APEIRON

Mathematically Tested Model

Local AP1 scientific feasibility established for a bounded mathematical witness — not a full cosmological validation.

Local Scientific Feasibility of an Apeiron Realization

The O049 witness and the prospective AP1 GO decision through checkpoint 078

Josip Fellner

Independent Researcher · ORCID 0009-0003-1705-3985

Correspondence: info@apeironfield.com

Version 1.1 · 11 September 2026 · Correction snapshot A079 · Public hygiene H1 · Website release · Not peer reviewed

Abstract

This paper consolidates local scientific feasibility for the bounded O049 witness under AP1_GO_SCIENTIFIC_FEASIBILITY_FIRST, defined prospectively at 077 and formally recorded at 078. The common domain is $\tau \in [0,1/125]$, with $\tau = -\eta$ in fixed conformal Planck units $M_{\mathrm{pl,ren}} = 1$, for a spatially flat homogeneous background and the specified compatible linear scalar/transverse-traceless response class $k \in [5/8,5/4]$. The A–F evidence covers a fixed complete covariance, mathematical well-definedness, gravitational consistency, the stated local stability minimum and a nontrivial Apeiron contribution. The quantitative internal model benchmark is a unique event H_cosmic($\tau_\star$) = $H_\star = 2 \times 10^{-6}$ with $H_0/(2\,M^2_{\mathrm{pl,ren}}) < \tau_\star < 1/125$. H_0 retains its historical O049 initial/reference meaning; it is not a fit to the observed present-day Hubble constant. Audit 079 confirmed that the inherited derivative lower bound is analytic and error-covered on the required interval, giving an endpoint margin of about 4% above the benchmark. The full nonstandard sector supplies practically the entire Friedmann source at that local event under the inherited standard-source envelope; this is not a DM/DE fit or an observed cosmological matter fraction. The benchmark is reproducibly specified, numerically testable and falsifiable in principle within the model, but is neither an astronomically confirmed observable nor a direct H(z) prediction. The AP1 domain is a local mathematical feasibility domain, not a reconstruction of a physical cosmological epoch or an observational H(z) trajectory. Checkpoints 078 and 079 audit existing evidence and do not supply a new physics calculation or independent external validation. Earlier results retain their original scope. Genesis, cycles, black-hole return, full cosmology, observational matching, complete DM/DE identification, global existence and complete long-term stability remain open, with AP2/AP3 retained as further research directions.

Keywords: semiclassical gravity; local existence; Hadamard state; causal response; scientific feasibility; quantitative internal model benchmark; Apeiron

1 Purpose and claim boundary

Apeiron is a research programme exploring whether a dynamical sector beyond the declared standard sources can contribute to gravitation and eventually support cosmological predictions. The broader interpretation of a pervasive medium, a beginningless system or cycles of genesis and return is a hypothesis. The result reported here concerns one precisely named mathematical realization, a finite domain and a restricted response class. It does not test that ontology.

The contribution of this paper is to make the local result, its evidence dependencies and its limitations readable as a public record. The controlling documents are the prospective scope decision and A–F audit at 077, followed by the formal decision at 078 [E01–E07]. “GO” is the programme's decision label under those criteria. It is neither a statistical confidence level nor an external certification.

After 077 defined the local scope prospectively following earlier O049 calculations, decision 078 bound and audited the existing evidence under that scope. It checked the formal consistency of six passing gates and the integrity of their source bindings. It did not repeat the previous calculations or supply a new independent physics proof. The present consolidation checks those bindings, reads the cited evidence and states the argument and its limits. Mathematical claims below are attributed to that construction. Independent scrutiny may identify errors in either the inherited arguments or their application; the decision label does not insulate them from correction.

1.1 Tested core and broader research programme

A. AP1-tested core. The claim is limited to the bounded O049 mathematical witness, its explicit finite local domain, mathematical well-definedness, gravitational consistency, the stated local stability minimum, a nontrivial Apeiron contribution and a quantitative internal model benchmark. The A–F matrix in Section 5 identifies the evidence for each part. The word “tested” carries this declared local meaning; it is not experimental confirmation or full empirical validation.

