Universal Grid Mechanics

Derivation Status and Gap Accounting

Companion Document to V02.10

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March 20, 2026

Purpose. This document provides: (1) a complete verified status table of every claimed result in the UGM corpus as of V02.10; (2) a dependency tree; (3) submission readiness assessment per paper with specific required actions; (4) a prioritized next-steps list; and (5) a "do not claim" table protecting against overclaiming. All Zenodo records verified by direct fetch. All classical physics is treated as not authoritative; evaluation is conducted against UGM's own axioms.

Contents

1 Frozen Canon Reference

Ax.	Name	Content
0	Admissibility Is Primitive	Continuity; bounded change; local info consistency
1	Grid Ontology	Continuous persistent substrate; no void
2	Ontology Precedes Mathematics	Formal divergence $\neq$ physical existence
3	Inadmissible States Forbidden	No divergence from admissible initial conditions
4	Structural Memory	Accumulates under admissible updates; cannot diverge

State: $X = (S, M)$; Domain: $\mathcal{D} = \{(S, M) : S_{\min} \leq S \leq S_{\max},\ 0 \leq M \leq F(S) \leq M_{\max} < \infty\}$
Projector: $\Pi_M(z; S) = \mathrm{clip}(z, 0, F(S))$; API: $\Delta M_{\text{realized}} \geq 0$ along realized paths (derived, not axiomatic)

2 Complete Result Status Table (V02.10)

Item	Status	Version	Note / Dependency
Foundation			
Hexagonal geometry selected	CLOSED	V02.1	Refs aniso, prim
$L_6 \to \nabla^2$ Taylor expansion	THEOREM	V02.4	Full proof; Prop. 8.1
Forward invariance of $\mathcal{D}$	THEOREM	V02.4	Thm. 7.1 via $\Pi_{\mathcal{D}}$
Admissible Path Interpretation	CANON	V02.06	Replaces global monotonicity
Pathwise consistency	THEOREM	V02.06	Prop. 6.4
Two-level write–release reading	CANON	V02.06	Resolves Axiom 4 tension
Refs [21]–[23] in-text citations	CLOSED	V02.09b	do Carmo, Blair in §5; Joos in §4
Admissible distance $d(X, Y)$ defined	CANON	V02.10	Def. 7.2; finite on $\mathcal{D}$ by Ax. 0
Global contraction theorem	NEW THEOREM	V02.10	Thm. 7.3; $d_{n+1} \leq \lambda d_n$
Uniqueness of admissible evolution	NEW THEOREM	V02.10	Cor. 7.4; closes uniqueness gap
Asymptotic stability ($d_n \leq \lambda^n d_0$)	NEW THEOREM	V02.10	Cor. 7.5
Attracting structure of $\mathcal{D}$	NEW THEOREM	V02.10	Cor. 7.6
Admissibility stability condition	NEW CANON	V02.10	$\alpha k > \beta C_H$ derived from Ax. 0
Gravity derivation chain			
UGM gravity Hamiltonian $\mathcal{H}_{\text{UGM}}$	THEOREM	Ham.	From admissibility + L_6
EOMs for $\bar{S}$, $\bar{M}$ from $\mathcal{H}$	THEOREM	Ham.	No postulated EOM
Scalar gravity closure	THEOREM	Ham.	$\Gamma_U \nabla^2(\bar{S} + \bar{M}) = \rho_\kappa + \bar{M}$
Newtonian branch (formal theorem)	THEOREM	Ham.	$G = \sqrt{3}/4\pi^2$

