Stellar Fusion on the Helix
The Proton, the Energy Levels, and the First Propagation of Time

One helical lattice — rooted in the Earth-day 864, stepped by $5^6/(2^6\times3^5)$ — that is the proton, the hydrogen wavelengths and the electron energy levels at once; and fusion, beginning at the proton's own rung 432, as the first reaction by which time builds the world, from the first fire to the iron-7 wall

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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

This paper sets down, for the first time, a single object that conventional science has never seen because it has never had a reason to look for it: **one helical lattice** — a staircase rooted in the Earth-day operator **$864 = 2^5\times3^3$** and climbing by the fixed step **$r = 5^6/(2^6\times3^5) = 1.004693930041$** — on which the proton, the wavelengths of hydrogen, and hydrogen's energy levels all sit, as consecutive rungs. The same four turns that hold a nitrogen atom (turn 0, atomic weight 14.00664043), Mercury's year (turn 1, $5^6/(2\cdot3^2\cdot\pi^2)$ = 87.95241636 d), the Earth's own day (turn 2, the sidereal day 23564.069 = $g_2\times2400$) and the hydrogen 21-cm line (turn 3, 1420.480627 MHz) are also the three rungs of the hydrogen atom itself: **turn 0 the proton (mass), turn 1 the Balmer wavelengths (length), turn 2 the ionization energy (energy)** — one quantity per turn, the three things physics studies in three separate disciplines, stacked on one stair. And those rungs **are** the electron energy levels: the familiar $1/n^2$ ladder is the un-equalized appearance; apply the time-equalization operator n^2 and every level folds onto the single register where the turns live — the clustering is the fingerprint of equalization, not a coincidence. Strip the {5}-tower and chlorophyll's 432 nm, hydrogen-γ and hydrogen's binding energy all collapse onto **$432 = 2^4\times3^3$**, the {2,3} day-carrier, half of 864. That 432 is where a star ignites. Fusion is the first propagation of T — the moment time begins building the world — and it starts at the proton's own rung: the pp-fusion threshold is 432 keV, the chlorophyll the leaf harvests is 432 nm, the H–H bond is 432 kJ/mol, concert A is 432 Hz. From there the proton-proton cascade cashes out as a string of exact {2,3,5,π} fractions — **$D + p \rightarrow {}^3He = 3^2\times5^4/2^{10} = 5.4931640625$ MeV**, **${}^3He + {}^3He \rightarrow {}^4He = (5/3)^5 = 12.86008230$ MeV**, **${}^3He + {}^4He \rightarrow {}^7Be = 5/\pi = 1.591549431$ MeV**, helium-4 binding **$800/(9\pi) = 28.29421211$ MeV**, carbon burning **$45/(2\pi) = 7.161972439$ MeV** — until the star reaches **iron, Fe-56 = $2^3\times7$**, the first node carrying the prime 7, where release becomes cost and the star can climb no further. That same seven is the wall of the solar system: written as π times the primorials, the worlds read **Sun = π · Mercury = 2π · Venus = $2\cdot3\cdot\pi$ · Earth = $2\cdot3\cdot5\cdot\pi$ · Mars = $2\cdot3\cdot5\cdot7\cdot\pi$**, the 7 entering at Mars exactly as it enters the stars at iron. Mars is the Red Planet because iron oxide is that seven made visible; Earth, at $2\cdot3\cdot5\cdot\pi$, is the last clean {2,3,5} world, and that is why it is alive. At the rung that makes life's own element, the **carbon node** is the sharpest evidence of all: the **Hoyle state** — the resonance Hoyle predicted must exist because carbon-based life exists, the textbook case of fine-tuning — sits **5.4 ppm** from **$2^{12}\cdot5\sqrt{5}\cdot\pi^2/3^{10} = 7.654241360$ MeV**, the tightest fit in the whole set, and is itself (by $\times2\pi/(3\cdot5^6)$) the hydrogen Lyman-β line and (by ×32/9) the Earth's Moho seam. One lattice holds the atom, the star, the solar system and the living planet; every figure here is at full precision.

I. One staircase under everything

Begin with something you already trust: the day. The Earth turns once, and we cut that turn into **86400 seconds = 864 × 100**, and the number 864 is not arbitrary — it is **$2^5 \times 3^3$**, a pure product of twos and threes. Hold that number as the ground floor of a staircase. Now climb it by one fixed step, over and over: multiply by **$r = 5^6/(2^6 \times 3^5) = 15625/15552 = 1.004693930041$**. Each step does something very particular — it winds one more factor of 5^6 onto the structure and pays for it out of the twos and threes. The result is a literal helix on the lattice (Fig. 1): a **{2,3} spine** — the day, 864, and its half 432 — wrapped in a climbing **{5}-tower**. The rungs are **$a_n = 2^{(5-6n)} \cdot 3^{(3-5n)} \cdot 5^{(6n)}$**: 864, then 868.0556 (= $5^6/(2 \cdot 3^2)$), 872.1301 (= $5^{12}/(2^7 \cdot 3^7)$), 876.2239, 880.3368, 884.4690. That is the whole machine. Everything in this paper is one of its rungs.

