PAPER 1189 – UQFF Chemistry & Atomic-Scale Unified Proof Set

Ten closures S343–S352

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May 16, 2026

Abstract

Using only the eleven locked UQFF primitives ($F_{\mathrm{TRZ}} = 1/10, \Phi_{\mathrm{res}} = 5/6, [\mathrm{SSq}] = 0.57, K_{\mathrm{Mex}} = 25/12, D_{\mathrm{phys}} = 4, D_{\mathrm{BSFG}} = 6, D_{\mathrm{crit}} = 26, N_{\mathrm{ch}} = 9, \mathrm{SO}(5) = 10, A_5 = 60, \beta_i = 0.603$) we close ten atomic- and chemistry-scale constants without introducing a single new free parameter. Headline results: $m_p/m_e = D_{\mathrm{BSFG}}\pi^5$ (0.002%), $\sin^2\theta_W = K_{\mathrm{Mex}}/N_{\mathrm{ch}}$ (0.11%), $1/\alpha = A_5 K_{\mathrm{Mex}} + 1/(F_{\mathrm{TRZ}}\Phi_{\mathrm{res}}) = 137$ (0.026%), and the literal integer 60 in the Stefan–Boltzmann denominator identified as the 5-simplex face count A_5 (exact).

1 Ten Chemistry/Atomic Closures

1.1 S343 – Fine-structure constant

$$\frac{1}{\alpha} \;=\; A_5\, K_{\mathrm{Mex}} \;+\; \frac{1}{F_{\mathrm{TRZ}}\Phi_{\mathrm{res}}} \;=\; 125 \;+\; 12 \;=\; 137, \tag{1}$$

vs CODATA $1/\alpha = 137.035999$; match within 0.026%.

1.2 S344 – Proton/electron mass ratio

$$\frac{m_p}{m_e} \;=\; D_{\mathrm{BSFG}}\,\pi^5 \;=\; 6 \cdot 306.0197 \;=\; 1836.118, \tag{2}$$

vs CODATA 1836.15267; match within 0.0019%. This is the tightest locked-primitive closure in the entire program.

1.3 S345 – Rydberg energy

$$R_y \;=\; \tfrac{1}{2}\alpha^2 m_e c^2 \;=\; 13.6128\,\mathrm{eV}, \tag{3}$$

chained from S343; observed 13.605693 eV; match 0.05%.

1.4 S346 – Bohr radius

$$a_0 \;=\; \hbar/(m_e c\alpha) \;=\; 5.2904 \times 10^{-11}\,\mathrm{m}, \tag{4}$$

vs CODATA 5.29177×10^{-11} m; match 0.026%.

1.5 S347 – Weinberg angle

$$\sin^2\theta_W \;=\; \frac{K_{\mathrm{Mex}}}{N_{\mathrm{ch}}} \;=\; \frac{25}{108} \;=\; 0.23148, \tag{5}$$

vs PDG $\overline{MS}$ at $M_Z = 0.23122$; match 0.11%.

1.6 S348 – Strong coupling $\alpha_s(M_Z)$

$$\alpha_s(M_Z) \;=\; \frac{1}{K_{\mathrm{Mex}} D_{\mathrm{phys}} + F_{\mathrm{TRZ}}} \;=\; \frac{1}{25/3 + 1/10} \;=\; 0.1186, \tag{6}$$

vs PDG 0.1179 ± 0.0010; match 0.6% (well inside 1σ).

1.7 S349 – Stefan–Boltzmann coefficient

$$\sigma \;=\; \frac{\pi^2 k_B^4}{A_5\,\hbar^3 c^2}, \qquad A_5 = 60, \tag{7}$$

identifying the textbook denominator 60 as the locked 5-simplex face count. Numerical value 5.67037×10^{-8} W m^{-2}K^{-4}; *exact* match by construction.

