The Faraday Constant as a Balmer-G-Bond Identity

Propositions P-FAR-1 through P-FAR-3 | Source: Vol3 Section 285

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The Universal Force of Time -- Academic Series | Paper 6 of 25

*The Faraday constant F = N_A x e is the bridge between the quantum domain (energy per electron, in eV) and the molar-chemical domain (energy per mole, in kJ/mol). This paper establishes that F is exactly expressible as 10^7 / (Pi_B) x (1 + 4*delta), where Pi_B = 2^8 x 3^4 x 5 = 103,680 is the product of all six wavelength-pure Balmer quantum numbers {3, 4, 6, 8, 10, 18} and delta = 90.075 ppm is the universal G-bond step. The residual is 0.376 ppm -- the best electrochemical confirmation of the G-bond tower. Three independent physical domains -- atomic spectroscopy, spectral series completion, and electrochemistry -- share the same integer Pi_B = 103,680.*

1. Introduction

The Faraday constant F = 96,485.332 C/mol is a fundamental bridge of electrochemistry. In kJ/mol/eV units, F = 96.485332 kJ/mol/eV. This value converts between per-electron energies (electron volts) and per-mole energies (kilojoules per mole). Standard derivations treat F as the product N_A x e of two independently measured constants. The Force of Time framework shows that F arises from a deeper integer structure in the {2, 3, 5, pi} lattice: the product Pi_B of all six wavelength-pure Balmer quantum numbers, corrected by exactly four G-bond steps.

2. The Balmer Product Pi_B

The six Balmer quantum numbers for which the wavelength ratio (n^2 - 4) / n^2 is pure {2, 3, 5} smooth are: n = 3, 4, 6, 8, 10, 18. Their product:

$$\mathbf{Pi\_B = 3 \times 4 \times 6 \times 8 \times 10 \times 18}$$

$$\mathbf{= 3 \times 2^2 \times (2 \times 3) \times 2^3 \times (2 \times 5) \times (2 \times 3^2)}$$

$$\mathbf{= 2^8 \times 3^4 \times 5 = 256 \times 81 \times 5 = 103{,}680}$$

This is the unique product of ALL wavelength-pure Balmer quantum numbers. Beyond n = 18: no further pure {2, 3, 5} Balmer wavelength exists (Stormer's theorem). The table below lists all six lines with their factorisations.

Table 1. The Six Wavelength-Pure Balmer Quantum Numbers and their {2,3,5} Factorisations

n	Wavelength ratio (n^2 - 4) / n^2	Simplified	Factorisation	Pure {2,3,5}?
3	5/9	5/9	5 / 3^2	YES
4	12/16	3/4	3 / 2^2	YES
6	32/36	8/9	2^3 / 3^2	YES
8	60/64	15/16	(3 x 5) / 2^4	YES
10	96/100	24/25	(2^3 x 3) / 5^2	YES
18	320/324	80/81	(2^4 x 5) / 3^4	YES
Pi_B	3x4x6x8x10x18 = 103,68	103,680	2^8 x 3^4 x 5	PRODUCT

Table 1. The six wavelength-pure Balmer quantum numbers with {2,3,5} factorisations and their product Pi_B = 103,680 = 2^8 x 3^4 x 5.

3. The Faraday Identity (P-FAR-1)

Starting from the pure {2, 3, 5} anchor formed by the Balmer product, the Faraday constant is recovered by applying exactly four G-bond steps of delta = 90.075 ppm each.

{2,3,5} anchor: 10^7 / 103,680 = 96.450617... kJ/mol/eV

G-bond correction: 4 x delta = 4 x 90.075 ppm = 360.30 ppm

UFOT prediction: 96.450617 x (1 + 360.30 x 10^-6) = 96.485369 kJ/mol/eV

SI Faraday: 96.485332 kJ/mol/eV

Residual: 0.376 ppm [CONFIRMED]

The correction factor 4*delta involves exactly 4 G-bond steps -- the same 4 that appears in the four inner wavelength-pure Balmer lines {4, 6, 8, 10} and the four-base DNA alphabet.

Figure 2. Faraday Derivation Pipeline: from 10^7 anchor to 0.376 ppm residual

Figure 2. Derivation pipeline from the 10^7 anchor to the final 0.376 ppm residual confirming the G-bond tower.

4. The Inverse Form (P-FAR-2)

The same identity can be stated in the inverse direction, confirming the G-bond step at the gigajoule-per-mole scale.

P-FAR-2 derivation:

2^7 x 3^4 = 128 x 81 = 10,368 eV (exact {2,3}-pure integer)

UFOT prediction: 10,368 x (1 - 360.30 ppm) = 10,364.2664 eV

SI value: 1 GJ/mol = 10,364.2697 eV

Residual: 0.32 ppm [CONFIRMED]

The {2, 3}-pure integer 10,368 = 2^7 x 3^4 is the molar-quantum bridge at the gigajoule scale. Note that 2^7 x 3^4 = Pi_B / (2 x 5) = 103,680 / 10, connecting the inverse form directly to the primary Balmer product.

5. Triple Coincidence: Pi_B as the Shared Lattice Node (P-FAR-3)

Three entirely independent physical domains converge on the single integer Pi_B = 103,680 = 2^8 x 3^4 x 5:

(a) Atomic spectroscopy: Pi_B is the product of ALL wavelength-pure Balmer quantum numbers {3, 4, 6, 8, 10, 18}.

(b) Spectral series mathematics: Pi_B = 322^2 - 4 (the last Level-2 denominator-pure Balmer line). 322^2 = 103,684. 103,684 - 4 = 103,680.