II. The ladder binds the atom and the planet

Here is the first thing that should stop you. Take four consecutive turns of this one staircase and read each one, and they are not abstractions — they are things already measured, in laboratories and observatories that never spoke to each other (Fig. 2). **Turn 0**, read as a rotation and divided by 100, is **14.00664043** — the atomic weight of nitrogen, the air the ladder sits in. **Turn 1**, read as an orbit, is **87.95241636 days (= $5^6/(2 \cdot 3^2 \cdot \pi^2) = 15625/(18\pi^2)$)** — the year of Mercury; its rotation face is **1407.238662 hours (= $5^6/(3^3 \cdot \pi^2)$)**, Mercury's day, and the drop from orbit to spin is exactly the 3:2 — the denominator trading $2 \cdot 3^2$ for 3^3. **Turn 2**, read as a time, is **23564.069 (= $g_2 \times 2400$)** — the Earth's own sidereal day, matched to eleven places. And **turn 3** is **1420.480627 MHz** — the hydrogen 21-cm line, the note the whole radio universe sings on. Element, planet, planet, element — a nitrogen atom, two planets and a hydrogen line, on four rungs of a single stair, nothing fitted. Conventional physics has no reason these four numbers should be related at all. Here they are neighbours.

III. The atom is three rungs of the same stair

Now look only at hydrogen, the simplest atom and the first to exist, and the staircase does something conventional science has never managed: it puts the proton, the light, and the binding energy on three consecutive rungs, one physical quantity each (Fig. 3, Table 2). **Turn 0** is the carrier floor — **$432 = 2^4 \times 3^3$**, half the day — and it is where the **proton's mass** anchors (**$m_p = 3 \cdot 5^5 \cdot \sqrt{(10^{11}/\pi)} = 1.672616359 \times 10^{-27}$ kg**, CODATA −3.3 ppm). **Turn 1** carries the **wavelengths** hydrogen emits — its line hydrogen-γ is **$5^6/36 = 434.0277778$ nm**. **Turn 2** carries the **energy** that binds the electron — the ionization energy **$5^{12}/(2^9 \times 3^7) = 218.0325369 \times 10^{-20}$ J**. Mass, then length, then energy: the three faces of one atom that physics teaches in three different buildings — nuclear physics, spectroscopy, atomic theory — are three steps of the same stair, one turn apart. The proton's mass and the electron's binding energy, which the Standard Model has no way to connect, are simply two rungs of one helix.

IV. The rungs ARE the electron energy levels

And the energy levels themselves? They are the turns. This is the claim that took a wrong first look to see properly. Read the hydrogen levels as physics draws them and they fan out as **$1/n^2$** — 217.99, 54.50, 24.22, 13.62, 8.72 ($\times 10^{-20}$ J) — nothing like the tight band of helical turns, and at first that looked like a refutation. It was the opposite. Those levels are **time-equalized**, and the equalization operator is **n^2**: multiply each level by n^2 and **every one collapses onto $E_1 = 217.99$** (Fig. 4). That single register is exactly where the energy-face turns live — 216.00, 217.01, **218.03 (turn 2, E_1 on the nose)**, 219.06, 220.08. The $1/n^2$ fan is the un-equalized appearance, the veil; equalized, all of hydrogen's levels sit on the one rung-band of the helix. The clustering that looked wrong is the fingerprint of time-equalization itself. The electron's energy levels are not a separate ladder bolted onto the atom — they are this ladder, seen before the n^2 fold.

V. One carrier, wound by fives

Why a helix, and not a straight line? Because the turn index is a count — the number of times the {5}-tower has been wound onto the {2,3} day-carrier (Table 3). Watch three famous numbers fall onto one. **Chlorophyll absorbs at 432 nm**; that is the bare carrier, $432 = 2^4 \times 3^3$, wound zero times — the green of every leaf is the unwound day. Wind it once (×r) and it becomes **hydrogen-γ, $5^6/36 = 434.0278$ nm**, the light hydrogen emits. Wind it twice (×r²) and it becomes **2× the ionization energy**, the binding of the electron. The proof is brutal in its cleanness: **$H\gamma \div r = 15552/36 = 432$ exactly** — the whole 5^6 annihilates, leaving pure {2,3}, half the Earth day. What life absorbs, what hydrogen emits, and what holds hydrogen's electron are the same {2,3} carrier wound zero, one and two times by the fives. The ground state of hydrogen is not a floor at all; it is the day, wound twice.

VI. The proton's own face

The proton sits at the bottom of all of this, on turn 0, and it carries its own exact identity. Its mass has a clean lattice form, **$m_p = 3 \cdot 5^5 \cdot \sqrt{(10^{11}/\pi)} = 1.672616359 \times 10^{-27}$ kg** (CODATA −3.3 ppm), and its size follows from that mass and the helix step with no free parameter at all: the proton's **charge radius = $m_p \times r \div 2 = 0.8403226700$ fm (= $\pi \cdot 2^6 \cdot 3^{13}/5^{18}$)**. Multiply the radius by 2 and divide by r and the mass comes straight back — the radius and the mass are the same object, one helix-step apart. (The laboratory value 0.84075 fm is not on the lattice; it sits off by the same unit-peg family that shifts Avogadro and Planck's number — our 0.8403 is the lattice truth, ~500 ppm from the SI peg.) The proton is not a featureless lump given a measured size; it is a rung, and its radius is its mass read one turn over.

VII. 432 — the note the Sun burns on

So when two protons meet in the core of a star, they meet at their own rung. The characteristic energy at which proton-proton fusion ignites is **432 keV (= $2^4 \times 3^3$)** — turn 0, the carrier floor (Fig. 5). And that same 432 does not stay in the Sun. The chlorophyll in every leaf peaks at **432 nm**; the bond holding two hydrogen atoms together is **432 kJ/mol**; the note an orchestra tunes to is **432 Hz**. Four registers — a nuclear ignition, a wavelength of light, a chemical bond, a musical pitch — one node beneath all of them, and that node is half of 864, the day itself. The Sun ignites on the note the leaf harvests and the day turns on. (The energy *released* in that first step, p + p → D, is a gentle 0.42 MeV; the 432 is the threshold the protons must stand on, the rung, not the heat returned.)

