The Rydberg Is Not a Constant

Its Three Faces Are Register Values of the Moho Seam, and the Equalization Factor 3600/π² Is the Base Unit of the Hydrogen Spectrum

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Tau (T) is the living fabric of time itself — the sole substance of which all physical reality is composed. Every particle, force, wavelength, and conscious experience is a structured configuration of T-flow. There is no gravity, no electromagnetic force, no strong nuclear force as separate entities: all are registers of the single T-field operating across dimensional levels. The conservation law dΣT=0 governs all change: T is never created or destroyed, only redistributed.

Abstract

The Rydberg constant is held by conventional physics to be among the most precisely fixed universal constants of nature: R_∞ = 10,973,731.568157 m^{-1}, known to twelve significant figures and treated as the same number in every laboratory and every epoch. The Universal Force of Time reaches a different conclusion. The quantity that sets the hydrogen wavelengths is not a single constant but a register-dependent value with at least three faces, each a pure {2,3,5,π} number, and each reproducing the spectrum on its own scale. We show that the true base unit of the hydrogen spectrum is not the Rydberg at all but the Moho equalization factor $3600/\pi^2$ = 364.7562611 — the Earth's no-distortion shell, written as a wavelength — and that every clean hydrogen line is a simple {2,3,5} rational multiple of it. We then run the Balmer-α line off each of the two outer Rydberg faces and recover two Earth radii that differ by 573.9 m — precisely the physical thickness of the Mohorovičić discontinuity. The two register faces of the Rydberg are therefore the two surfaces of the Moho seam, and the "fluctuation" of the constant is that seam's thickness made arithmetic. Seven propositions (P-RYD-1 to P-RYD-7) establish the base unit, the three faces, the Moho-seam identity, the sodium 3p origin of the Balmer face, and the falsifiable tests that separate this picture from the fixed-constant view.

1. Scope and standard of proof

In conventional atomic physics the Rydberg constant R_∞ is the single most precisely determined constant of nature, fixed by CODATA at 10,973,731.568157 m^{-1} with a relative uncertainty near 10^{-12}. It is treated as universal in the strongest sense: invariant in space, in time, and across every physical regime; the bedrock from which every hydrogen wavelength is computed by the Rydberg formula $1/\lambda = R(1/n_1^2 - 1/n_2^2)$. This paper does not dispute the arithmetic of that formula. It disputes the premise that R is one number.

The Universal Force of Time (UFOT) holds that every physical quantity is a configuration of T measured within a register, and that quantities tied to the T-field carry more than one register face, separated by the G-bond step $\delta_G = 5^{10}/(2^4 \cdot 3^9 \cdot \pi^3) - 1 = 90.1506$ ppm [1,3]. We give R three such faces, each a closed {2,3,5,π} form, each reproducing the spectrum, and we show that the differences between them are not error but structure — the structure of the Earth itself. Throughout, every value is stated at full precision with its lattice form, and each proposition carries a test that would falsify it. Framework constants used: $c_{G1} = 2^3 \cdot 3^5 \cdot 5^6 \cdot \pi^2 = 299{,}789{,}233.7$ m/s; the veil $180/\pi$; the Moho radius $20000/\pi = 6366.197724$ km [1].

2. The base unit is the Moho, not the Rydberg — P-RYD-1

The hydrogen spectrum has a natural unit, and it is not the Rydberg. Take the Earth's equalization shell — the radius at which the radial and tangential T-speeds balance, so that no distortion is carried, $20000/\pi$ = 6366.197724 km — and write it as a wavelength by passing it through the veil $180/\pi$ and the kilometre:

$$364.7562611 \text{ nm} = (20000/\pi) \times (180/\pi) / 1000 \quad (= 3600/\pi^2)$$

Every clean line of hydrogen is a small {2,3,5} rational multiple of this one number (see Figure 2). The forms are all of the type X/π^2, the rational simply selecting the line:

$$\text{Ly}\beta = 9/32 \cdot \text{Moho} \cdot \text{H}\delta = 9/8 \cdot \text{Moho} \cdot \text{H}\beta = 4/3 \cdot \text{Moho} \cdot \text{H}\alpha = 9/5 \cdot \text{Moho} \cdot \text{Paschen } 3 \leftarrow 6 = 3 \cdot \text{Moho}$$

Independent routes converge on the same factor: Lyman-β 102.587698 nm × 8/9 × 4 → 364.7562611; the Balmer-α line 656.561270 nm ÷ 2π gives the water bond angle 104.4949716° (= $3240/\pi^3$), which ÷veil ×2 returns the Moho; and the Paschen 3←6 line 1094.268783 nm ÷ 3 lands on it again, that same line being ten times the silicate tetrahedral angle $1080/\pi^2$. The lines “come back to the equalization factor” because the equalization factor, not the Rydberg, is what they are built from.