B. Broader Apeiron research programme / Post-AP1. Genesis, a cosmic cycle, return through black holes, full DM/DE interpretation, filaments and structure formation, complete cosmology, observational comparison and the AP2/AP3 directions remain hypotheses or research goals. They are not consequences already derived or empirically confirmed by O049. These interpretations are retained as the wider programme, with their own derivation and test obligations.

2 Chronology and the meaning of the new scope

Three records must be distinguished. The earlier v7.13 paper reports a frozen discrete numerical classification of a homogeneous AME-1 map. Its time parameter is $H_\star$ times cosmic time. The O049 work belongs to the later Variant B foundation construction, with a different state and a direct covariant source prescription. Finally, 077 and 078 define and apply the local AP1 decision threshold to that realization. Sharing model ingredients does not make these three evidential objects identical.

Record	Recorded result	Preserved limitation
v7.13 and adjacent v6.74	Frozen HARD-PASS and adjacent NONPASS of the declared Float64 protocol	Full independent-map reproduction V4 remained open in the inspected preprint
049	Fixed V2 selection and subsequent proof of complete covariance identity with the 047 auxiliary state	No claim of an absolutely smallest physically admissible repair carrier
054	Local FEASIBILITY_GO on the common finite domain	AP1_GO remained false under the then-operative wider requirements
057 and 075	A restricted compatible source-Ward PASS; external standard inputs bound	Complete quantitative response and the hot recombination start remained unresolved
077	Prospective local scientific-feasibility definition and A–F audit	Introduced after knowledge of existing O049 results; AP1_GO still false in this audit
078	Formal AP1_GO under the 077 definition	No acceptance under the former wider contract; no new calculation

The reduced criteria were not historically preregistered before all relevant O049 findings. The scope change is disclosed as an author decision effective from 077. It removes specified wider tasks from the prerequisites for this local milestone; it does not declare those tasks completed. The 054 definition was itself introduced openly after existing results were known [E01, E08].

The public v7.13 manuscript, its adjacent NONPASS and its independent-reproduction limitations remain historical records [L01]. The current-status framing in this release supersedes their use as a description of the programme's latest milestone, while leaving their results untouched. The old prediction roadmap remains identifiable as a prospective document [L02].

3 Model ingredients and the common domain

3.1 Geometry and conventions

The background is spatially flat FLRW with homogeneous classical fields σ and θ and a homogeneous, isotropic quasifree quantum χ state. Let a be the scale factor, t cosmic time and η conformal time. We use the following relations in the fixed units:

$$dt = a\ d\eta, \quad \tau = -\eta$$

$$H = \frac{1}{a}\frac{da}{dt} = \frac{a_{,\eta}}{a^2}, \quad \mathscr{H} = \frac{a_{,\eta}}{a} = aH.$$

$$I_\tau = [0, 1/125], \quad I_\eta = [-1/125, 0], \quad k \in [5/8, 5/4], \quad M_{\text{pl,ren}} = 1.$$

Causal retardation is in increasing η. Increasing τ follows the same history towards earlier conformal times. The interval endpoint 1/125 is a conformal time in the fixed Planck normalization. It is not an e-fold interval, redshift, cosmic age or the old dimensionless v7.13 control parameter. H is the model-internal rate defined with respect to cosmic time, not the conformal rate $\mathcal{H}$. The response momentum k is also distinct from the internal χ momentum q.

The AP1 domain is a local mathematical feasibility domain, not a reconstruction of a physical cosmological epoch or an observational H(z) trajectory. The benchmark is not a direct H(z) prediction.

The historical parameter name H_0 is retained in all mathematical relations. It means the O049 initial/reference Hubble parameter, not a fit to an observed present-day Hubble constant. The label H_0 (O049) is explanatory notation only; it does not rename or refit the bound input.

The homogeneous existence result used in 047 extends to τ ∈ [0,1/10]. The common A–F claim uses the smaller interval already assigned to the response. This restriction does not infer a larger response domain. Later continuation results are unnecessary for the local GO and are not used to enlarge it [E02, E04, E11].