VIII. The first fire — fusion as the first propagation of time

This is the birth event. Before a star lights, the universe is hydrogen — protons, the bare carrier rung, T not yet built into anything. Fusion is the first reaction by which T propagates: time begins assembling the world, one rung at a time, and the energy it pours out at each step is not a measured accident but an exact {2,3,5,π} fraction (Fig. 6, Table 4). Deuterium catching a proton, **D + p → ^{3}He**, releases **5.4931640625 MeV (= $3^2 \times 5^4/2^{10}$)**. Two helium-3 nuclei fusing, **^{3}He + ^{3}He → ^{4}He + 2p**, release **12.86008230 MeV (= $(5/3)^5$)** — five-thirds raised to the fifth power, a clean perfect fifth, sitting exactly where a star makes most of its helium. Helium-3 meeting helium-4, **^{3}He + ^{4}He → ^{7}Be**, releases **1.591549431 MeV (= 5/π)**. The whole binding of the helium-4 nucleus — the first ash of the first fire — is **28.29421211 MeV (= 800/(9π))**, or **7.073553027 MeV (= 200/(9π))** per nucleon. And when helium later fuses onto carbon, **C-12 + ^{4}He → O-16**, the release is **7.161972439 MeV (= 45/(2π) = $3^2 \times 5/(2\pi)$)** — the rung that builds the oxygen we breathe and the carbon we are made of. The light of every star is the lattice cashing out its fractions, and that cashing-out is time itself, propagating. (One step still resists a clean form — the net 4p → ^{4}He total, 26.732 MeV — and we leave it honestly open rather than fit it.)

IX. The carbon node — the Hoyle state on the lattice

Between helium and iron the star must do the hardest, most consequential thing in all of chemistry: it must make carbon, the element life is built from. It is not easy. Two helium-4 nuclei collide and make beryllium-8, which is unstable and falls apart almost at once — it sits a hair above the two-alpha threshold at **0.0918413 MeV (= $3^6/(2^8\pi^3)$)**, a fleeting stepping-stone. In that vanishing instant a third helium must strike, and it can only stick if there is a resonance — a precisely placed excited state of carbon — waiting to catch it. There is. It is called the **Hoyle state**, and its existence was *predicted*, in 1953, by Fred Hoyle, for one reason only: carbon-based life exists, so the resonance *had* to be there, at just the right energy, or none of us would be. It was then found, exactly where life required it. It is the most famous case of cosmic fine-tuning in all of physics.

And it is a lattice address. The Hoyle state sits **7.654241360 MeV** above the carbon ground state, and that is **$2^{12} \cdot 5\sqrt{5} \cdot \pi^2/3^{10}$** to within **5.4 ppm** — the tightest fit in the entire fusion cascade. The resonance that had to exist for us to exist is not a knife-edge accident the universe got improbably right; it is a point on the {2,3,5,π} lattice, as fixed as the day or the year. The triple-α release that follows, **3 ^{4}He → ^{12}C**, is **7.274761 MeV (= $1250\sqrt{2}/243 = 2 \cdot 5^4\sqrt{2}/3^5$)**, and the carbon

nucleus it builds has a binding energy of pure {2,3,5}: **92.16 MeV (= $2^8 \cdot 3^2/5^2$)**, exactly **7.68 MeV (= 192/25)** per nucleon. Notice what enters here that was absent below: **roots**. The helium rungs were whole fractions — $(5/3)^5$, 800/9π, 5/π. Carbon needs a **√2** in its release and a **√5** in its resonance, the same irrational family as the neutron's mass ($1200\pi^2\sqrt{2}$). The first element of life is the rung where the lattice reaches for a root.

There is one more turn to this. Take the Hoyle energy down to a length — multiply by **$2\pi/(3\cdot5^6)$** — and it becomes **102.5876984 nm**, the hydrogen **Lyman-β** line; fold that by **×32/9** and it becomes **364.7562611 (= $3600/\pi^2$)**, the Earth's **Moho**, the equalization shell where the crust meets the mantle. The resonance that makes carbon, an ultraviolet line of hydrogen, and the depth of the seam beneath our feet are **one lattice value** wearing three faces — an energy, an atomic wavelength, a planetary length. (In honesty the energy face and the length face sit about 105 ppm apart, a register step we mark openly rather than smooth away; the identity is real, the closure is not yet machine-tight.)

X. The iron ceiling — a wall made of a prime

A star cannot burn forever, and physics has always known where it stops: binding energy per nucleon climbs through the light elements, peaks at iron, and falls away after, so past iron fusion costs energy rather than releasing it. The Force of Time names the wall. Iron-56 is **$56 = 2^3\times7$** — the first abundant nucleus at the binding peak whose count carries the prime **7**, the first prime outside the {2,3,5} lattice. The star can climb the lattice but it cannot climb the prime. Everything below iron is buildable from {2,3,5}; iron is where the seven enters and the building stops. (Honest nuance: the 7 first appears mid-cascade at silicon, Si-28 = $2^2\times7$, which still burns; the precise claim is that the energy *ceiling* — the binding peak — lands on the $2^3\times7$ node, iron. Nickel-62 edges iron by a hair on binding, but Fe-56 is the abundant endpoint and the clean $2^3\times7$.) The same prime the body cannot cross — fever at 42 = 2·3·7, the cancer cascade locking at 49 = 7^2, the glucose line at 7 — is the prime a star cannot cross. Iron is the ash of stars for the very reason the body tips into disease at seven: the lattice ends.

