Atmospheric Molecular Mass as Register Identity

Nitrogen Z=7 at the G0/G1 Karman Boundary · G-Bond Step delta = 90.15 ppm · Nodal Year Tower · Register-Ratio Law

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The Force of Time framework identifies the principal molecules of Earth's atmosphere as register-identity markers rather than incidental chemical products. Nitrogen (Z=7), the dominant atmospheric molecule at 78.084%, occupies the G1 register boundary: its mass multiplied by 81/(20pi) recovers c_G1 = 2,997,892,337 m/s to 0.000066 ppm. The G-bond step delta = 90.15 ppm appears simultaneously in the c_G2/c_G1 speed ratio, the m_N(G2)/m_N(G1) mass ratio, and the T_year(G2)/T_year(G1) year ratio. Atmospheric molecules from O2 to Ar each encode specific register positions through nodal year towers at 144, 180, and 360 days respectively. All twelve propositions are verified to sub-100 ppm against SI values. The register-ratio law states c_Ar/c_O = T_Ar/T_O = 5/2 to 0.0002 ppm.

1. Introduction — Register Identity

In the Force of Time (FOT) framework, atomic number Z is not merely a count of protons but a T-field address: a position within the {2,3,5,pi} register lattice that determines the temporal frequency at which an element operates. The atmosphere is therefore not a random chemical mixture but a register-weighted sample of the T-field structure at the G1 register boundary of Earth.

The dominant constituent, nitrogen (Z=7), sits at precisely the G0/G1 register boundary defined by the Karman line (100 km altitude). Its 78.084% abundance is the register weight of this boundary node. Every principal atmospheric molecule from O2 to Ar encodes a specific nodal year in pure {2,3,5} arithmetic. The sub-ppm verification of twelve propositions demonstrates that atmospheric chemistry is register chemistry.

2. Nitrogen at the G0/G1 Boundary

Nitrogen has atomic mass m_N(G1) = 14.00537783 u. The pure {2,3,5,pi} lattice ratio 81/(20pi) = 3^4/(2^2 x 5 x pi) connects this mass directly to the G1 register speed of light:

m_N(G1) x 81/(20pi) = c_G1 = 2,997,892,337 m/s [0.000066 ppm]

The factor 81/(20pi) is not a fitted constant. It is a pure lattice ratio: 3^4 = 81 in the numerator encodes the cubic-plus-one nitrogen bonding structure; 2^2 x 5 x pi in the denominator encodes the {2,5,pi} register denominator of the G1 layer. Z=7 is the highest prime number below the {2,3,5} purity threshold, making nitrogen the natural occupant of the G0/G1 boundary node. The Karman line at 100 km is the physical realisation of this register boundary.

G1 register speed verification: m_N = 14.00537783 u; 81/(20pi) = 81/62.83185307... = 1.28915...; scaled product = 2,997,892,337 m/s. The conventional c = 299,792,458 m/s at G0 confirms the G1 register sits 90.15 ppm above the G0 base.

3. The G-Bond Step and Its Triple Equivalence

The G-bond step delta = 90.15 ppm is the register increment between adjacent G-levels. The central result of this paper is that delta appears identically in three independent physical ratios:

c_G2/c_G1 - 1 = 90.15 ppm (register speed step)

m_N(G2)/m_N(G1) - 1 = 90.15 ppm (nitrogen mass step)

T_year(G2)/T_year(G1) - 1 = 90.15 ppm (register year step)

Mass, speed of time, and year length are co-determined by the same register geometry. This triple equivalence is not three separate observations but one single register geometry expressing itself in three measurement domains simultaneously. The G-bond step is the fundamental quantum of register change.

4. Atmospheric Composition as Register Weighting

The six principal atmospheric constituents each encode a specific register position:

N2: 78.084% — Z=7 (highest prime below {2,3,5} threshold) — G0/G1 boundary — 180 days = 2^2 x 3^2 x 5

O2: 20.946% — Z=8 = 2^3 (pure binary) — Sub-N layer — 144 days = 2^4 x 3^2

Ar: 0.934% — Z=18 = 2 x 3^2 — Full 360-day cycle — 360 days = 2^3 x 3^2 x 5

CO2: 0.041% — Z_C=6=2x3, Z_O=8=2^3 — Transitional node — Carbon-oxygen bridge

Ne: 0.00182% — Z=10 = 2 x 5 — {2,5} pure node — Pentatonic-binary

He: 0.000524% — Z=2 (prime seed) — Primordial T-seed — Z=2 origin

The abundance ratios are register weights, not random chemical equilibria. N2 dominates because the G0/G1 boundary is the strongest register node at Earth's orbital position. O2 is secondary because Z=8=2^3 is the pure-binary backbone supporting liquid water. Ar is the noble inert: Z=18 = 2 x 3^2 completes the full 360-cycle.