Item	Status	Version	Note / Dependency
$G = \sqrt{3}/4\pi^2$ (dimensionless)	THEOREM	V02.3	Geometric; no grav. data
Inverse-square law as Green's fn	THEOREM	V02.3	From Poisson equation
$\delta F \sim \ell^2 GM/r^4$ correction	THEOREM	V02.3	Falsifiable prediction
MOND-like branch (formal theorem)	THEOREM	Ham.	Screened Poisson derived
MOND screened Poisson (form)	THEOREM	Ham.	Formally closed
Branch separation (3 regimes)	THEOREM	Ham.	Newton/MOND-like/history
MOND transition scale (structural)	THEOREM	Ham.	$g^\dagger = ((\omega_W \tau_M - 1)/\tau_M)\bar{S}_0$
Branch ratio $R = \bar{M}/\bar{S}$ fundamental	THEOREM	Ham.	Grounds discriminator
Lorentz / special relativity			
Interval $\mathcal{Q} = c^2t^2 - \|R\|^2$	CANON	V02.3	Hexagonal Gram matrix
$\gamma, L, E, p, E^2 - p^2c^2 = E_0^2$	CANON	V02.3	No spacetime metric
GR and singularity exclusion			
GR structural exclusion	THEOREM	V02.10	API-strengthened; Thm. 14.3
Hawking–Penrose not applicable	THEOREM	V02.3	No smooth causal manifold
No-go chain for ω_W			
Isotropic-even write: quadratic onset	NO-GO	V02.4	Lemma 9.1
Affine bg: drift-filtered	NO-GO	V02.4	Shell neutrality
Isotropic quadratic bg: no response	NO-GO	V02.4	Thm. 9.2
Scalar deviatoric invariants: quadratic	NO-GO	V02.4	Prop. from V02.4
Deviatoric bg opens first channel	PARTIAL	V02.4	E1 route
E1/E2 bifurcation theorem	THEOREM	V02.05	Prop. 9.3
E2 primitive write program			
Pathwise memory accumulation	THEOREM	V02.06	Replaces "monotone"
Headroom-gated ansatz well-posed	THEOREM	V02.05	Prop. 10.2
N2 (realized) $\succ$ N1 (shell-mean)	THEOREM	V02.05	Strictly preferable
O3 is correct E2 branch	THEOREM	V02.05	Unique admissible class
O3 admissible but not unique	THEOREM	V02.05	Canon forces family
Canon-forced structural-width envelope	THEOREM	V02.05	$\Delta_{\text{env}} = S_{\max} - S_{\min}$
Envelope write law well-defined	THEOREM	V02.05	Bounded, irreversible
Level-1 linear coarse coefficient	THEOREM	V02.06	Prop. 11.1; no new postulate
$P_W + P_\Delta$ close O3 ambiguity	CANON	V02.06	Prop. 11.2; with failure modes

Item	Status	Version	Note / Dependency
Sharp ω_W conditional	THEOREM	V02.06	Prop. 11.3; under $P_W + P_\Delta$
ω_W^{env} (Level 1)	PARTIAL	V02.06	Branch-conditional
ω_W (Level 2 functional form)	PARTIAL	V02.06	Cond. on $P_W + P_\Delta$
ω_W **branch universality**	OPEN	—	**Final E2 bottleneck**
Route B: normalization and ℓ			
K3 only viable Route B candidate	THEOREM	V02.05	K1,K2 fail screening
B1–B5 don't force uniqueness	THEOREM	V02.06	Prop. 12.1
$f_{\mathrm{sat}}(x) = 3A_{\max}x$ unique	THEOREM	V02.06	Prop. 12.2; under P_A
$\mathcal{B}(\ell, A_{\max}) = 0$ **bridge**	OPEN	—	**Final Route B bottleneck**
MOND numerical closure			
$g^\dagger \approx 1.2 \times 10^{-10}\,\mathrm{m\,s^{-2}}$	OPEN	—	After ω_W
$\mu(x) = x/\sqrt{1+x^2}$ derived	OPEN	—	Harder than $g^\dagger$
RAR $\mathrm{Var}[X] < \infty$ connection	PARTIAL	V02.10	Structural pathway stated
Causal memory kernel $\zeta(t)$	CANON	V02.07+	Connects to RAR; uniqueness open
$\rho_{\mathrm{eff}} = \rho_\kappa(1+\chi)$	CANON	V02.07+	Effective source
$\tau_0 \approx 3\,\mathrm{Gyr}$ RAR-anchored	PARTIAL	V02.10	Empirical; not derived
SI dimensional closure (one block)			
G in SI units	OPEN	—	After ℓ fixed
c numerical derivation	OPEN	—	After ℓ fixed
h numerical derivation	OPEN	—	After ℓ fixed
Empirical programme (verified against Zenodo records)			
Jupiter/Saturn paper (19058448)	PRE-REG	V02.10	Pre-measurement framework only; archival analysis pending
Spiral disk LSST (19024392)	PRE-REG	V02.10	6 predictions pre-registered; survey data pending
Galactic disk null result (18820324)	PARTIAL	V02.10	Non-detection consistent with quasi-steady branch; NGC 3198 null
$\tau_0 \approx 3\,\mathrm{Gyr}$ from MMGS	PARTIAL	V02.10	Empirical anchor; not axiomatic derivation
Kinematic discriminator grounded	THEOREM	Ham.	Via $R = \bar{M}/\bar{S}$ fundamental
Full tensor closure	OPEN	—	Subsequent paper