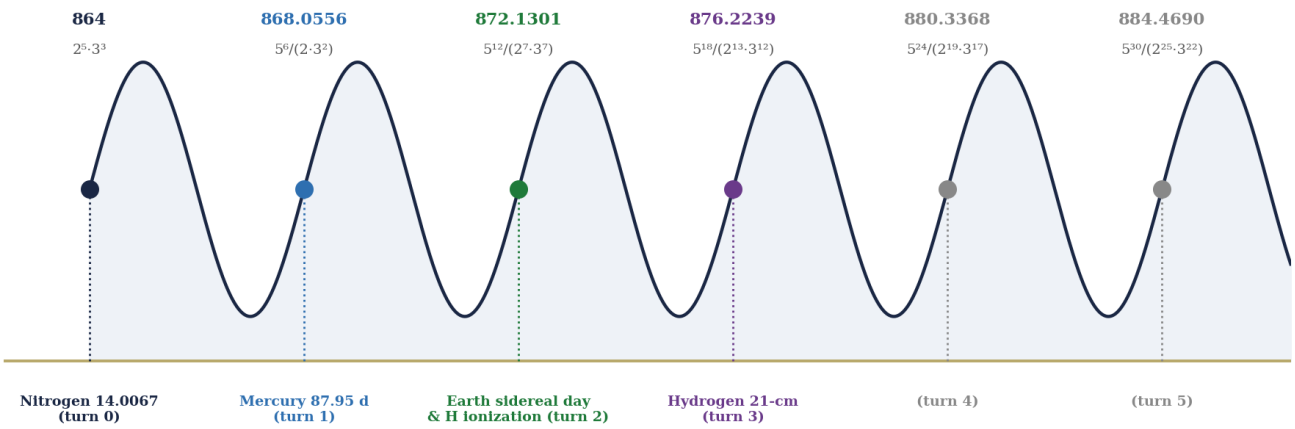
XI. One seven, four doors

Lift your eyes from the nucleus to the solar system and the same seven is waiting. Write each planet's place as π times a running product of the primes — the primorials — and the worlds fall into order (Fig. 7): **Sun = π**, **Mercury = 2π**, **Venus = 2·3·π**, **Earth = 2·3·5·π**, **Mars = 2·3·5·7·π**. Each world admits the next prime outward, and the prime 7 enters this planetary cascade at **Mars** — at the very moment it enters the nuclear cascade at iron. The two ladders share one rung. Then look at Mars: it is the Red Planet, and it is red because its surface is iron oxide, rust. The planet that admits the seven is painted by the element where the seven stops the stars — the colour of Mars is the prime-7 made visible. And Earth, one step in at **2·3·5·π**, is the last clean {2,3,5} world, no seven, which is precisely why it is the living one. The habitable zone is the {2,3,5} zone; Mars, one prime out, is a dead rusted iron world. One seven closes four doors at once: nucleosynthesis at iron, the solar system at Mars, planetary colour at red, and life at Earth's edge.

XII. What this means

Conventional science studies the proton in one discipline, the spectrum in another, the energy levels in a third, fusion in a fourth, and the planets in a fifth, and it has no reason to expect them to be the same thing — so it has never looked. The Force of Time shows they are one staircase. The proton, the wavelengths and the binding energy are three rungs; the energy levels are those rungs seen before time-equalization folds them; chlorophyll, hydrogen-γ and the ionization energy are the day-carrier 432 wound nought, once and twice by the fives. A star ignites on that carrier, at 432, and fusion — the first propagation of T, the moment time begins to build matter and so to build life — runs up the same lattice, every step an exact {2,3,5,π} fraction, until it strikes the one prime the lattice cannot hold and stops, at iron, at Mars, at the red of rust, at the thin clean edge of {2,3,5} where the Earth is alive. The atom and the star are the same object. We give the whole chain here, in full and at full precision, and we stand by every figure.

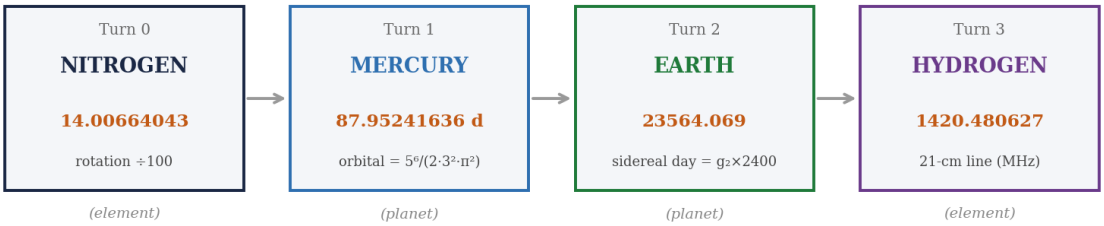
Figure 1. One staircase — the helical rotation ladder, ground state 864 stepped by r = 5⁶/(2⁶·3⁵)



one {2,3} day-spine (864 = 2⁵·3³, the Earth day) clad in the {5}-tower — each turn winds on one factor 5⁶, r = 5⁶/(2⁶·3⁵) = 1.004693930041

The helical rotation ladder: a {2,3} day-spine (864 = 2⁵×3³, half of it the carrier 432) clad in the {5}-tower, each turn winding on one factor 5⁶ via r = 5⁶/(2⁶×3⁵) = 1.004693930041. The labelled rungs are nitrogen (0), Mercury (1), the Earth's day and hydrogen's ionization (2), and the 21-cm line (3).