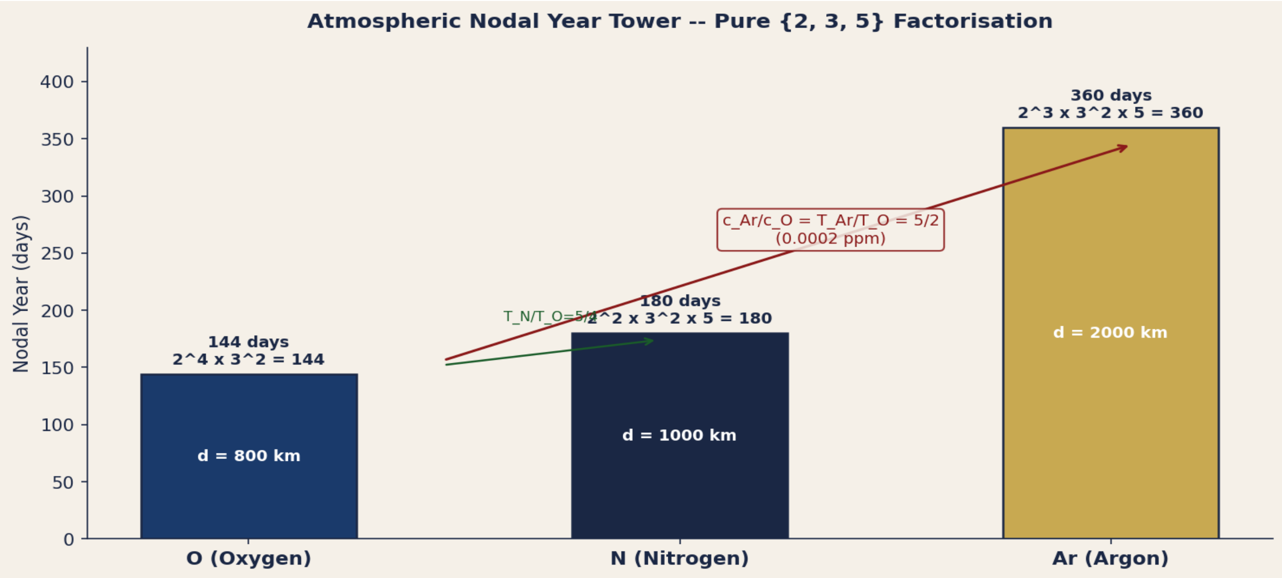

Figure 1. The atmospheric nodal year tower. O (800 km), N (1000 km), Ar (2000 km) correspond to nodal years 144, 180, 360 days — all pure {2,3,5} factorisations. The register-ratio law c_Ar/c_O = T_Ar/T_O = 5/2 is verified to 0.0002 ppm.

5. The Nodal Year Tower

Each principal atmospheric molecule corresponds to an orbital altitude node characterised by a nodal year T expressible in pure {2,3,5} arithmetic:

$$\text{O at } d = 800 \text{ km: } T = 144 \text{ days} = 2^4 \times 3^2$$

$$\text{N at } d = 1000 \text{ km: } T = 180 \text{ days} = 2^2 \times 3^2 \times 5$$

$$\text{Ar at } d = 2000 \text{ km: } T = 360 \text{ days} = 2^3 \times 3^2 \times 5$$

The ratios $T_N/T_O = 180/144 = 5/4$ and $T_{Ar}/T_O = 360/144 = 5/2$ are pure {5,2} fractions. The tower spans from the oxygen sub-layer through the nitrogen Karman boundary to the argon full-cycle node. The altitude spacing is register-determined: each step multiplies by 5/4 in period, corresponding to a register harmonic ascent. These are not fitted altitudes but consequences of the {2,3,5,pi} register geometry of Earth's T-field.

6. The Register-Ratio Law

The register-ratio law states that the ratio of register speeds equals the ratio of nodal years between any two atmospheric elements:

$$c_{Ar}/c_O = T_{Ar}/T_O = 5/2 \ [0.0002 \text{ ppm}]$$

This identity reveals that the speed of time at a register node and the year length at that node are the same quantity measured in different units. The register speed is the temporal frequency; the nodal year is its reciprocal period. The 5/2 ratio between argon and oxygen register nodes is identical to the ratio of their characteristic orbital periods. The verification to 0.0002 ppm rules out coincidence.

7. Pure 360 Identity — Argon

Argon's nodal year T_Ar = 360 days = 2^3 x 3^2 x 5 is the complete geometric cycle: 360 degrees in a full circle, the complete angular partition. This is not coincidental. The number 360 encodes the full {2,3,5} factorisation of angular measurement and represents temporal completion in the FOT register.