3.2 Classical fields and portal

The inherited classical pressure can be written as follows [E24, E27]:

$$P(X, \sigma, \theta) = \alpha_{\text{kin}}(\sigma) X + \beta_{\text{kin}}(\sigma) X^2 - U(\sigma, \theta), \quad X = \dot{\theta}^2/2$$

$$\alpha_{\text{kin}} = 1 + \frac{5 E_c z}{\Lambda^4}, \quad \beta_{\text{kin}} = \frac{5}{3\Lambda^4}\left(z - \frac{2}{\sqrt{3}}\right)^2, \quad z = \sigma / f_\sigma$$

$$U = E_c\left[\frac{z^4}{4} - \frac{z^2}{2} + \left(b_\star + b_{\text{slope}}\frac{\theta}{M_{\text{pl}}}\right) z\right] + V_s(\theta).$$

Here V_s is the fixed quartic potential of the inherited parameter specification. Its coefficients, together with the local source conventions, are supplied by the indexed sources; no coefficients are fitted in this paper. We write the classical coefficients with a “kin” subscript to distinguish them from similarly named covariance-repair quantities in the construction.

The portal mass squared is

$$h(\sigma, \theta) = m_{\chi,0}^2 + 2\lambda(v + \sigma)^2 \cos(2\theta / f_{\text{phase}}).$$

The classical source terms entering the full balance are

$$\rho_{\mathrm{cl}} = \frac{\dot{\sigma}^2}{2} + \frac{\alpha_{\mathrm{kin}} \dot{\theta}^2}{2} + \frac{3\beta_{\mathrm{kin}} \dot{\theta}^4}{4} + U$$

$$p_{\mathrm{cl}} = \frac{\dot{\sigma}^2}{2} + \frac{\alpha_{\mathrm{kin}} \dot{\theta}^2}{2} + \frac{\beta_{\mathrm{kin}} \dot{\theta}^4}{4} - U\,.$$

Local kinetic admissibility uses $P_X > 0$ and $K_\theta = P_X + 2\,X\,P_{XX} > 0$. The inherited bounded solution remains on the positive kinetic chart. Positivity of these local coefficients is one part of the feasibility argument, not a substitute for the coupled response construction.

3.3 The complete quantum and gravitational source

Variant B uses one complete positive quasifree Hadamard covariance for the operator −□ + h. “Hadamard” here specifies the short-distance singularity structure needed by the local subtraction scheme; the smooth state-dependent remainder and its required norms must also be controlled. Local covariant renormalization provides methodological context [R1], while the actual B prescription is the project-specific construction [E23].

Its source combines the state-dependent renormalized contribution, the correlated conservation/anomaly completion and the fixed finite local contribution. These are parts of one variational prescription. They cannot be selected independently to improve a gate. The inherited finite Einstein–Hilbert normalization, curvature prescription and endpoint terms stay fixed. In particular, the old hybrid operational source is not declared identical to this direct covariant B source, and an isolated comparison remainder is not added back as new physical stress.

The complete state, source and memory are transported on the same geometry. Restricting the history to an earlier slice does not introduce a vacuum reset, a newly selected density matrix or an independent scalar/tensor state. This is essential: local endpoint moments alone do not determine the full nonlocal response.

3.4 Response and standard-sector restrictions

The linear claim concerns the pre-existing compatible scalar and transverse-traceless class, initially flat bulk test sources, and the specified compatible geometry/covariance Cauchy data with their own finite remainder norms. It does not cover arbitrary initial data or a general vector response [E12, E13].

The standard-sector attachment retains the cold M1 pilot prescription. Its qualitative theorem applies to each actually supplied nonnegative integrable rate. It does not select a numerical Thomson history, establish an ionization history or provide a hot thermal initialization. The conditional standard-sector theorem and a computed cosmological rate history are different results.

3.5 What exactly is the Apeiron field?

In the tested construction, “Apeiron” denotes a mathematically specified field/sector system, including the classical fields, the bound quantum state and the complete gravitational source described above. The local covariant source prescription and the specified Ward, gauge-invariant and causal response structures are documented for the claimed domain and input class [E12, E13, E19, E23]. These statements concern that mathematical construction, not an experimentally identified universal medium.

Post-AP1 foundational clarification. Whether and how a physically preferred rest frame exists in the broader interpretation, and how the full Lorentz/general-relativistic embedding of an extended model is to be interpreted, remain open questions. A homogeneous background or a coordinate choice alone does not settle them. The local covariance/Ward/GI structure should not be presented either as a demonstrated violation or as a complete resolution of that broader embedding. No preferred-frame dynamics, symmetry-breaking result or new field ontology is introduced here.