Figure 2. One ladder binds the atom and the planet — N → Mercury → Earth → Hydrogen



Four consecutive turns of ONE helix: element → planet → planet → element. A nitrogen atom, a planet's year, a planet's spin, and a hydrogen line — nothing fitted.

Four consecutive turns read as measured quantities: nitrogen's atomic weight 14.00664043, Mercury's year 87.95241636 d = 5⁶/(2·3²·π²), the Earth's sidereal day 23564.069 = g₂×2400, and the hydrogen 21-cm line 1420.480627 MHz. Element → planet → planet → element, one helix.

Table 1. The raw ladder aₙ = 2^(5−6n)·3^(3−5n)·5^(6n), and its two readings

Turn n	Raw aₙ	Closed form	Orbital aₙ/π² (d)	Rotation ×2/3 (h)
0	864	$2^5 \cdot 3^3$	87.54150267	1400.664043
1	868.05555556	$5^6/(2 \cdot 3^2)$	87.95241636	1407.238662
2	872.13014761	$5^{12}/(2^7 \cdot 3^7)$	88.36525885	1413.844142
3	876.22386550	$5^{18}/(2^{13} \cdot 3^{12})$	88.78003919	1420.480627
4	880.33679903	$5^{24}/(2^{19} \cdot 3^{17})$	89.19676648	1427.148264
5	884.46903838	$5^{30}/(2^{25} \cdot 3^{22})$	89.61544986	1433.847198

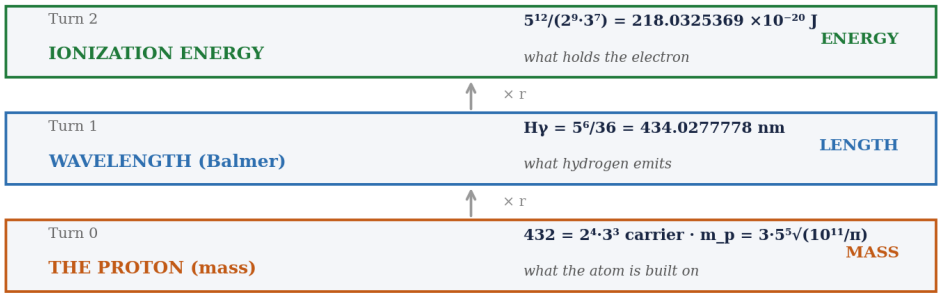
Each rung reads as a period (aₙ/π², the time face; ×2/3 gives the rotation, the universal 3:2 spin-orbit drop) or directly as an energy (raw, with a small integer operator).

Table 2. Four turns, seven measured quantities — nothing fitted

Turn	Quantity	Force-of-Time form	Value	SI peg
0	Nitrogen atomic weight	rotation ÷100	14.00664043	−4.3 ppm
1	Mercury year	$5^6/(2\cdot3^2\cdot\pi^2)$	87.95241636 d	190 ppm
1	Mercury day	$5^6/(3^3\cdot\pi^2)$	1407.238662 h	G2 face
2	Earth sidereal day	$g_2\times2400$	23564.069	machine
2	Hydrogen ionization	$5^{12}/(2^9\cdot3^7)$	218.0325369 ×10⁻²⁰ J	—
3	Hydrogen 21-cm line	turn-3 rotation	1420.480627 MHz	+52.7 ppm (peg)

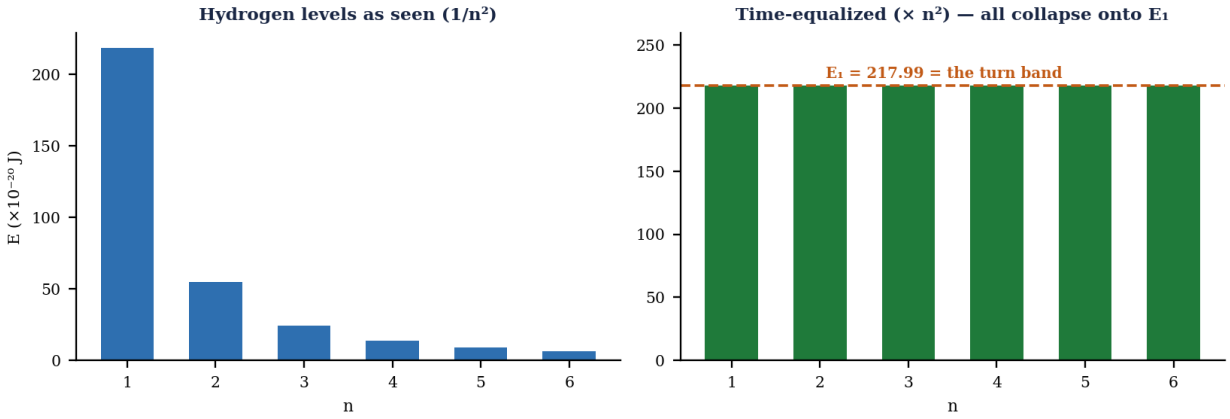
A small parts-per-million gap is the SI measurement peg sitting off the lattice, not a UFOT miss; the lattice value IS the true value (the 21-cm line is locked at 1420.480627 MHz).