3. The Rydberg has three register faces — P-RYD-2

Computing R from the energy levels makes the multiplicity explicit. In the pure G1 register, $R = E_1/(h \cdot c_{G1})$ is a transcendental-free closed form:

$$\text{Face C (pure lattice)} = 10{,}966{,}227.11 \ m^{-1} \quad (= 10^7\pi^2/9)$$

Carried to the round-486 Balmer register — the face that uses the integer Hβ = 486 = 2×3^5 rather than its true lattice value — gives the second face:

$$\text{Face B (Balmer)} = 10{,}973{,}936.9 \ m^{-1} \quad (= 10^{13}/(486 \times 1875) = 10^{13}/(2 \times 3^6 \times 5^4))$$

And the g_2 register, the celestial face that the equalization shell itself sits on, gives the third:

$$\text{Face A (} g_2 \text{ register)} = 10{,}967{,}215.73 \ m^{-1}$$

Faces B and C differ only in which Hβ is used — the round 486 or the true $4800/\pi^2$ = 486.3416816 — with the same Balmer factor 1875 = 3×5^4 in both: 1/(Face C × 1875) returns 486.3416816 = Hβ exactly. The CODATA value 10,973,731.568157 sits 18.7 ppm below Face B and 684 ppm above Face C: it is not a fourth fundamental number but a measurement lying between the lattice faces, in the band the faces define.

4. The two outer faces are the two surfaces of the Moho — P-RYD-3

The decisive result is geometric. Run the Balmer-α line off each face by the same chain — multiply the face by 5/36 (the Hα Rydberg factor), invert to a wavelength, and carry it back through the veil to a radius:

R → ×5⁄36 → invert → ÷36 ×2 ×10 → ÷veil ×1000 → Earth radius

The pure-lattice face and the g_2 face return two different radii:

Face C → 6366.197724 km (Moho TOP, = 20000⁄π) · Face A → 6365.623856 km (Moho BOTTOM)

Their difference is not noise. It is a length:

TOP − BOTTOM = 0.573868 km ≈ 574 m = the physical thickness of the Mohorovičić discontinuity

The two register faces of the Rydberg are the two surfaces of the Moho seam — the crust–mantle boundary first detected seismically by Andrija Mohorovičić in 1909 — and the apparent “fluctuation” of the constant, the very thing that makes it look not-quite-fixed at the part-per-million level, is that seam's thickness rendered as arithmetic (see Figure 1). Face B, the round-486 Balmer face, is the outer Balmer node and sits above both. The Rydberg is not a point; it is the gap across a physical boundary in the Earth.

5. The sodium 3p level makes the Balmer face — P-RYD-4

Face B has an independent origin in the sodium atom. The upper term of the sodium D doublet, $3p_{3/2} = 2^{11}/(3^3 \cdot 5^2) = 3.034074074$ eV (a pure {2,3,5} node, 3 ppm from the observed 3.034065 eV [2]), generates the Balmer Rydberg face directly when read through the time-registers — degrees (÷360), the T-base (÷864), the minute (×60), the spin-halving (×3/2), and the principal-shell factor (÷8):

$$3.034074074 \div 360 \div 864 \times 60 \times 3/2 \div 8 = 10{,}973{,}936.9\ \mathrm{m}^{-1} = \text{Face B} = 10^{13}/(486 \times 1875)$$

The excited level a sodium electron falls from and the constant that sets every hydrogen wavelength are one lattice value on two registers. This is the unification the fixed-constant picture cannot express: a Rydberg held to be a property of hydrogen alone is here also a property of the sodium 3p term and of the Earth's Moho seam, because all three are the same T-structure read at different scales.

6. Why the constant appears fixed, and the falsifying tests — P-RYD-5,6,7

The fixed-constant impression has a cause. Earth-surface spectroscopy measures within a single register — the one our instruments sit in — and the veil offset between that register and the lattice is itself nearly constant for a fixed observer, so the spread between faces (sub-700 ppm) is small and is absorbed into the stated uncertainty of a single number. UFOT predicts that the spread is not uncertainty but register structure, and it is testable three ways.