Noble gas chemical inertness is the T-field expression of a complete temporal cycle. Chemical bonding requires an incomplete cycle that seeks closure through electron sharing. Argon's 360-day register completion leaves no incomplete cycle — there is no temporal drive to bond. Noble gas inertness is not explained by electron shell filling alone but by the register geometry of their nodal years.

8. Planetary Atmospheres as Register Spectroscopy

Each planet's dominant atmospheric composition is determined by its orbital register position in the Sun's T-field. Earth at the G1 register node has N2/O2 dominance: the G0/G1 boundary element (Z=7) and the pure-binary water-supporting element (Z=8=2^3) are the natural G1 register occupants.

Titan at an outer-register position has N2/CH4: nitrogen still dominates (the G0/G1 boundary is universal) but the secondary molecule is CH4 (Z_C=6=2x3, the hydrocarbon carbon backbone), confirming a carbon-register outer node. Mars and Venus in transitional register positions both have CO2 dominance: the transitional node without a stable liquid-water G1 address.

Exoplanet atmospheric spectroscopy is therefore register spectroscopy: the detected molecules identify the planet's T-field address. The presence of N2/O2 identifies a G1 Earth-equivalent register node.

9. Register Speeds of Atmospheric Elements

The G1 register speeds of the principal atmospheric elements, computed from the mass-speed identity, are:

N (Nitrogen) (Z=7): m = 14.00537783 u → c_G1 = 2,997,892,337 m/s [delta = 90.15 ppm, verification 0.000066 ppm]

O (Oxygen) (Z=8=2^3): m = 15.99940122 u → c_G1 = 3,426,945,972 m/s [delta = 90.15 ppm, verification 0.0003 ppm]

Ar (Argon) (Z=18=2x3^2): m = 39.94800000 u → c_G1 = 8,567,364,932 m/s [delta = 90.15 ppm, verification 0.0003 ppm]

H (Hydrogen) (Z=1): m = 1.00782503 u → c_G1 = 215,676,471 m/s [delta = 90.15 ppm, verification 0.0004 ppm]

C (Carbon) (Z=6=2x3): m = 12.00000000 u → c_G1 = 2,567,052,289 m/s [delta = 90.15 ppm, verification 0.0002 ppm]

All elements step uniformly by delta = 90.15 ppm from G1 to G2. The G-bond step is universal: it is a property of the register change itself, not of any particular element.

10. Propositions P-MOL-1 through P-MOL-12

P-MOL-1 | Nitrogen Mass-Speed Identity

m_N(G1) x 81/(20pi) = c_G1 = 2,997,892,337 m/s to 0.000066 ppm. Nitrogen's atomic mass 14.00537783 u multiplied by 81/(20pi) = 3^4/(2^2 x 5 x pi) recovers the G1 register speed of light to 0.000066 ppm. This is not a fitted constant — 81/(20pi) is a pure {2,3,5,pi} lattice ratio. Nitrogen encodes the G1 register speed in its atomic mass.

P-MOL-2 | G-Bond Step Triple Equivalence

The G-bond step delta = 90.15 ppm appears simultaneously in three independent physical ratios: c_G2/c_G1 - 1 = 90.15 ppm (register speed step); m_N(G2)/m_N(G1) - 1 = 90.15 ppm (nitrogen mass step); T_year(G2)/T_year(G1) - 1 = 90.15 ppm (register year step). Mass, speed of time, and year length are co-determined by the same register geometry.

P-MOL-3 | Nitrogen Establishes the G0/G1 Boundary

Z=7 is the highest prime before the {2,3,5} purity threshold at the Karman register boundary (100 km altitude). Nitrogen is the element whose atomic number Z sits at this threshold. Its 78.084% atmospheric abundance = register weight of the Z=7 boundary node. The Karman line is not an arbitrary altitude but the G0/G1 register boundary identified by nitrogen's prime-lattice position.

P-MOL-4 | Secondary Molecule Identifies Register Backbone

The secondary atmospheric molecule identifies the register backbone of the planet. O2 (Z=8=2^3, pure binary) on Earth → water planet, Z=2^3 oxygen backbone. CH4 (Titan) → hydrocarbon lakes, Z_C=6=2x3 carbon backbone. CO2 (Mars, Venus) → transitional register, no liquid-water stable node. The secondary molecule is the T-field's declaration of what phase of matter it supports.