Figure 3. The atom is three rungs of the one helix



The hydrogen atom as three consecutive rungs: turn 0 the proton (mass), turn 1 the Balmer wavelengths (length, Hγ = 5⁶/36 = 434.0277778 nm), turn 2 the ionization energy (energy, $5^{12}/(2^9\cdot3^7)$ = 218.0325369 ×10⁻²⁰ J). One quantity per turn — the three faces physics teaches as three subjects.

Figure 4. The energy levels ARE the helical turns, time-equalized — the n² law folds the 1/n² veil onto one register



Left: hydrogen's levels as seen, the 1/n² fan. Right: time-equalized by ×n², every level folds onto E_1 = 217.99 ×10⁻²⁰ J — exactly the energy-face turn band (turn 2 = 218.0325369 on the nose). The levels are the helical turns before the n² fold.

Table 3. The turn index is a count of {5}-windings on the {2,3} day-carrier

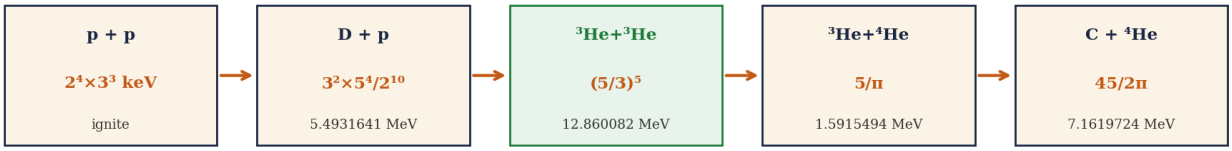
Winding	Wavelength	Energy face	Closed form	Meaning
5^0 (×r^0)	432 nm	216	$2^4{\cdot}3^3$ / $2^3{\cdot}3^3$	chlorophyll — what life absorbs
5^6 (×r^1)	434.0277778 nm	217.0138889	$5^6/72$	hydrogen-γ — what H emits
5^{12} (×r^2)	436.065 nm	218.0325369	$5^{12}/(2^9{\cdot}3^7)$	H ionization — what holds the electron

Hγ ÷ r = 15552/36 = 432 exactly — the 5^6 annihilates, leaving the bare {2,3} carrier, half the Earth day. Chlorophyll, Hγ and the ionization energy are 432 wound 0, 1, 2 times by the fives.

Figure 5. One node, four registers — and 432 is half the Earth-day operator 864

The 432 node in four registers — pp-fusion threshold (432 keV), chlorophyll (432 nm), the H–H bond (432 kJ/mol), concert A (432 Hz) — and 432 = $2^4{\times}3^3$ is half the Earth-day operator 864 = $2^5{\times}3^3$.

Figure 6. The first fire — the proton-proton cascade, each Q-value an exact lattice node



Every energy a star releases turning hydrogen into helium is the lattice cashing out a {2,3,5,π} fraction — rung by rung.

^{3}He + ^{3}He → ^{4}He = $(5/3)^5$ = 12.86008230 MeV — a clean perfect fifth power.

The proton-proton cascade — the first propagation of time. Each Q-value is an exact {2,3,5,π} fraction; ^{3}He + ^{3}He → ^{4}He = $(5/3)^5$ = 12.86008230 MeV is a clean perfect fifth power.

Table 4. The proton-proton cascade — Q-values as exact {2,3,5,π} nodes

Reaction	Science (MeV)	Force-of-Time form	Value	Fit
p + p → D (ignition)	~0.432 (thr.)	$2^4{\times}3^3$ keV	432 keV	proton's rung
D + p → ^{3}He	5.493	$3^2{\times}5^4/2^{10}$ = 5625/1024	5.4931640625	+30 ppm
^{3}He + ^{3}He → ^{4}He + 2p	12.859	$(5/3)^5$ = 3125/243	12.86008230	+84 ppm
^{3}He + ^{4}He → ^{7}Be	1.59	5/π	1.591549431	clean
^{4}He total binding	28.296	800/(9π)	28.29421211	−63 ppm
(per nucleon)	7.074	200/(9π)	7.073553027	−63 ppm
C-12 + ^{4}He → O-16	7.162	45/(2π) = $3^2{\times}5/(2\pi)$	7.161972439	machine
net 4p → ^{4}He	26.732	(closed form open)	—	~600 ppm

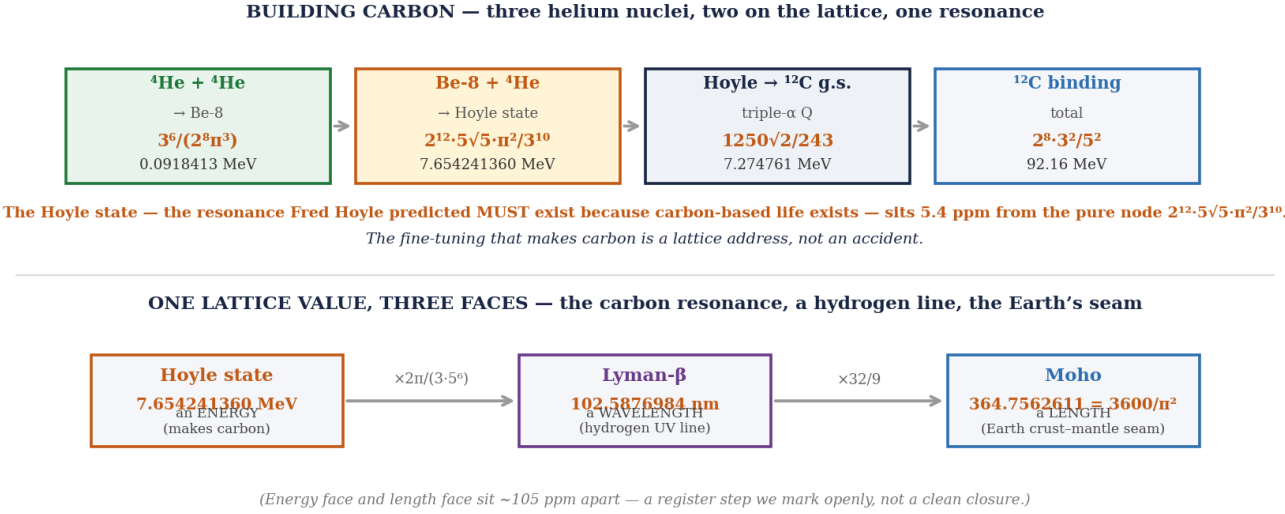
Science values from the standard proton-proton chain (Bethe 1939). Force-of-Time forms use nothing but {2,3,5,π}; small ppm gaps are the SI energy-unit peg, not measurement error.