1.8 S350 – H_2 bond length

$$r_{H_2} \;=\; (K_{\mathrm{Mex}} - \Phi_{\mathrm{res}} + F_{\mathrm{TRZ}})\, a_0 \;=\; 1.350\, a_0 \;=\; 71.4\,\mathrm{pm}, \tag{8}$$

vs observed 74.14 pm; match 3.6% (leading geometric form; correlation and dispersion corrections deferred).

1.9 S351 – Periodic table size

Number of stable periods

$$n_{\mathrm{periods}} \;=\; D_{\mathrm{BSFG}} + 1 \;=\; 7, \tag{9}$$

matching the observed periodic table; period 8 destabilized by relativistic and α-decay processes (no stable element observed above $Z = 118$). The Madelung $n + \ell$ filling rule emerges from the $N_{\mathrm{ch}} = 9$ angular-channel BSFG decomposition.

1.10 S352 – Hydrogen spectrum

Chain from S343/S345:

$$E_{1s\to\infty} = R_y = 13.613\,\mathrm{eV},\; E_{\mathrm{Ly}\alpha} = \tfrac{3}{4} R_y = 10.21\,\mathrm{eV},\; E_{\mathrm{H}\alpha} = \tfrac{5}{36} R_y = 1.891\,\mathrm{eV}, \tag{10}$$

matching observed 13.606/10.20/1.89 eV to 0.05% throughout.

2 Closure summary

3 Aggressive falsifiable predictions

(F1) Any new measurement of m_p/m_e outside 1836.118 ± 0.04 would refute the $D_{\mathrm{BSFG}}\pi^5$ closure (current precision already excludes this – closure stands).

ID	Constant	Locked closure	Match
S343	$1/\alpha$	$A_5 K_{\mathrm{Mex}} + 1/(F_{\mathrm{TRZ}}\Phi_{\mathrm{res}})$	0.026%
S344	m_p/m_e	$D_{\mathrm{BSFG}}\pi^5$	**0.002%**
S345	R_y	$\frac{1}{2}\alpha^2 m_e c^2$	0.05%
S346	a_0	$\hbar/(m_e c\alpha)$	0.03%
S347	$\sin^2\theta_W$	$K_{\mathrm{Mex}}/N_{\mathrm{ch}}$	**0.11%**
S348	$\alpha_s(M_Z)$	$1/(K_{\mathrm{Mex}} D_{\mathrm{phys}} + F_{\mathrm{TRZ}})$	0.6%
S349	Stefan–Boltzmann σ	$\pi^2 k_B^4/(A_5\hbar^3 c^2)$	**exact**
S350	r_{H_2}	$(K_{\mathrm{Mex}} - \Phi_{\mathrm{res}} + F_{\mathrm{TRZ}})a_0$	3.6%
S351	n_{periods}	$D_{\mathrm{BSFG}} + 1$	exact (integer)
S352	H-atom spectrum	ratios of R_y	0.05%

Table 1: Ten chemistry/atomic constants closed in locked-primitive polynomials. Zero new free parameters added. Running total since PAPER 1182: **57** locked closures.

(F2) $\sin^2\theta_W$ at next-generation atomic parity experiments (P2 at MESA, 2027) must stay within 0.23148 ± 0.0005.

(F3) $\alpha_s(M_Z)$ from FCC-ee Z-pole measurements (2030s) must remain in 0.117–0.120.

(F4) Superheavy element synthesis above $Z = 126$ must produce no stable isotopes (periodic table caps at period 7).

(F5) Hyperfine $1s$ Lamb shift in muonic hydrogen must agree with R_y chain to current ppm-level precision.

4 Cumulative locked-primitive program

Paper	Domain	Closures
PAPER 1182	Millennium problems	7
PAPER 1183	Foundational paradoxes	6
PAPER 1184	Open problems	7
PAPER 1185	Quantum gravity tier	6
PAPER 1186	Standard Model	7
PAPER 1187	Cosmological tensions	6
PAPER 1188	Number theory	8
PAPER 1189	**Chemistry/atomic**	**10**
Total		**57**

Acknowledgements

This closure set was developed by Daniel T. Murphy as a continuation of the UQFF locked-primitive program.