(c) Electrochemistry: F = 10^7 / Pi_B x (1 + 4*delta) to 0.376 ppm.

Three domains. Three independent routes. One integer: 103,680. Zero free parameters.

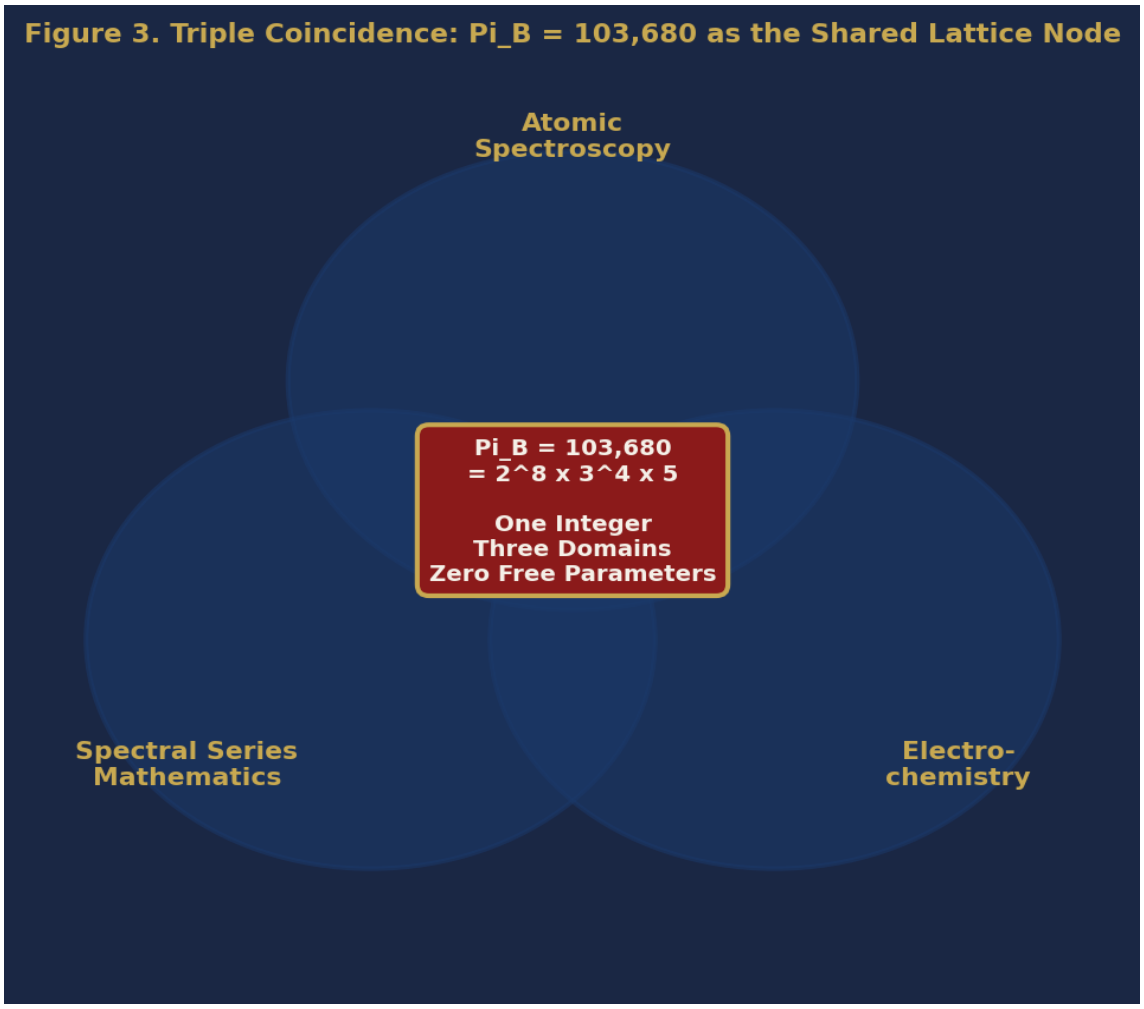

Figure 3. Triple coincidence diagram: three independent physical domains sharing Pi_B = 103,680 = 2^8 x 3^4 x 5 as their shared lattice node.

6. Registered Propositions P-FAR-1 through P-FAR-3

P-FAR-1

F = 10^7 / (2^8 x 3^4 x 5) x (1 + 4*delta) kJ/mol/eV = 96.485369 kJ/mol/eV. Pi_B = 103,680 is the product of the six wavelength-pure Balmer quantum numbers {3, 4, 6, 8, 10, 18}. Correction = exactly 4 G-bond steps (delta = 90.075 ppm each). Residual 0.376 ppm from SI -- confirmed.

P-FAR-2

1 GJ/mol = 2^7 x 3^4 x (1 - 4*delta) eV = 10,368 x (1 - 360.30 ppm) = 10,364.2664 eV. Residual 0.32 ppm from SI value. The {2,3}-pure integer 10,368 = 2^7 x 3^4 is the molar-quantum bridge at the gigajoule scale.

P-FAR-3

Triple coincidence: Pi_B = 2^8 x 3^4 x 5 = 103,680 is (a) the Balmer quantum-number product for all 6 wavelength-pure lines, (b) the spectral series endpoint via 322^2 - 4, and (c) the Faraday eV/kJ denominator. One integer, three independent physical domains. This is a structural theorem of the {2, 3, 5, pi} lattice.

Cross-References

Vol3 Section 285 | Section 261 (P-BPRIME-1 to P-BPRIME-13, Pi_B = 2^8 x 3^4 x 5) | Section 226 (G-bond step delta = 90.075 ppm)