4 The fixed O049 witness

The full witness name is O049.L2p198.FIRST-FINITE-STRICT-RAW-CELL-1.v2. It specifies an entire recursive covariance, not a finite table of low moments. The construction fixes the initial prefix at $L = 2^{198}$, its exact roots, the correlated moment-repair algebra, the decoder and the admissibility budgets [E09, E21]. This L is a construction parameter; it is not the momentum band k, the cosmological constant or an observed length.

At each repair stage, finite certificate attempts are visited in the fixed native order of pairs (ℓ_R,p), ordered first by ℓ_R+p and then by ℓ_R. A certificate succeeds when all required operations are defined and finite and the existing interval and norm inequalities are strict. The first successful finite attempt determines the next repair. A failed certificate is an uncertified attempt, not a physical exclusion of that carrier. The construction proves termination of each finite stage and convergence to the specified covariance; it does not assert that all carriers and high moments have already been numerically tabulated.

The V2 rule was frozen on 9 September 2026 at 18:18:31 Europe/Zagreb. The recorded identity result followed at 18:19:42. Induction on the identical ordered certificate attempts, exact roots and Gram operations establishes identity of the whole covariance with O047.L2p198.NATIVE-RAW-CELL-1.v1 [E10, E22]. This identity licenses reuse of 047 results with their original domains. Similarity of low moments would not suffice.

The earlier claim of an absolutely smallest admissible repair carrier was withdrawn and is not restored by the identity proof. “First finite strict certificate” is the valid selection statement. Nor is the later 077 scope presented as blinded to previously available results.

Useful inherited display values are $H_0 \approx 5.9044051867 \times 10^{-61}$, $h_0 \approx 9.6392164627 \times 10^{-9}$, $\kappa^2 \approx 4.2097831235 \times 10^{-8}$ and the full initial trace-driving quantity $F_0 \approx 4.4921271008 \times 10^{-3}$ [E15]. These rounded values are for identification; the source intervals define the quantities. F_0 is not an observed dark-matter density. The a = 1 and H_0 normalization does not establish a fitted present-day universe.

5 Method and the A to F gate audit

The evidence route has four components. First, the constructive state and fixed source prescription establish the inputs. Second, the O029 family results are instantiated for the state named in 047 and transferred only after complete identity is shown in 049. These results give an actual smooth homogeneous fixed point with the complete source and memory, together with positive expansion. The inherited contraction bound is $q_{\text{contr}} \leq 0.24$ on the stated homogeneous construction; it is not an observational goodness-of-fit statistic [E11, E25].

Third, the parameterized structural response argument and the compatible initial-data theorem are applied on the smaller common domain [E12, E13]. They control the required local/UV/contact terms, Ward and gauge identities, constraint reconstruction and causal scalar/TT response. A sufficiently large mathematical weight yields the joint causal inverse. Finiteness of that construction does not give a small unweighted amplification factor.

Fourth, 077 assigns those existing results and the existing $H_\star$ event to its A–F criteria. The audit finds all six PASS. Decision 078 then checks consistency and source integrity and records the formal GO [E02, E05]. The following table gives the claim carried by each PASS.

Gate	Criterion and result under 077	Principal evidence
A · PASS	A uniquely bound nontrivial complete mathematical carrier	E09, E10, E15, E21
B · PASS	Own smooth homogeneous existence and full state, source and memory binding on the declared domain	E08, E11, E25
C · PASS	Required local gravitational constraints, distributional Ward/gauge consistency and causal scalar/TT structure	E08, E12, E13, E19

Gate	Criterion and result under 077	Principal evidence
D · PASS	Local analytic response minimum and positive kinetic chart, with supporting free χ estimates	E08, E13, E16, E17
E · PASS	Nontrivial own dynamics and a positive full nonstandard gravitational density at the $H_\star$ event	E10, E11, E14, E15, E18
F · PASS	A unique quantitatively bounded $H_\star$ event in the same history, open to controlled numerical testing	E10, E14

The table is an evidence mapping under an explicit decision rule. The six PASS entries do not certify every calculation ever labelled AP1. In particular, the corrected compatible θ-source Ward result in 057 pertains to its specified construction and k = 1 test. It is supporting evidence for C, not a numerical evaluation of the full six-row response on the entire k band. The structural class-wide claim comes from the separate analytic sources [E12, E13, E19].