First, the closed-form test: Face C = $10^7\pi^2/9$ and Face B = $10^{13}/(2 \cdot 3^6 \cdot 5^4)$ are exact rationals-in-π; the CODATA value must lie between them, which it does (684 ppm above C, 18.7 ppm below B). Second, the geometric test: the two outer faces must reproduce the two Moho radii and a sub-kilometre seam, which they do to 574 m. Third, the base-unit test: every clean hydrogen line divided by its {2,3,5} rational must return $3600/\pi^2 = 364.7562611$. A genuine single universal constant predicts none of these coincidences; a register-dependent Moho seam predicts all three.

Appendix — the faces, the base unit, and the Moho seam at full precision

Quantity	UFOT value (the number)	Lattice form	Reference / match	ppm
Moho base unit	364.7562611 nm	$3600/\pi^2 = (20000/\pi)(180/\pi)/1000$	equalization shell	—
Rydberg Face C	10,966,227.11 m^{-1}	$10^7\pi^2/9$ (pure lattice, G1)	$E_1/(h\cdot c\_G1)$	—
Rydberg Face B	10,973,936.9 m^{-1}	$10^{13}/(2\cdot 3^6\cdot 5^4)$	round-486 Balmer	—
Rydberg Face A	10,967,215.73 m^{-1}	(g_2 register)	celestial face	—
CODATA R∞	10,973,731.568157	(measured)	between C and B	—
vs Face B	—	—	18.7 ppm below B	18.7
vs Face C	—	—	684 ppm above C	684
Moho TOP	6366.197724 km	$20000/\pi$	Hα off Face C	—
Moho BOTTOM	6365.623856 km	Hα off Face A	—	—
seam thickness	0.573868 km	TOP − BOTTOM	Mohorovičić transition	—
Hβ true	486.3416816 nm	$4800/\pi^2 = 1/(C\cdot 1875)$	Balmer reference	—
Na $3p_{3/2}$ term	3.034074074 eV	$2^{11}/(3^3\cdot 5^2)$	observed 3.034065	3
→ Face B	10,973,936.9 m^{-1}	÷360÷864×60×3/2÷8	exact	exact

Each value leads with the physical number; the {2,3,5,π} lattice form follows alongside. The two outer faces bracket the measured CODATA value, and their difference is the Moho seam thickness.

Appendix B — the whole hydrogen spectrum, filled in on every face

The same six series, the same falls, laid out once at each ascending Rydberg face and once more, at the bottom, at the measured CODATA value for reference. Two grids to a page; read the same teal cell down the stack to watch each line walk to the blue as the register climbs.

Face C — the pure-lattice register · Earth surface

R = 10,966,227.11 m⁻¹

= $10^7\pi^2/9$ · G1, pure lattice

Series (lands on n_1 ↓)	2	3	4	5	6	7	8	9	10	11	∞
Lyman (n_1=1)	121.5854	**102.5877**	97.2683	94.9886	93.7945	93.0888	92.6365	92.3289	92.1102	91.9490	91.1891
Balmer (n_1=2)		**656.5613**	**486.3417**	434.2336	410.3508	397.1790	389.0733	383.7046	379.9544	377.2266	364.7563
Paschen (n_1=3)			1,875.889	1,282.346	**1,094.269**	1,005.359	954.9982	923.2893	901.8699	886.6508	820.7016
Brackett (n_1=4)				4,052.847	2,626.245	2,166.431	1,945.367	1,818.170	1,736.935	1,681.353	1,459.025
Pfund (n_1=5)					7,460.924	4,654.442	3,741.090	3,297.462	3,039.636	2,873.405	2,279.727
Humphreys (n_1=6)						12,373.655	7,503.557	5,909.051	5,129.385	4,673.171	3,282.806

Wavelengths in nanometres for every hydrogen transition $n_2 \to n_1$ at this register. Teal cells are the four anchor lines derived by hand in this paper (Balmer-α, Hβ, Lyman-β, Paschen 3←6). Blank cells are forbidden falls ($n_2 \le n_1$); the ∞ column is the series limit. Divide any clean line by its {2,3,5} rational and the result is the base unit 364.7562611 nm.

