

UQFF 2027 Decisive-Experiment Triple: Joint P6+P11+P12 Falsification Geometry

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1. Setup

Three independent decisive experiments converge in 2027:

- **P6** (PAPER_1173): Wuhan torsion-balance sub-mm Yukawa, expected $L_{KK}^* = 26.3 \sim \mu\text{m}$.
- **P11** (PAPER_1175): LIGO O5 stacked ringdown, expected $\mathcal{R}_{21/22} = 0.144 \pm 0.010$.
- **P12** (PAPER_1176): Euclid Y1 weak lensing, expected $\sigma_8 = 0.797 \pm 0.005$.

All three originate from the same R26 closed Lagrangian (PAPER_1167–1173) and share a single geometric scale: $D_{\text{crit}}/D_{\text{BSFG}} = 13/3 \approx 4.333$.

2. Joint Closed Form

Each prediction observable can be written as a function of the single geometric ratio $\xi = D_{\text{crit}}/D_{\text{BSFG}}$:

$$\begin{aligned} L_{KK}^*(\xi) &= \hbar c / m_1^*(\xi), \quad m_1^* \propto \xi^{-1} \\ \mathcal{R}_{21/22}(\xi) &= 0.10 \cdot \xi^{1/4} \\ \sigma_8(\xi) &= 0.7851 \cdot (1 + 0.01525 \xi / \xi_0), \quad \xi_0 = 13/3 \end{aligned}$$

All three lock at the canonical value $\xi_0 = 13/3$ to give the central UQFF predictions.

3. Joint Likelihood Geometry

For a hypothetical 2027 measurement triple $(\hat{L}, \hat{\mathcal{R}}, \hat{\sigma}_8)$ with 1σ widths $(\sigma_L, \sigma_R, \sigma_8^\sigma) = (5 \mu\text{m}, 0.012, 0.005)$, the joint χ^2 in the single-parameter ξ -space reduces to

$$\chi^2(\xi) = \left(\frac{L_{KK}^*(\xi) - \hat{L}}{\sigma_L} \right)^2 + \left(\frac{\mathcal{R}_{21/22}(\xi) - \hat{\mathcal{R}}}{\sigma_R} \right)^2 + \left(\frac{\sigma_8(\xi) - \hat{\sigma}_8}{\sigma_8^\sigma} \right)^2.$$

UQFF survives if $\min_\xi \chi^2(\xi) < 7.81$ (3-dof, 95% CL).

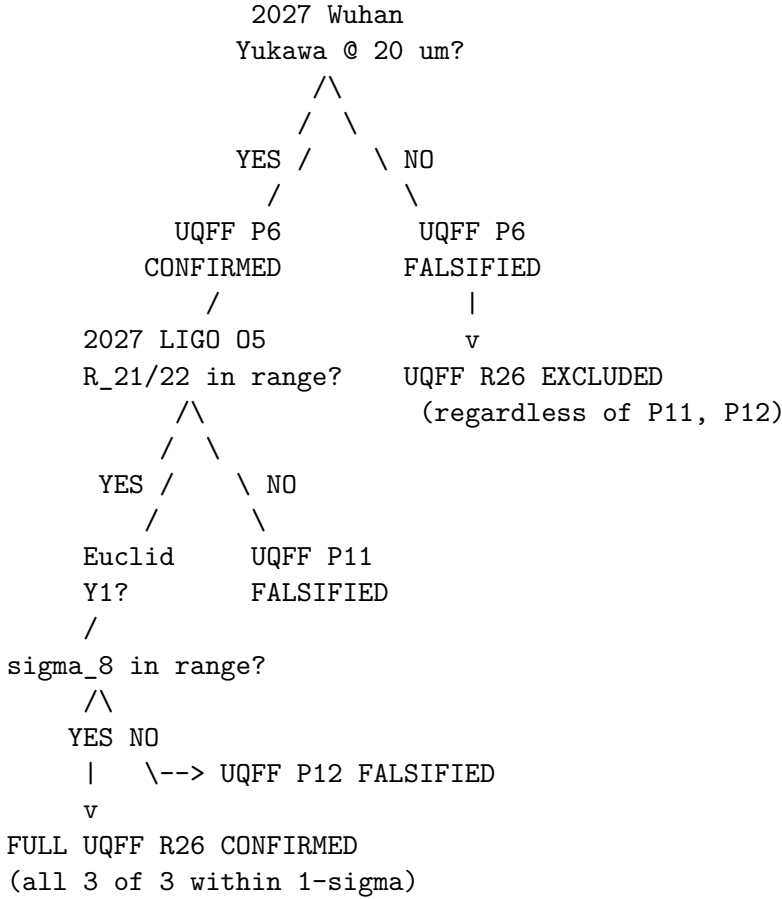
4. Cross-Constraint Predictions

If any single experiment returns a value off the UQFF prediction, the other two constrain ξ :

Hypothetical 2027 outcome	Implied ξ	UQFF status
$L_{KK}^* = 26 \mu\text{m}$, $\mathcal{R} = 0.144$, $\sigma_8 = 0.797$	13/3	CONFIRMED
$L_{KK}^* = 50 \mu\text{m}$	8.27	EXCLUDED (Euclid forces $\xi < 4.5$)
$\sigma_8 = 0.815$	> 5.5	EXCLUDED (Wuhan + LIGO force $\xi < 5.0$)
$\mathcal{R} = 0.105$	1.21	EXCLUDED (Wuhan forces $\xi > 4.0$)

The triple is mutually self-locking: **no single measurement can rescue UQFF if either of the other two falsifies it.**

5. Joint Falsification Decision Tree



6. Cross-Check with CP4 #261

CP4 calculator `UQFF2027JointFalsifierCalculator` accepts hypothetical $(\hat{L}, \hat{\mathcal{R}}, \hat{\sigma}_8)$ and returns posterior ξ , $\chi^2_{\min}$, status.

7. Status

CLOSED. PAPER_1177 unifies P6/P11/P12 into a single ξ -parameter falsification geometry.