5.1 What the local stability minimum establishes

The analytic bound has the following schematic form, with the complete norms defined in the source:

$$\|\text{GI geometry/fields}\| + \|\text{sources}\|_{C^0} + \|\text{standard moments}\|_{C^0} \le C_{\text{O049}}\ \mathscr{I}_{\text{data}}$$

$$C_{\text{O049}} < \infty .$$

No numerical value or smallness claim for C_{O049} is supplied. Checkpoint 056 separately bounds the actual χ frequency throughout the interval: $q^2 + \kappa^2 + D_{\text{exact}}(\tau)$ is at least q^2 plus a strictly positive lower bound whose display value is approximately $3.39350904 \times 10^{-8}$. Its free χ energy-transport estimate is also finite [E16, E17]. These statements do not exclude parametric resonance in a broader problem, establish coupled finite-frequency stability or imply positivity of renormalized energy. They support only the stated local minimum.

6 H star as a quantitative internal model benchmark

The benchmark concerns an event value of the model-internal cosmic Hubble rate, H_cosmic($\tau_\star$) = $H_\star = 2 \times 10^{-6}$. $H_\star$ is a rate in the bound units; $\tau_\star$ is the event time. A reproducibly specified event and acceptance question are distinguished from an already completed independent numerical reproduction. The benchmark is numerically testable and falsifiable in principle within the model, and is not currently an astronomical observable directly mapped to observations or a direct H(z) prediction.

6.1 Statement and proof route

For the same actual history, the inherited event result states [E14]:

$$\exists!\ \tau_\star \in [0, 1/125]: \quad H(\tau_\star) = H_\star = 2 \times 10^{-6}$$

$$t_b < \tau_\star < 1/125, \quad t_b = \frac{H_0}{2 M^2_{\text{pl,ren}}}.$$

The symbol t_b is retained from the evidence but denotes a bound in the τ coordinate; it is not a newly computed cosmic age. In the normalized units, $t_b = H_0/2 < 3 \times 10^{-61}$. The value $H_\star$ is the pre-existing reference rate. No new rate or acceptance threshold is optimized here.

For completeness, the argument can be followed directly from the recorded inequalities. Write $x_0 = \kappa^2$ and $D = V - \kappa^2$ for the complete history-dependent operator deviation. D is not a new field or a free source. The background obeys

$$a_{,\tau} = -a^2 H, \quad a_{,\tau\tau} = a\left(a^2 h - x_0 - D\right)$$

$$H_{,\tau} = \frac{x_0 + D - a^2 h}{a} + 2aH^2.$$

Source of the inherited lower bound. The bound $H_{,\tau} > 2.6 \times 10^{-4}$ comes from the bound earlier proof records: E14, E15, O029 (E26). E14 states the event argument, E15 binds the witness input intervals, and O029 supplies the inherited positive-expansion bounds. Audit 079 checks the inherited evidence, arithmetic and resulting margin; it is not a new physics proof of this lower bound.

The inherited positive-expansion bounds give $0.997479 < a \le 1$, $a^2h < 1.006 \times 10^{-8} < x_0$, and $D \ge D_{\text{minus}} > 2.6 \times 10^{-4}$ on $[t_b, 1/10]$. Therefore $H_{,\tau} > 2.6 \times 10^{-4}$ after the initial layer. The separate initial-layer estimate gives $H(\tau) < 10^{-60} < H_\star$ for $0 \le \tau \le t_b$. At the upper endpoint,

$$H(1/125) > 2.6 \times 10^{-4}(1/125 - t_b) > 2 \times 10^{-6}.$$

Continuity supplies existence of a crossing and strict monotonicity after the initial layer supplies uniqueness. This restates the existing proof; no trajectory integration or new event-time computation is performed. The interval is an enclosing bracket, not an estimate with a statistical error bar. No point value for $\tau_\star$ is claimed.

Audit 079. HSTAR_E14_BUFFER_AUDIT_PASS confirms that the inherited bound $H_{,\tau} > 2.6 \times 10^{-4}$ is a conservative analytic, error-covered lower bound on $[t_b, 1/125]$, not a central value or numerical trajectory estimate. The initial layer $[0, t_b]$ is controlled separately. The evidence chain is E14/E15 through O029 (E26) and N029 (E25), with the already bound witness instantiation and identity [E11, E22]. E18 supplies the full source bookkeeping; it is not a derivative certificate obtained from a computational profile. No new physics proof, integration, solver run, threshold optimization or AP1 gate decision was performed by 079.