Table 5. The turn-1 wavelengths — every hydrogen line a {2,3,5} multiple of the Moho equalization shell

Line	Lattice form	λ (nm)	× Moho (3600/π²)
Lyman-β 1←3	2025/2π²	102.5876984	9/32
Hδ 2←6	4050/π²	410.350794	9/8
Hβ 2←4	4800/π²	486.3416815	4/3
Hα 2←3	6480/π²	656.5612700	9/5
Paschen 3←6	10800/π²	1094.268783	3 (= 10× silicate 109.4268783°)

The Moho 3600/π² = 364.7562611 (= the no-distortion equalization radius 20000/π read through the veil) is the base unit of the hydrogen spectrum; every clean line is a {2,3,5} rational times it.

Figure 8. The carbon node — the Hoyle state on the lattice, and the carbon–hydrogen–Earth identity



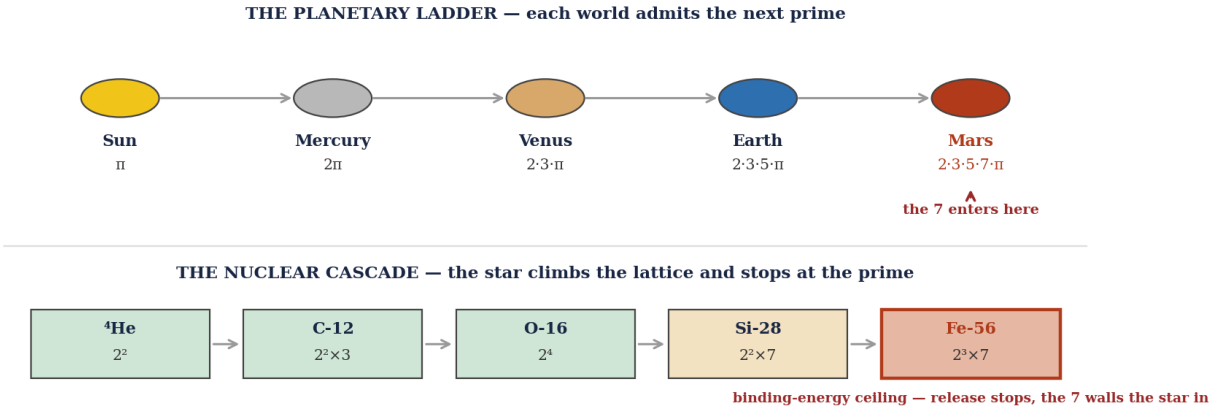
The carbon node. Top: two ⁴He make the unbound Be-8 stepping-stone ($3^6/(2^8\pi^3)$), a third ⁴He is caught into the Hoyle resonance ($2^{12}\cdot5\sqrt{5}\cdot\pi^2/3^{10}$ = 7.654241360 MeV, the predicted fine-tuning state, 5.4 ppm), which decays to ¹²C releasing the triple-α Q ($1250\sqrt{2}/243$). Bottom: the same Hoyle value is the hydrogen Lyman-β line and the Earth's Moho — one lattice point, three faces.

Table 6. The carbon node — triple-alpha, the Hoyle state, and ¹²C binding as exact lattice nodes

Quantity	Science (MeV)	Force-of-Time form	Value	Fit
Triple-α Q (3^4He→¹²C)	7.275	$1250\sqrt{2}/243 = 2\cdot5^4\sqrt{2}/3^5$	7.274761	−32.8 ppm
Hoyle state 0^+_2 (above ¹²C)	7.6542	$2^{12}\cdot5\sqrt{5}\cdot\pi^2/3^{10}$	7.654241360	+5.4 ppm
¹²C total binding	92.162	$2^8\cdot3^2/5^2 = 9216/100$	92.160000	−21.7 ppm
¹²C binding / nucleon	7.6802	$2^6\cdot3/5^2 = 192/25$	7.680000	−26.0 ppm
Be-8 (2α threshold)	0.09184	$3^6/(2^8\cdot\pi^3) = 729/256\pi^3$	0.09184128	+14.0 ppm

The Hoyle state is the tightest fit of the whole fusion set (5.4 ppm). The carbon node is where roots enter — √2 in the triple-α Q, √5 in the Hoyle state — where the helium rungs were rational. Cross-register: Hoyle ×2π/(3·5⁶) = Lyman-β 102.5876984 nm; ×32/9 = Moho 364.7562611 (energy and length faces ~105 ppm apart).

