A pre-registered galaxy-scale gravitational-slip prediction: screened metric response $\gamma_{\rm eff}(g_b)$ from a finite-QEC substrate

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Abstract

This is a *registration document*, not a results paper: it freezes, before the deciding data, a falsifiable galaxy-scale prediction of the finite-QEC substrate programme (TCH). The framework's dark-sector response split assigns massive tracers the reading $H = g_b + g_z$ and photons the reading $S = H + g_M$ with a screened metric response $g_M = \sqrt{a_0 g_b}\, e^{-g_b/(ka_0)}$, $a_0 = cH_0/2\pi$, $k = 1.9483$ (derived-conditional; chain summarised below). Galaxy-scale lensing-plus-dynamics comparisons therefore read an effective post-Newtonian-like parameter $\gamma_{\rm eff}(g_b) > 1$ that *rises toward low acceleration* — a signature produced by neither GR+CDM nor MOND-class single-operator theories, both of which predict $\gamma = 1$ at all g_b. The prediction already sits within 2.2σ of the strongest published constraint; one modern SLACS-class reanalysis binned in g_b, or one resolved measurement on a lens at $g_b \approx 4 \times 10^{-10}\,\mathrm{m\,s^{-2}}$ (predicted 12% lensing-mass excess), decides it. All numbers in this document are computed and asserted by a companion audit script; no-retune rules and disclosed open conditions are part of the registration.

1 The registered prediction

Photons read a screened metric (curvature/slip) response that massive tracers do not:

$$g_M(g_b) \;=\; \sqrt{a_0\, g_b}\;\exp\!\left[-\frac{g_b}{k\, a_0}\right], \qquad a_0 = \frac{cH_0}{2\pi} = 1.0422 \times 10^{-10}\,\mathrm{m\,s^{-2}}, \qquad k = 1.9483. \tag{1}$$

A lensing-plus-dynamics comparison at the Einstein radius of a lens with baryonic acceleration g_b reads

$$\gamma_{\rm eff}(g_b) \;=\; 1 + \frac{2\, g_M(g_b)}{g_b + g_z(g_b)}, \tag{2}$$

where g_z is the framework's zero-mode halo law inside its edge (parameter-free in this regime: $\rho_z = A/(r^2 + r_c^2)$, $A = \sqrt{GM_b a_0}/4\pi G$, $r_c = r_M/3$, $r_M = \sqrt{GM_b/a_0}$). Registered values, evaluated at the reference configuration $R_E = 4.2$ kpc (SLACS median); real tests evaluate per lens with the same mapping:

g_b ($\mathrm{m\,s^{-2}}$)	g_b/a_0	γ_{pred}
1.04×10^{-10}	1.0	1.756
2.08×10^{-10}	2.0	1.381
4.00×10^{-10}	3.8	1.121
7.30×10^{-10}	7.0	1.019
1.50×10^{-9}	14.4	1.0003
5.00×10^{-9}	48.0	1.0000

The distinctive, theory-discriminating feature is the *rise toward low acceleration*: GR+CDM predicts $\gamma = 1$ everywhere; MOND-class theories boost dynamics and lensing identically and also predict $\gamma = 1$. Nothing else known to us produces this curve.

2 Standing constraints (disclosed at registration)

Against published strong-lensing-plus-dynamics constraints, evaluated over declared conservative lens bands: Schwab, Bolton & Rappaport 2010 ($\gamma = 1.01 \pm 0.05$, 53 SLACS lenses): worst tension 2.21σ; Bolton et al. 2006 (0.98 ± 0.07): 2.01σ; Collett et al. 2018 (ESO 325-G004, 0.97 ± 0.09): 0.34σ. The registration is made *knowing* it sits within one error-bar improvement of falsification. The framework's low-acceleration programme is insensitive to the screening (weak-lensing offset window preserved at 98–99%; deep-tail slope 0.4995).

3 Derivation chain and statuses

(i) *Exponential survival form*: derived-conditional on the anchored Lindbladian layer — same-address service cycles conserve the response polarisation exactly (QEC protection); one committed syndrome increment decorrelates with $p = 1$; clocked (stroboscopic) service gives per-cycle survival $e^{-\nu_{\mathrm{loc}}/\nu_{\mathrm{svc}}}$; the Poissonian-service alternative $1/(1+x)$ is excluded at 3.4σ by the same γ constraints. (ii) *Scale* a_0: the only rate in the response sector; bounded by data to $[0.5, 2.0] \times a_0$. (iii) *Coefficient*: the committable channel is the secular Floquet–Kubo response of the tilted clock walk (the one-step impulse is non-committable micromotion), $\kappa_{\mathrm{FK}}(1/2) = 0.656125 \pm 0.00017$; exact $k_\perp$-fiber transfer to the isotropic 3D minimal record gives $\kappa_{3D} = 0.604312$, hence $k = \sqrt{2\ln 2}/\kappa_{3D} = 1.9483$. The one-bit commit trigger is data-selected (the 3-bit-trigger variant gives $k = 3.37$, excluded). Coefficient history with supersessions: $k = 1 \to 1.18 \to 1.7945 \to 1.9483$.

Disclosed open conditions: the substrate's 3D coin structure beyond dispersion grade (bipyramid face register); the R4-line-side identification; the witness acceleration-channel normalisation (non-load-bearing).

4 Kill and confirmation conditions (frozen)

Failure: any measurement or ensemble reanalysis at $g_b \le 7 \times 10^{-10}\,\mathrm{m\,s^{-2}}$ finding γ below the registered curve by $\ge 3\sigma$ under the registered per-lens mapping. **Positive**: a detected γ excess consistent with the registered curve, including its rise toward low g_b, without per-lens retuning. **Near-term decisive**: a SLACS-class reanalysis binned in g_b, or one Collett-style resolved lens at $g_b \approx 4 \times 10^{-10}$ (predicted 12% lensing-mass excess).

No-retune rules: k, the one-bit threshold, the minimal-record width, and a_0 may not be adjusted to fit future posteriors; no lens-type or environment-dependent screening may be introduced to rescue a failed test; a revision of k from the disclosed open conditions counts only if derived and dated *before* the deciding data. Allowed: recording branch failure (the ledger identifies which link broke), or opening a new labelled branch with its own date.

5 Provenance and audit

The registration is self-auditing: every number above is computed from the derivation chain and asserted by `slip_prediction_registration_audit.py` (exit 0 at registration). The full derivation ledger (fourteen gates, all exit 0, including three recorded witness-iteration failures and one same-day retraction) is in the programme repository at commits `f88402d` and `7f12b57` (`https://github.com/dgedge/octahedrons`), files `DRIFT.md`/`ANCHOR.md` entries dated 2026-07-10, with the machine-readable registration in `recent_papers/slip_prediction/slip_prediction_preregistration.json`.