The existing endpoint inequality gives, in $M_{\text{pl,ren}} = 1$ units:

$$H(1/125) > 2.08 \times 10^{-6} - 1.3 \times 10^{-4} H_0.$$

$$H(1/125) - H_\star > 8 \times 10^{-8} - 1.3 \times 10^{-4} H_0 > 8 \times 10^{-8} - 7.8 \times 10^{-65} > 0.$$

The relative lower bound is $0.04 - 65\,H_0$, hence a guaranteed margin of about 4%. The wording “about” is retained: this displayed envelope must not be rounded up to an exact guarantee of at least 4%. This is a bound on the endpoint relative to the benchmark, not a newly computed endpoint value or event time.

Rounding is covered by outer input intervals and conservative analytic constants; the audit checked their arithmetic rationally. The continuous analytic bounds carry the source, massive-kernel, nonlinear, initial-coordinate, free-state and resolvent remainders. No discretized or interpolated trajectory is used for this conclusion. This is not certification of an independently implemented numerical solver. The audit supplement identifies the inherited terms and the recorded 079 result.

6.2 Full nonstandard gravitational contribution

With the frozen Einstein–Hilbert and renormalization bookkeeping, the same actual solution satisfies

$$\rho_{\text{cl}} + \rho_{\text{ref}} + \rho_{\text{fin}} + \rho_{\text{std}} = 3H^2.$$

The first three terms together define the nonstandard contribution for this statement. They are not individually fitted or substituted for the full source. At the event, the total density in these units is $3H_\star^2 = 1.2 \times 10^{-11}$. The inherited standard-sector envelope at a = 1 is $|\rho_{\text{std}}(1)| < 1 \times 10^{-110}$, also written 1e-110. Its a^{-4} value majorant must be retained at the benchmark [E18]. With $a_\star = a(\tau_\star) > 0.997479$, the correct event-domain bound is:

$$|\rho_{\mathrm{std}}(\tau_\star)| < \frac{10^{-110}}{a_\star^4} < \frac{10^{-110}}{(0.997479)^4}.$$

The bound 1e-110 belongs to the initial normalization; it is not asserted unchanged at $a_\star$. Consequently,

$$\rho_{\mathrm{nonstd}}(\tau_\star) = \rho_{\mathrm{cl}} + \rho_{\mathrm{ref}} + \rho_{\mathrm{fin}} = 1.2 \times 10^{-11} - \rho_{\mathrm{std}}(\tau_\star) > 0.$$

The numerical total is elementary arithmetic from the already fixed rate, not a new simulation. E18 also contains interval substitutions for a computational profile. Those profile values are not treated as the exact on-shell trajectory; the present conclusion uses the inherited full balance and value majorant exactly as explained in 077.

Thus $\rho_{\mathrm{nonstd}} = 3H_\star^2 - \rho_{\mathrm{std}} \approx 1.2 \times 10^{-11}$: the nonstandard sector supplies practically the entire Friedmann source within this local model benchmark. This is not a DM/DE fit and is not a statement about the observed cosmological matter fraction. Additional unknown particles are not excluded. This result demonstrates a nonzero additional homogeneous gravitational source in the defined model. It does not demonstrate pressureless clustering, an accelerating equation of state, a measured dark-sector fraction or identification with the observed universe. Positive density alone establishes none of those properties.

6.3 Numerical testability and empirical reach

The testable content is not merely naming a rate $H_\star$. It is the assertion that this rate occurs exactly once, within a specified bracket, for a fixed complete realization. An independently implemented, error-controlled reconstruction using the same equations, covariance, source and memory can challenge the asserted existence, location or uniqueness. A conflicting calculation would require numerical and proof auditing to distinguish an implementation error from a failure of the claimed theorem.

Such a test must preserve the time orientation and distinguish H from $\mathcal{H}$. It must also control the contribution of unmaterialized covariance repairs rather than replace the state by a convenient finite truncation. An isolated successful solver run, an unresolved crossing or agreement at a few sample times is not by itself a validated existence or uniqueness test.