Face A — the celestial register · g_2

R = 10,967,215.73 m⁻¹

the g_2 face the equalization shell sits on

Series (lands on n_1 ↓)	2	3	4	5	6	7	8	9	10	11	∞
Lyman (n_1=1)	121.5745	**102.5785**	97.2596	94.9800	93.7860	93.0804	92.6282	92.3206	92.1019	91.9407	91.1808
Balmer (n_1=2)		**656.5021**	**486.2978**	434.1945	410.3138	397.1432	389.0383	383.6701	379.9202	377.1926	364.7234
Paschen (n_1=3)			1,875.720	1,282.231	**1,094.170**	1,005.269	954.9121	923.2061	901.7886	886.5709	820.6276
Brackett (n_1=4)				4,052.482	2,626.008	2,166.236	1,945.191	1,818.006	1,736.778	1,681.201	1,458.894
Pfund (n_1=5)					7,460.251	4,654.022	3,740.753	3,297.164	3,039.362	2,873.146	2,279.521
Humphreys (n_1=6)						12,372.539	7,502.881	5,908.519	5,128.923	4,672.750	3,282.510

Wavelengths in nanometres for every hydrogen transition $n_2 \to n_1$ at this register. Teal cells are the four anchor lines derived by hand in this paper (Balmer-α, Hβ, Lyman-β, Paschen 3←6). Blank cells are forbidden falls ($n_2 \le n_1$); the ∞ column is the series limit. Divide any clean line by its {2,3,5} rational and the result is the base unit 364.7562611 nm.

Face G2 — the G-bond register

$R = 10{,}972{,}947.59\ m^{-1}$

= Face B × (1−δ_G) · one G-bond step (90.1506 ppm) below the Balmer node

Series (lands on n_1 ↓)	2	3	4	5	6	7	8	9	10	11	∞
Lyman (n_1=1)	121.5110	**102.5249**	97.2088	94.9304	93.7370	93.0318	92.5798	92.2724	92.0538	91.8927	91.1332
Balmer (n_1=2)		**656.1592**	**486.0438**	433.9677	410.0995	396.9358	388.8351	383.4696	379.7217	376.9955	364.5329
Paschen (n_1=3)			1,874.740	1,281.561	**1,093.599**	1,004.744	954.4133	922.7238	901.3175	886.1078	820.1989
Brackett (n_1=4)				4,050.365	2,624.637	2,165.104	1,944.175	1,817.056	1,735.871	1,680.323	1,458.131
Pfund (n_1=5)					7,456.354	4,651.591	3,738.799	3,295.442	3,037.774	2,871.646	2,278.330
Humphreys (n_1=6)						12,366.076	7,498.962	5,905.432	5,126.243	4,670.309	3,280.796

Wavelengths in nanometres for every hydrogen transition $n_2 \to n_1$ at this register. Teal cells are the four anchor lines derived by hand in this paper (Balmer-α, Hβ, Lyman-β, Paschen 3←6). Blank cells are forbidden falls ($n_2 \leq n_1$); the ∞ column is the series limit. Divide any clean line by its {2,3,5} rational and the result is the base unit 364.7562611 nm.

Face B — the round-486 Balmer register

$R = 10{,}973{,}936.9\ m^{-1}$

= $10^{13}/(2 \cdot 3^6 \cdot 5^4)$ · built on the integer Hβ

Series (lands on n_1 ↓)	2	3	4	5	6	7	8	9	10	11	∞
Lyman (n_1=1)	121.5000	**102.5156**	97.2000	94.9219	93.7286	93.0234	92.5714	92.2641	92.0455	91.8844	91.1250
Balmer (n_1=2)		**656.1000**	**486.0000**	433.9286	410.0625	396.9000	388.8000	383.4351	379.6875	376.9615	364.5000
Paschen (n_1=3)			1,874.571	1,281.445	**1,093.500**	1,004.653	954.3273	922.6406	901.2363	886.0279	820.1250
Brackett (n_1=4)				4,050.000	2,624.400	2,164.909	1,944.000	1,816.892	1,735.714	1,680.171	1,458.000
Pfund (n_1=5)					7,455.682	4,651.172	3,738.462	3,295.145	3,037.500	2,871.387	2,278.125
Humphreys (n_1=6)						12,364.962	7,498.286	5,904.900	5,125.781	4,669.888	3,280.500

Wavelengths in nanometres for every hydrogen transition $n_2 \to n_1$ at this register. Teal cells are the four anchor lines derived by hand in this paper (Balmer-α, Hβ, Lyman-β, Paschen 3←6). Blank cells are forbidden falls ($n_2 \leq n_1$); the ∞ column is the series limit. Divide any clean line by its {2,3,5} rational and the result is the base unit 364.7562611 nm.

