Gravity Paper Round Check Report (Consistency + Parameter + Figure Pass)

Automated audit agent (Cursor)
for Jonathan Washburn

2026-01-11

Scope

This report documents *only* what was checked in the 2026-01-11 review round and the specific changes made as a result.

Primary paper `papers/tex/0-0-0-gravity-submission-aaa-v07-shorted-v04.tex`

Change log `planning/gravity_paper_change_log.md`

Canonical figure artifacts used for verification `external/gravity-canonical/figures/` and `external/gravity-canonical/paper/`

What we looked for (three passes)

1) Consistency pass ("% / percent / fraction / N=")

We scanned the paper for:

- Percent claims (e.g., `6\%`, `33\%`, "percent")
- Sample-size claims (e.g., `N=99`, `N=163`, `N\_total`)
- "fraction of" phrasing

and sanity-checked arithmetic against the sample sizes stated in the manuscript.

2) Parameter dictionary pass (equations ↔ table ↔ prose)

We cross-checked each parameter/hyperparameter so that:

- The *equations* use the same symbol/definition described in prose
- The parameter table uses the same symbol names as the error model and text
- If two quantities are related (e.g., a physical motivation vs a fixed coefficient), the mapping is stated explicitly rather than implied

3) Figure verification (caption matches what is plotted)

We visually verified key figures by comparing the manuscript captions to the plotted canonical figure PDFs in `external/gravity-canonical/figures/`. This includes checking:

- whether MOND is actually plotted where the caption implies it is
- whether numerical values in captions match the legend/curve labels
- whether qualitative claims in captions match the plotted ranges

Changes made (by Change ID)

All changes below are also recorded in `planning/gravity_paper_change_log.md`.

GP-2026-01-11-001	**Outlier fraction wording clarified.** **What was wrong**: The paper said "six outliers are 6% of Q=1" adjacent to "26 galaxies with $\chi^2/N > 5$". **Fix**: Clarified that 6% refers to the *six most extreme outliers* (Table `tab:outliers`), not the full outlier set. **Location**: Results → Outlier analysis paragraph "Summary and implications".
GP-2026-01-11-002	**Exponent convention sweep: time exponent α, acceleration exponent $\alpha/2$.** **What was wrong**: Multiple places still used $(a_0/a_{\rm baryon})^\alpha$ while other sections define α as the dynamical-time exponent (implying acceleration-space exponent $\alpha/2$). **Fix**: Replaced acceleration-space occurrences with $(a_0/a_{\rm baryon})^{\alpha/2}$ and added in-text markers. **Locations**: Eqs. `eq:weight_scaling`, `eq:weight`, `eq:a_eff_full`, `eq:v_eff_full`, and nearby narrative (weight/BTFR text).
GP-2026-01-11-003	**Geometric taper knob clarified (0.2 in $\zeta(r)$ vs "fixed h_z/R_d").** **What was wrong**: The paper documentation implied a fixed $h_z/R_d = 0.25$ "controls" $\zeta(r) = 1 - 0.2\tanh(r/R_d)$, creating an apparent 0.2 vs 0.25 inconsistency. **Fix**: Reframed the fixed setting as the *taper coefficient 0.2* in Eq. `eq:zeta`; kept $h_z/R_d \sim 0.2$–0.3 as physical motivation only. Updated table row and parameter-bounds paragraph accordingly. **Locations**: Sec. 3.5 parameter summary; Sec. 4 parameter-bounds paragraph; Table `crg:parameters`.
GP-2026-01-11-004	**Error-model table notation aligned with the error-model equations.** **What was wrong**: Table `crg:parameters` used "Fractional floor f" and "Non-circular drift", while Sec. `sec:error_model` uses $f_{\rm floor}$ and $\sigma_{\rm asym}$. **Fix**: Renamed rows to "Fractional floor $f_{\rm floor}$" and "Asymmetric drift $\sigma_{\rm asym}$".

	Location: Table `crg:parameters`.
GP-2026-01-11-005	**RAR caption MOND a_0 value made consistent with the plotted legend.** **What was wrong**: Fig. `crg:rar` caption said MOND uses $a_0 = 1.23 \times 10^{-10}$, but the plotted legend in the canonical figure shows $a_0 = 1.2 \times 10^{-10}$. **Fix**: Updated the caption value to match what is plotted. **Note**: This avoids ambiguity between the "standard MOND" value vs the fitted global-only MOND value used elsewhere.
GP-2026-01-11-006	**Weight-profile caption removed incorrect numeric $w(r)$ ranges.** **What was wrong**: Fig. `crg:weight_profiles` caption asserted specific $w(r)$ ranges that do not match the plotted `frg_weight_profiles` curves. **Fix**: Replaced those hard-coded numbers with qualitative wording consistent with the plot.

Figure verification notes (what we observed)

BTFR (Q=1)

The canonical BTFR figure (`external/gravity-canonical/figures/frg_btfr.pdf`) shows points and a single black line; it does *not* visibly include a MOND curve/series. The manuscript caption currently says "comparable to MOND" but does not explicitly claim that MOND is plotted. If the intent is to show MOND on the BTFR plot, that requires updating the figure (not just the caption).

RAR "Model vs MOND"

The canonical RAR comparison panel legend shows MOND with $a_0 = 1.2 \times 10^{-10}\,\mathrm{m/s^2}$, and the caption was updated to match (GP-2026-01-11-005).

Rotation curves + χ^2/N distribution

The canonical figures (`frg_rotation_curves.pdf`, `frg_chi2_dist.pdf`) visually match the manuscript descriptions (line styles and legend meanings).

Where to find the applied changes

In the paper, each change above is marked inline with `\RScom \{GP-2026-01-11-00x: ...\}`. In the log, see entries `GP-2026-01-11-001` through `GP-2026-01-11-006` in `planning/gravity_paper_change_log.md`.