

Every Prediction the Four Pillars Make That Could Kill the Framework

Where the four pillars are exposed. One row per pillar sub-theorem, each naming the prediction, the observable that would falsify it, and where the measurement stands today. The fourth column is the honest one: some rows are already confirmed to high precision and are no longer at risk, and the rest name the facility that will decide them. A framework that forces its parameters has to accept that a single failed row ends it. These are the pillars' own falsifiers, not the cohort's ten — for those see [GG-A1-Constitution](#). In full: [Table 20](#), p. 229.

Pillar / ST	Prediction	Empirical observable	Status / facility
TGG-ST6, ST7	Master Conservation Law $\nabla_\mu T_{\text{TGG}}^{\mu\nu} = 0$	Tests of energy/momentum conservation in any boundary process	Confirmed to 10^{-15} in low-energy experiments
CCI-ST7	Modified TOV $\Delta_{\text{GS}} \sim 9.6 \times 10^{-3}$	0.1%–1% shift of NS mass–radius curve from standard TOV	NICER (current); next-gen X-ray timing; LIGO/Virgo NS inspirals
GFF-ST7 (1)	Equipartition $\langle \delta X^2 \rangle = T_{\text{GFF}} \chi$ for any boundary observable	Universal T -scaling of fluctuations near equilibrium	Ultra-cold atoms, optomechanics; quantum-limited sensors
GFF-ST7 (2)	Fluctuation–dissipation: $\langle \delta F^2 \rangle = T_{\text{GFF}} \chi_{\text{GFF}}$	Einstein-type relation between mobility and diffusion	Mesoscopic transport experiments
GFF-ST7 (3)	Onsager reciprocity $L_{ij} = L_{ji}$	Symmetric cross-coupling matrix in any open boundary network	Molecular motors, active matter, biophysical networks
GRIP-ST7	Generation weight ladder $w_{[2k] \rightarrow [2(k-1)]} = e^{-\pi k}$	Geometric gate weight along the family chains $\tau \rightarrow \mu \rightarrow e, t \rightarrow \dots \rightarrow u/d$ (absolute lifetimes via A9)	Generation-ordering of the gate-action ladder; controlled-kinematics decay class
GRIP-ST7	Cascade-toll sum rule	$\sum_i S_{\text{tot}}^{(i)} = \pi N_g(N_g - 1)(N_g + 1)/6$, a toll budget, not a timescale	None by itself; the ordering is read from the mass hierarchy
BI-6 (Companion)	KK resonance cluster $M_{\text{lock}} \simeq 3.85 \text{ TeV}$	Tower of KK modes near 3.85 TeV in dijet/diphoton/dilepton	LHC Run 3, HL-LHC; FCC-hh
BI-6 (Companion)	Kaxion dark matter $m_K \approx 8.1 \text{ } \mu\text{eV}$	Ultra-light bosonic DM near μeV with axion-like couplings	ABRACADABRA, DMRadio, ADMX-EFR; cosmological constraints
GG-Cosmos	Modified Friedmann equations	Coherent shift of $f\sigma_8(z)$, $w(z) + 1 \propto \langle X_4 \rangle / M_{\text{KK}}^4$	DESI, Euclid, Roman Space Telescope; CMB-S4
GG-6F (code-book)	28 SM parameters at $\sim 0.5\%$ precision	e.g. m_τ/m_μ to 0.5% from cascade depths	Global SM precision fits (Particle Data Group (Particle Data Group, 2024))