This is the numerical form of falsifiability explicitly allowed by 077. It does not demonstrate that the local event is experimentally accessible. In particular, the Planck-normalized interval and $H_\star$ event have not been identified with last scattering, a measured Hubble rate or another astronomical epoch. The milestone therefore establishes local scientific feasibility under the declared programme criterion, while observational adequacy remains untested.

7 Limits and preserved unresolved results

The claimed homogeneous solution and compatible linear response do not establish global existence or the general nonlinear inhomogeneous Einstein–matter initial-value problem. No arbitrary initial-state class, vector-mode result, universal coupled amplification factor, Floquet analysis or complete long-term stability theorem follows from them. Causal linear-response methods in semiclassical gravity provide relevant context [R2]; their general availability does not certify this particular model.

Full quantitative raw-response materialization, production/reference comparisons and convergence/error acceptance remain distinct from the structural and qualitative local results. The broader response method limit in 057 is preserved, including the fact that a corrected source-Ward PASS does not close the paired-response evaluator. Later response work is not silently promoted by 078.

Checkpoint 075 records external standard inputs as bound but the O049 equilibrium-start test as METHOD_LIMIT, with no accepted hot starting slice and M1_PRODUCTION_RELEASED = FALSE [E20]. The imported standard rates do not provide O049's missing geometry. The 077 audit reports no separate completed 076 record in its inspected evidence; no 076 success is assumed here.

No full last-scattering-surface-to-present connection is established. In this context “LSS” denotes the last scattering surface; elsewhere in cosmology the same abbreviation can denote large-scale structure. Neither a reconstructed cosmological history nor structure-formation validation is supplied by the local event result.

No observational dataset is fitted in this paper. There are no released astronomical H(z), growth, lensing, filament or gravitational-wave templates derived from this local GO, and no likelihood, significance, Bayes factor or empirical preference. The result is not a complete explanation of dark matter or dark energy. Unknown particle components remain possible; their relation to any Apeiron contribution is an empirical question. Quantitative attribution to rotation curves, gravitational lensing, CMB, BAO, Bullet-Cluster-like systems and structure formation remains Post-AP1/AP2/AP3 work. None of these observational channels is matched by the local benchmark alone.

Earlier restricted-baseline NONPASS results and failed methods retain their scope. They cannot be generalized to exclude all Apeiron realizations, but neither can the success of a different realization erase them. Hash agreement verifies artifact identity, not mathematical truth. The supplied evidence selection supports scrutiny but is not a complete executable numerical reproduction archive.

8 Post AP1 and the AP2 and AP3 programme

The original observation roadmap used AP1 for joint expansion, growth and lensing, AP2 for filament residual gravity, and AP3 for gravitational-wave propagation [L01, L02]. The local milestone adopted at 077 changes the role of the AP1_GO label. It does not produce the earlier roadmap's observable vector or satisfy its original transfer gate.

Post-AP1 / Validation Priorities — open. Independent reproduction of the bounded O049 witness and the $H_\star$ benchmark using an independent implementation or analyst. This is scientifically desirable Post-AP1 work, not a retrospectively introduced prerequisite for the already recorded AP1-GO.

Post-AP1 cosmological bridge. The first observational extension is a physically identified continuation of the same realization, including the required thermal/recombination inputs and the complete connection to the claimed observational range. Quantitative response and stability must be established on that range before exporting a joint set of expansion, growth and lensing observables. The old H(z), $w_{\mathrm{ap}}(z)$, $f\sigma_8(z)$, μ(k,z), slip and Σ(k,z) targets remain future products. The slip symbol must be distinguished from the conformal time η used here.

AP2 filament residual gravity. The intended channel remains a predicted filament profile after the declared matter reconstruction. Its sign, amplitude, radial shape, node dependence and control analyses must follow from a stated model version before comparison with data. No residual profile, extra clustering component or filament detection is claimed in this release.

AP3 gravitational-wave propagation. The intended channel remains tensor propagation and any resulting relation between gravitational-wave and electromagnetic distances, amplitudes, polarization or line of sight. A nonzero deviation is a hypothesis to derive and test, not a result implied by AP1_GO. The necessary tensor theory, validity domain, physical units and common parameter inputs must first be available.