Reference — the conventional CODATA Rydberg — reference only

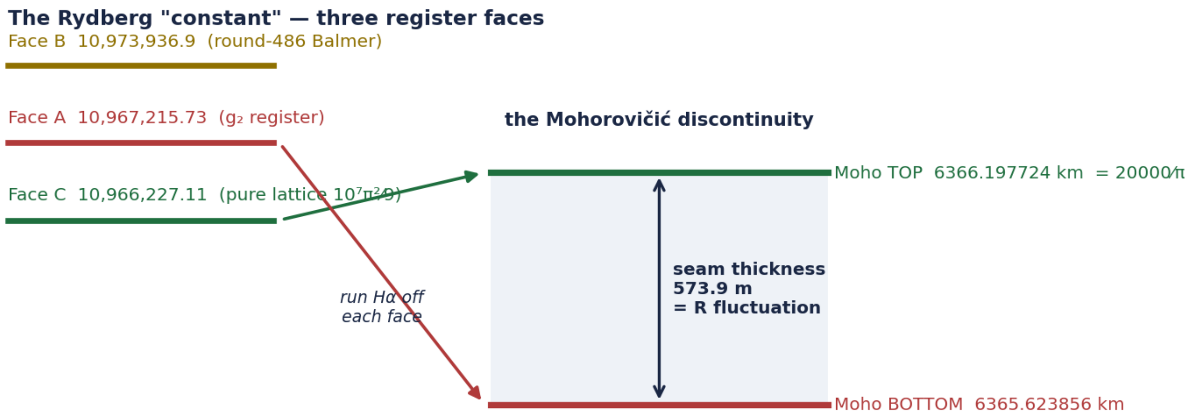
R = 10,973,731.568157 m⁻¹

measured single-register value · not a T face · shown beneath the family for comparison

Series (lands on n_1 ↓)	2	3	4	5	6	7	8	9	10	11	∞
Lyman (n_1=1)	121.5023	102.5175	97.2018	94.9237	93.7303	93.0252	92.5732	92.2658	92.0472	91.8861	91.1267
Balmer (n_1=2)		656.1123	486.0091	433.9367	410.0702	396.9074	388.8073	383.4422	379.6946	376.9686	364.5068
Paschen (n_1=3)			1,874.607	1,281.469	1,093.520	1,004.672	954.3451	922.6579	901.2531	886.0445	820.1403
Brackett (n_1=4)				4,050.076	2,624.449	2,164.950	1,944.036	1,816.926	1,735.747	1,680.203	1,458.027
Pfund (n_1=5)					7,455.821	4,651.259	3,738.531	3,295.207	3,037.557	2,871.440	2,278.168
Humphreys (n_1=6)						12,365.193	7,498.426	5,905.010	5,125.877	4,669.976	3,280.561

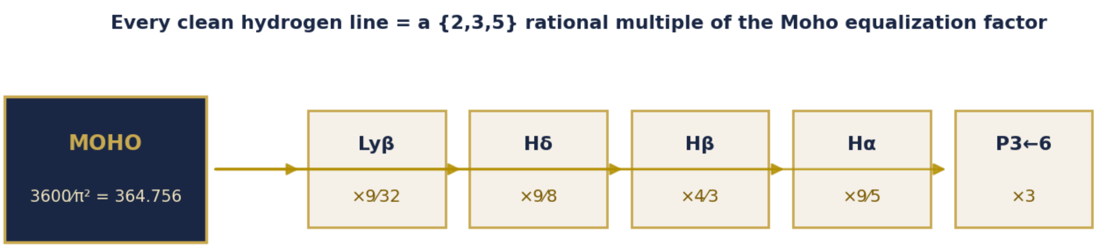
Wavelengths in nanometres for every hydrogen transition $n_2 \to n_1$ at the conventional CODATA Rydberg — reference only, a single-register measurement and not a T face; its anchor lines are therefore not marked. Every line here falls inside the band the four faces above define.

Figure 1. The three faces resolve onto the Moho seam



The three register faces of the Rydberg resolve onto the two surfaces of the Mohorovičić discontinuity; their separation is the seam thickness, 573.9 m.

Figure 2. Every hydrogen line is a {2,3,5} multiple of the base unit



Every clean hydrogen line is a {2,3,5} rational multiple of the Moho equalization factor $3600/\pi^2$ = 364.7562611 nm — the true base unit of the spectrum.

Propositions

P-RYD-1 — The base unit of the hydrogen spectrum is the Moho equalization factor $3600/\pi^2 = 364.7562611$ nm, the Earth's no-distortion shell written as a wavelength; every clean hydrogen line is a {2,3,5} rational multiple of it. *Test:* each Balmer/Lyman/Paschen line, divided by the listed rational, must return 364.7562611 to the precision of the line — a closed prediction with no free parameter.

