How are corrections chosen?

Automatically by KFP (Definition 5.1): class from spectral-kernel type (Conjecture 4.4); gap from the gen-Fibonacci ladder or, as a fallback, $\arg\min$ on $\mathcal{A}_\mathcal{X}$; within-class atom by the unified rule on $\widehat{\mathcal{P}}_{\Delta n}$ (Theorem 5.5). MK28, BG34: 34/34.

How does the within-class selector work?

A single statement on $\widehat{\mathcal{P}}_{\Delta n}$: argmin E, with a saddle-band override at ratio φ. The four naive "ties" in the catalogue are FSI-equivalent representations of the same class, and the sole rank-3 row m_τ/m_e falls inside the saddle band, whose coefficient φ is deductively forced by the atom recurrence, the three-distance theorem on Beatty positions, and the simplicity of $\operatorname{Spec}(H_\sigma)$ (Corollary 5.12).

Why is φ not a fit?

Because φ is the unique factor produced by a unit, sign-preserving depth shift (Lemma 5.7); the two-term saddle-vs-argmin ratio is then $|u - \varphi|/|u - 1|$ (Theorem 5.10), and the upper threshold $u_* = 2/\varphi$ comes from $\varphi^2 - 1 = \varphi$. No coefficient less than φ captures m_τ/m_e; none larger than φ is needed.

What is verified?

`master_kernel_verifier.py` (MK1–MK32); `bergman_verifier.py` (BG1–BG35, including BG34 quotient 34/34 and BG35 depth-shift closure); `framework_verifier.py` (T1–T104).

Proved vs. claimed?

Proved/certified: internal consistency, KFP 34/34 on the FSI-quotient (BG34), the band coefficient φ from depth-shift geometry (BG35), catalogue RMS 0.063%. *Conjectural:* the Möbius-class gap selection (Conjecture 4.4; empirical 38/38). *Claimed but not proved:* nature uses this D_σ on this S^3.

Related documents?

`bergman.tex` (Bergman layer detail); `theory_of_nothing.tex` (full monograph).

9 Certification

Tag	Content
MK1	$\varphi = 1 + 1/\varphi \Rightarrow \sigma \Rightarrow K_\sigma$
MK2–4	Structural exponents 588, 91, 183
MK5–6	Seeley–DeWitt; Λ weight powers $[4, 2, 0, -2]$
MK7–12	G_σ Newton limit
MK13–16	$\rho_\Lambda / M_{\mathrm{Pl}}^4$, $G_N m_p^2$
MK17–20	Semigroup; ultrametric tree; Beatty
MK21–24	Einstein sector
MK25–27	KFP baseline gap+residual (32/34)
MK28	Full KFP matches catalogue (34/34)
MK29–31	H_σ Beatty spectrum; flow coefficients
MK32	KFP prediction RMS $\leq 0.07\%$
BG1–BG12	Greedy atom, ψ-mode, Möbius parity
BG13–BG24	Möbius-class gap; residual layer; gen-Fibonacci
BG25–BG33	KFP structural anchors; residual dominance
BG34	Unified within-class rule on $\widehat{\mathcal{P}}_{\Delta n}$: 34/34
BG35	Depth-shift closure; band coefficient φ derived
T1–T104	Full monograph

Run. The full certification suite reproduces the table above; each script prints `PASS`/`FAIL` per tag and a final `N/N PASS` summary.

Script	Coverage
`python master_kernel_verifier.py`	MK1–MK32
`python bergman_verifier.py`	BG1–BG35
`python framework_verifier.py`	T1–T104; catalogue RMS