3 Dependency Tree

Target		**Requires**
ω_W universal (Level 2)	$\Leftarrow$	$P_W + P_\Delta$ + branch-universality proof
$g^\dagger$ numerical	$\Leftarrow$	ω_W (Level 2)
$\mu(x)$ derived	$\Leftarrow$	$g^\dagger$ + screened Poisson structure
$A_{\max}$ fixed	$\Leftarrow$	$P_A + \mathcal{B}(\ell, A_{\max}) = 0$
ℓ fixed	$\Leftarrow$	$A_{\max}$
G, c, h in SI	$\Leftarrow$	ℓ (one block)
GR exclusion (Thm. 14.3)	$\Leftarrow$	Memory-dependent admissibility + contractive irreversibility (V02.10)
Parallel tracks (fully independent of each other):		
E2 branch universality		Does not require Route B progress
$\mathcal{B}(\ell, A_{\max}) = 0$		Does not require ω_W
Juno/JUNO rigor upgrade		Independent; strategic priority

4 Submission Readiness by Paper

Paper	Readiness	Required actions
Primitive Operator Selection (Zenodo 19080033)	**Ready**	Add one sentence connecting $C[\text{hex}] = 1/3$ to Route B input; state $A_{\max} \to \ell$ bridge is open.
Gravity Hamiltonian (companion to 18529620)	**Near-ready**	(1) Abstract: state $g^\dagger$ structurally identified, not numerically derived. (2) API / Axiom 4 resolution incorporated. (3) Branch III: add one quantitative observational prediction.
Galactic Disk Discriminator (Zenodo 18820324)	**Near-ready**	(1) Promote RAR scatter / Var$[X]$ connection to abstract. (2) Add memory kernel section. (3) τ_0 repositioned as RAR-anchored. (4) Variable identification table added. (5) Null result for NGC 3198 reported prominently, not buried.
LSST Predictions (Zenodo 19024392)	**Near-ready**	State explicitly that ω_W open means predicted discriminator amplitude is structurally constrained but not first-principles closed.
Jupiter/Saturn Discrete States (Zenodo 19058448)	**Near-ready**	Make $\Gamma_U = \pi\sqrt{3}/3$ derivation chain explicit. Clarify: pre-measurement framework only; archival analysis is the next step.
UGM V02.10 (axiomatic core)	**Submission-ready**	Three referee fixes applied. Submit to Foundations of Physics, GRG, or EPJ A.
Juno/JUNO Oscillation (Zenodo 17676198)	**Rigor needed**	Derivation chain needs same standard as operator paper. Weakest entry point in the corpus; upgrade before corpus-level submission.
Five Impossible Problems (Zenodo 17706256)	**Repositioning needed**	Reframe explicitly as philosophical motivation companion, or upgrade to technical derivation paper.

5 Prioritized Next Steps

1. **[PARALLEL TRACK A — E2 branch universality]** Determine whether admissibility forces a unique active branch making $H_\star\chi^\star + \Delta_\star F'(S_\star)$ branch-independent. This is the sole remaining gate on universal primitive ω_W. If closed: $g^\dagger$ follows as landmark derivation (PRL-level target).
2. **[PARALLEL TRACK B — dimensional bridge]** Prove $\mathcal{B}(\ell, A_{\max}) = 0$ with dimensional dependence only through ℓ. Approach: compute $A_{\max}$ via K3 saturation from the hexagonal Brillouin-zone integral (tractable closed-form); verify uniqueness under P_A. If closed: G, c, h in SI all follow as one block.
3. **[IMMEDIATE SUBMISSION]** Submit V02.10 to Foundations of Physics or GRG. All referee-identified issues are resolved. The no-go chain, API, and GR exclusion theorem are publication-ready.
4. **[ADMINISTRATIVE — endorsers]** Follow-up emails to Hongsheng Zhao, Stacy McGaugh, Federico Lelli, Benoit Famaey, and Pavel Kroupa. Single-sentence hooks per en-

dorser below (§7).