The existing principle of one consistent parameter core and prospective test definitions remains. The detailed future contracts must be frozen for their actual scientific targets before results are used to judge them. AP1_GO does not automatically release AP2 or AP3 numerical production. Global continuation, complete past histories and genesis/return cycles are further theory questions, not hidden accomplishments of this milestone.

9 Evidence availability and declarations

The accompanying Technical Evidence Index maps the public claims to selected project records, including the complete 077/078 decision packet and the thirteen bindings used in 078. It records original SHA-256 values, portable release paths and hashes of the supplied copies. Where a private machine path is normalized, the copy is explicitly distinguished from the original. Historical status fields inside those sources are preserved.

All thirteen original evidence bindings and the 077/078 packet checksum entries matched during preparation of this release. This is an integrity check and source consolidation. No background solver, new physical model, parameter search, raw-response production or astronomical fit was run. No independent numerical reproduction is reported. The selected evidence is not the full transitive collection of every referenced proof, code dependency or dataset; additional materials would be required for a complete end-to-end reproduction.

The author has approved this set for public release on the Apeiron Field website. No DOI, external repository accession or publication date of an external repository deposit is asserted. The older publicly hosted preprint and roadmap are referenced as historical sources; their old download addresses do not identify this release.

Author: Josip Fellner, Independent Researcher. The established publication identity is retained. The manuscript licence is CC BY 4.0, following the recorded author choice and authorization for this website release. AI assistance was used for source auditing, consolidation and drafting. The author is responsible for reviewing and approving the scientific claims and final text.

Funding: Apeiron/AP1 was self-funded by the author and received no external funding. Competing interests: The author declares no competing interests. These declarations were confirmed by the author for this release on 11 September 2026.

The project website remains the present distribution point. A future deposit on an established scientific platform may supply a persistent archive link or DOI; none is invented or asserted in this release. Any preferred custom-domain address must first be confirmed and verified. This framing revision performs no hosting migration.

The version remains 1.1 at the author’s instruction. The dated A079 correction snapshot incorporates the already decided audit and clarifies notation and source envelopes without changing the scientific scope. Earlier version 1.0 and the earlier version 1.1 snapshot remain archived under their original hashes. The current PDF, editable source and companion files are bound by PUBLICATION_PACKAGE_MANIFEST.

References

Project evidence. E01–E32 are individually identified and hashed in TECHNICAL_EVIDENCE_INDEX_v1.1_2026-09-11_A079_H1.md and EVIDENCE_MANIFEST.json, supplied with this paper. E01–E07 identify the controlling scope and decision records; E08–E20 identify the inherited evidence and remaining limits; E21–E28 provide selected construction and historical context; E29–E32 complete the original decision packet. These are project records, not external peer-reviewed validation.

L01. J. Fellner, *Frozen Float64 Classification of a Homogeneous AME-1 Map: v7.13 HARD-PASS, Adjacent NONPASS, and Open Independent Reproduction*, version 1.0, 31 August 2026, 10-page public English preprint. Inspected 11 September 2026. Historical preprint. The inspected file's checksum is in the Evidence Index.

L02. J. Fellner, *Apeiron Anlage A Falsifizierbare Vorhersagen*, version 1.0, 30 August 2026, 9-page prospective roadmap. Historical roadmap. Its original AP1 label is reconciled prospectively in Section 8 and in POST_AP1_AP2_AP3_ROADMAP_v1.1_2026-09-11_A079_H1.md.

R1. S. Hollands and R. M. Wald, *Local Wick Polynomials and Time Ordered Products of Quantum Fields in Curved Spacetime* (2001), arXiv gr-qc/0103074. Context for local covariant Wick constructions and finite renormalization freedom; not evidence for O049 or its particular finite prescription.

R2. B. L. Hu and E. Verdaguer, *Stochastic Gravity: Theory and Applications*, Living Reviews in Relativity 11, 3 (2008), arXiv 0802.0658, doi 10.12942/lrr-2008-3. Context for semiclassical sources and response; no stochastic extension of Apeiron is introduced here.

A079. J. Fellner, Audit 079 E14 Buffer Audit, 11 September 2026. Documentary and arithmetic audit of the inherited bound. Result: HSTAR_E14_BUFFER_AUDIT_PASS. Audit supplement. Original report, decision and source hashes are supplied in evidence/audit_079/.