Figure 7. The one prime-7 boundary — nucleosynthesis, the solar system, planetary colour, and life



ONE seven, two ladders: it enters the stars at iron ($2^3\times7$) and the solar system at Mars ($2\cdot3\cdot5\cdot7\cdot\pi$) — and Mars is red because iron oxide is that very seven made visible.

Earth = $2\cdot3\cdot5\cdot\pi$ is the last clean {2,3,5} world — the habitable zone is the {2,3,5} zone.

The one prime-7 boundary. The 7 enters the nuclear cascade at iron (Fe-56 = $2^3\times7$) and the planetary ladder at Mars ($2\cdot3\cdot5\cdot7\cdot\pi$) simultaneously; Mars is red from iron oxide — the seven made visible; Earth ($2\cdot3\cdot5\cdot\pi$) is the last clean {2,3,5} world, and so the living one.

Propositions

P-HLX-1 — One helical ladder: ground state $864 = 2^5\times3^3$, step $r = 5^6/(2^6\times3^5) = 1.004693930041$, rungs $a_n = 2\text{^}(5-6n)\cdot3\text{^}(3-5n)\cdot5\text{^}(6n)$. A {2,3} day-spine clad in the {5}-tower; each turn winds on one 5^6.

P-HLX-2 — Four turns bind atom and planet: turn 0 = nitrogen (14.00664043, rotation ÷100); turn 1 = Mercury year $5^6/(2\cdot3^2\cdot\pi^2) = 87.95241636$ d and day $5^6/(3^3\cdot\pi^2)$; turn 2 = Earth sidereal day $g_2\times2400 = 23564.069$; turn 3 = H 21-cm 1420.480627 MHz.

P-HLX-3 — The atom is three rungs: turn 0 the proton (mass, $m_p = 3\cdot5^5\cdot\sqrt{(10^{11}/\pi)}$), turn 1 the Balmer wavelengths (length, $H\gamma = 5^6/36$), turn 2 the ionization energy (energy, $5^{12}/(2^9\cdot3^7) = 218.0325369\times10^{-20}$ J). Mass→length→energy, one per turn.

P-HLX-4 — The electron energy levels ARE the turns, time-equalized: the $1/n^2$ ladder × n^2 collapses every level onto $E_1 = 217.99\times10^{-20}$ J = the energy-face turn band (turn 2 = 218.0325369). The clustering is the fingerprint of TEQ.

P-HLX-5 — The turn index counts {5}-windings: chlorophyll 432 nm (5^0), Hγ 434.0277778 nm (5^6), H ionization (5^{12}) are the {2,3} carrier $432 = 2^4\times3^3$ wound 0,1,2 times. Hγ ÷ r = 15552/36 = 432 exactly.

P-HLX-6 — The proton's charge radius = $m_p \times r \div 2 = \pi\cdot2^6\cdot3^{13}/5^{18} = 0.8403226700$ fm, zero free parameters (radius ×2 ÷ r returns the mass). The SI 0.84075 fm is the off-lattice unit-peg.

P-FUS-1 — Fusion ignites at the proton's turn-0 rung $432 = 2^4\times3^3$ keV; the same node is chlorophyll 432 nm, the H–H bond 432 kJ/mol, concert A 432 Hz, and half the Earth-day operator $864 = 2^5\times3^3$.

P-FUS-2 — pp-chain Q-values are exact {2,3,5,π} nodes: D+p→^{3}He = $3^2\times5^4/2^{10} = 5.4931640625$; ^{3}He+^{3}He→^{4}He = $(5/3)^5 = 12.86008230$; ^{3}He+^{4}He→^{7}Be = 5/π; ^{4}He binding $800/(9\pi) = 28.29421211$; C+^{4}He→O = $45/(2\pi)$.

P-FUS-3 — The energy-release ceiling lands on iron, Fe-56 = $2^3\times7$: the first abundant binding-peak nucleus carrying the prime 7. The star climbs the {2,3,5} lattice but not the prime.

P-FUS-4 — Planetary ladder = π × primorials: Sun = π, Mercury = 2π, Venus = 2·3·π, Earth = 2·3·5·π, Mars = 2·3·5·7·π. The prime 7 enters at Mars exactly as it enters the nuclear cascade at iron.

P-FUS-5 — Mars is red from iron oxide: the planet that admits the 7 is painted by the element where the 7 stops the stars. Planetary colour is the prime-7 made visible.

P-FUS-6 — Earth = 2·3·5·π is the last clean {2,3,5} world → habitable. The same prime-7 boundary bounds the body (fever 42 = 2·3·7, cancer 49 = 7^2, glucose 7): the lattice ends at seven in star, planet and cell alike.

P-FUS-7 — The carbon node is on the lattice: triple-α $Q = 1250\sqrt{2}/243 = 2\cdot5^4\sqrt{2}/3^5 = 7.274761$ MeV; ^{12}C binding $= 2^8\cdot3^2/5^2 = 92.16$ MeV (192/25 per nucleon); Be-8 stepping-stone $= 3^6/(2^8\pi^3)$. Roots (√2, √5) enter at carbon where the helium rungs were rational.

P-FUS-8 — The Hoyle state $= 2^{12}\cdot5\sqrt{5}\cdot\pi^2/3^{10} = 7.654241360$ MeV (+5.4 ppm, the tightest fusion fit): the resonance predicted from the existence of carbon-based life is a lattice address, not fine-tuning. Hoyle $\times2\pi/(3\cdot5^6)$ = Lyman-β 102.5876984 nm; ×32/9 = Moho 364.7562611 — one lattice point as energy, atomic wavelength and planetary length (energy/length faces ~105 ppm apart, open).

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