5. **[CORPUS HEALTH — Juno/JUNO rigor]** Apply same derivation standard as operator paper. This is the weakest entry point for any endorser reading the corpus sequentially.
6. **[GRAVITY HAMILTONIAN PAPER]** Three targeted revisions (see readiness table), then submit to GRG or EPJ A.
7. **[AFTER ω_W CLOSED]** First-principles $g^\dagger \approx 1.2 \times 10^{-10}\,\mathrm{m\,s^{-2}}$ without free parameters. Target: Physical Review Letters.

6 What Must Not Be Claimed

Do NOT claim	Correct statement
τ_0 derived from axioms	τ_0 is empirically anchored via RAR scale matching; derivation is open
$a^\star$ derived analytically	$a^\star$ emerges from memory-kinematic timescales; numerical derivation awaits ω_W
Uniqueness of exponential kernel	Minimal admissible single-timescale candidate; uniqueness not claimed
MOND derived without caveats	MOND-like behaviour structurally derived; $\mu(x)$ and $g^\dagger$ open
GR excluded by irreversibility	GR excluded by memory-dependent admissibility (API argument)
G in SI units fixed	$G = \sqrt{3}/4\pi^2$ in natural units derived; SI requires ℓ first
Jupiter/Saturn results closed	Pre-measurement framework only; archival analysis pending
Galactic disk confirms framework	Non-detection consistent with quasi-steady assumption; NGC 3198 null result

7 Endorser Hooks

For Zhao / Famaey: "UGM derives Newton and MOND-like screened Poisson from a single Hamiltonian, distinguishes a third history-dependent branch where MOND-like scaling fails, and structurally excludes GR via memory-dependent admissibility, without importing gravitational data."

For McGaugh / Lelli: "The UGM admissibility condition $\mathrm{Var}[X] < \infty$ is the derived theoretical counterpart to the near-zero scatter of the RAR across 153 galaxies, upgrading the kinematic discriminator from a future test to a retroactive structural explanation of an existing landmark anomaly."

For Kroupa: "UGM pre-registers six predictions for galactic disk kinematics against Gaia DR3 and Rubin/LSST, with $\tau_0 \approx 3\,\mathrm{Gyr}$ anchored to the RAR characteristic scale rather than fitted to individual galaxies."

For Banik (via Zhao's redirect): "Branch III of the UGM gravity sector predicts that MOND-like scaling explicitly fails in history-dependent configurations (merging systems, tidal streams), providing a qualitatively distinct prediction from algebraic MOND models in exactly the regimes where Banik's observational programme operates."

References

References

[1] Villarroel H., J. G. (2026). *UGM V02.10: Axiomatic Admissibility-First Framework for Physical Reality*. Zenodo. doi:10.5281/zenodo.18529620

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[3] Villarroel H., J. G. (2026). *Primitive Operator Selection in Universal Grid Mechanics (UGM_02)*. Zenodo. doi:10.5281/zenodo.19080033

[4] Villarroel H., J. G. (2026). *Pre-Registered Observational Tests of Memory-Mediated Spiral Disk Dynamics: Predictions for the Legacy Survey of Space and Time*. Zenodo. doi:10.5281/zenodo.19024392

[5] Villarroel H., J. G. (2026). *Discrete Geometric State Catalogs and Bounded Atmospheric Evolution in Jupiter and Saturn*. Zenodo. doi:10.5281/zenodo.19058448

[6] Villarroel H., J. G. (2026). *A Reproducible Kinematic Relaxation Discriminator for Galactic Disks*. Zenodo. doi:10.5281/zenodo.18820324

[7] Villarroel H., J. G. (2026). *UGM — The Gravity Hamiltonian: Recovering Newton, Structural MOND-like Dynamics, and the Mathematical Proof That General Relativity Cannot Be Recovered*. Zenodo. doi:10.5281/zenodo.19142185
(Gap Accounting companion: `ugm_gap_accounting_v107.pdf`, included in this record.)

[8] McGaugh, S. S., Lelli, F., & Schombert, J. M. (2016). Radial Acceleration Relation in Rotationally Supported Galaxies. *Phys. Rev. Lett.*, 117, 201101. doi:10.1103/PhysRevLett.117.201101

[9] Lelli, F., McGaugh, S. S., Schombert, J. M., & Pawlowski, M. S. (2017). One Law to Rule Them All: The Radial Acceleration Relation of Galaxies. *Astrophys. J.*, 836, 152. doi:10.3847/1538-4357/836/2/152