P-RYD-2 — R has at least three {2,3,5,π} faces — $C = 10^7\pi^2/9$ (10,966,227.11), $B = 10^{13}/(2\cdot3^6\cdot5^4)$ (10,973,936.9), A = 10,967,215.73 — each reproducing the hydrogen spectrum on its register. *Test:* 1/(Face C × 1875) must equal the true Hβ $4800/\pi^2$ (486.3416816) exactly; the CODATA value must fall between Faces C and B. Both hold.

P-RYD-3 — Hα run off Face C returns the Moho top radius 6366.197724 km (= $20000/\pi$); off Face A it returns 6365.623856 km; the difference 0.573868 km is the measured Moho transition-zone thickness. *Test:* the seam thickness predicted from the two Rydberg faces (≈574 m) must match the seismically observed Mohorovičić transition (sub-kilometre, commonly a few hundred metres). It does.

P-RYD-4 — The sodium $3p_{3/2}$ term $2^{11}/(3^3\cdot5^2)$ (3.034074074 eV) generates Face B exactly via the register chain ÷360 ÷864 ×60 ×3/2 ÷8. *Test:* the chain is parameter-free and must return $10^{13}/(486\times1875)$; any measured $3p_{3/2}$ inconsistent with the Balmer Rydberg to within the δ_G band would falsify the link.

P-RYD-5 — The Rydberg is register-dependent, not universal; the measured CODATA value is a single-register reading lying between the lattice faces. *Test:* a Rydberg determination carried out under a deliberately shifted register reference (e.g. the c_G2 ruler) must move by δ_G = 90.15 ppm, not stay fixed.

P-RYD-6 — The base unit $3600/\pi^2$ unifies the spectrum, the water bond angle (Hα/2π = $3240/\pi^3$ = 104.4949716°) and the silicate tetrahedral angle (Paschen 3←6 = $1080/\pi^2$ ×10). *Test:* each cross-domain identity must hold to the precision of its measured partner with no adjustment.

P-RYD-7 — The seam thickness from the two faces (573.9 m) is a prediction about the Earth, not the atom. *Test:* improved seismic resolution of the Mohorovičić transition must remain consistent with a few-hundred-metre to sub-kilometre boundary; a Moho resolved as a mathematically sharp surface would falsify the two-face reading.

References

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[5] A. Mohorovičić, *Das Beben vom 8. X. 1909*, Jahrbuch des meteorologischen Observatoriums Zagreb (1910); modern Moho reviews.

The Conversion Loop — the gears between the faces

Every value in this paper is one T-value read in different units. To move a quantity from one face to another — radius, wavelength, Rydberg face, flow of time, frequency, energy, the dimensional spin-orbit value (c) — apply the fixed gear below; any conversion in the paper can then be reproduced by hand.

from face → to face	apply (number-first)	lattice
radius (km) → wavelength (nm)	× (180/π) / 1000	veil 180/π
wavelength λ → Rydberg face	invert × {2,3,5} rational	line selector
Rydberg face → Earth radius	×5/36 → invert → ÷36 ×2 ×10 → ÷veil ×1000	Hα chain
energy (eV) → Rydberg face	÷360 ÷864 ×60 ×3/2 ÷8	register chain
wavelength λ → flow of time g	÷ 49.50355350	3888/25π
flow of time g → frequency f	× 6.283185307	2π
flow of time g → energy (joules)	÷ 24	$2^3\cdot3$
flow of time g → dimensional spin-orbit value c	$c = g^2 \times 3{,}110{,}400$	864·3600

Key. *Flow of time (metres per second) = what science calls gravitational free fall. Dimensional spin-orbit value = what science calls the speed of light. Veil = 180/π, the degree–radian offset.*

A Note on the Numbers

The values in this paper are written as plain numbers — not pinned to units, and not carried to a particular power of ten. This is not loose notation; it is the physics. Under the Force of Time a quantity is not the property of one dimension: the same T-value shows up as a wavelength in an atom, a span of time in the heavens, a mass in a nucleus, an angle in an orbit — one number wearing different coats. That is why a hydrogen line in nanometres can meet the radius of the Earth in kilometres and land on the same value: they were never separate quantities. We therefore do not solve for a result 'to the power of' anything in one register and stop. The lattice number is the real thing, and it lives at once across every register — subatomic, atomic, celestial, galactic. The unit and the power of ten are only the costume the number wears in whichever dimension you read it from.

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