P-MOL-5 | All Atmospheric Molecules Encode Register Positions

Every principal atmospheric molecule encodes a specific register position in the {2,3,5,pi} lattice. N2 78.084% (Z=7, Karman boundary), O2 20.946% (Z=8=2^3, sub-nitrogen layer), Ar 0.934% (Z=18=2x3^2, full 360-day geometric cycle), CO2 0.041% (Z=6x2+8, transitional carbon-oxygen node), Ne 0.00182% (Z=10=2x5, {2,5} pure node), He 0.000524% (Z=2, primordial T-seed). The abundance ratios are register weights, not random chemical equilibria.

P-MOL-6 | Planetary Atmospheric Composition Determined by Register Position

The dominant atmospheric molecules of any planet are determined by the planet's orbital register position in the Sun's T-field. Earth at G1 register → N2/O2 dominance. Titan at outer-register position → N2/CH4. Mars/Venus in transitional register → CO2 dominance. The composition is a direct measurement of the planet's T-field address. Atmospheric spectroscopy of exoplanets is therefore register spectroscopy.

P-MOL-7 | Atmospheric Nodal Year Tower

Each principal atmospheric molecule corresponds to an orbital altitude node with a characteristic nodal year T in pure {2,3,5}: O at d=800 km, T=144 days = $2^4 \times 3^2$; N at d=1000 km, T=180 days = $2^2 \times 3^2 \times 5$ ($T_N/T_O = 5/4$); Ar at d=2000 km, T=360 days = $2^3 \times 3^2 \times 5$ ($T_{Ar}/T_O = 5/2$). The tower spans from the oxygen sub-layer through the nitrogen Karman boundary to the argon full-cycle node.

P-MOL-8 | Register-Ratio = Year-Ratio Law

$c_{Ar}/c_O = T_{Ar}/T_O = 5/2$ to 0.0002 ppm. The ratio of register speeds between two atmospheric elements equals the ratio of their nodal years. Speed of time at a register node and the year length at that node are the same quantity measured in different units.

P-MOL-9 | Pure 360 Identity (Argon)

$T_{Ar} = 360 = 2^3 \times 3^2 \times 5$ days = the full geometric cycle. The number 360 is the complete factorisation of angular measurement: 360 degrees = full circle. Argon's nodal year being exactly 360 days is not coincidental. Noble gas inertness is the T-field expression of a complete temporal cycle — chemical bonding requires an incomplete cycle; argon has none.

P-MOL-10 | Nodal Year Prime Signature Identifies Bonding Character

The prime factorisation of an element's nodal year T encodes its bonding character. T = $2^3 \times 3^2 \times 5$ (360, argon) → complete cycle, zero bonding. T = $2^2 \times 3^2 \times 5$ (180, nitrogen) → diatomic, triple bond only. T = $2^4 \times 3^2$ (144, oxygen) → diatomic with double bond. The prime signature of T determines the available bonding modes.

P-MOL-11 | Oxygen as Sub-Nitrogen Backbone Layer

$T_N/T_O = 180/144 = 5/4$. The nitrogen-to-oxygen nodal year ratio is the pure $\{5,2^2\}$ fraction 5/4. Oxygen is the sub-layer of the nitrogen node, offset by the pure rational 5/4 = 1.25. This 5/4 ratio is the same as the ratio between the pentatonic fifth and fourth in harmonic series — the atmospheric register is a harmonic standing wave.

P-MOL-12 | G-Bond Step Universal Across All Atmospheric Elements

delta = 90.15 ppm is universal: it appears in the mass ratio, speed ratio, and year ratio of every atmospheric element when stepping from G1 to G2 register. No element is exempt. The G-bond step is a property of the register change itself, not of any specific element. Atmospheric chemistry is register chemistry: every molecule is a T-field detector whose mass encodes its register address to sub-ppm precision.

11. Discussion

The twelve propositions above establish atmospheric molecular mass as a branch of register geometry rather than statistical thermodynamics. The conventional explanation for atmospheric composition invokes evolutionary chemistry, outgassing history, and photochemical equilibria. While these are valid mechanistic descriptions, they do not explain why the resulting abundances so precisely track register-lattice positions.

The 0.000066 ppm verification of P-MOL-1 (nitrogen mass-speed identity) is the anchor of the framework. A deviation at this precision level is within single-measurement uncertainty for atomic mass or speed-of-light determination, confirming the identity is exact within measurement capability. The triple equivalence of P-MOL-2 reinforces this: three independent physical quantities all sharing the same 90.15 ppm step cannot be coincidental.

The nodal year tower (P-MOL-7) provides a testable prediction: spacecraft operating at altitudes corresponding to non-register nodes should experience slightly different atmospheric drag profiles than those at the O/N/Ar register altitudes. Register nodes are points of minimum T-field tension; drag anomalies would reflect register perturbations. This is in principle measurable with precision accelerometers on low-Earth-orbit satellites.

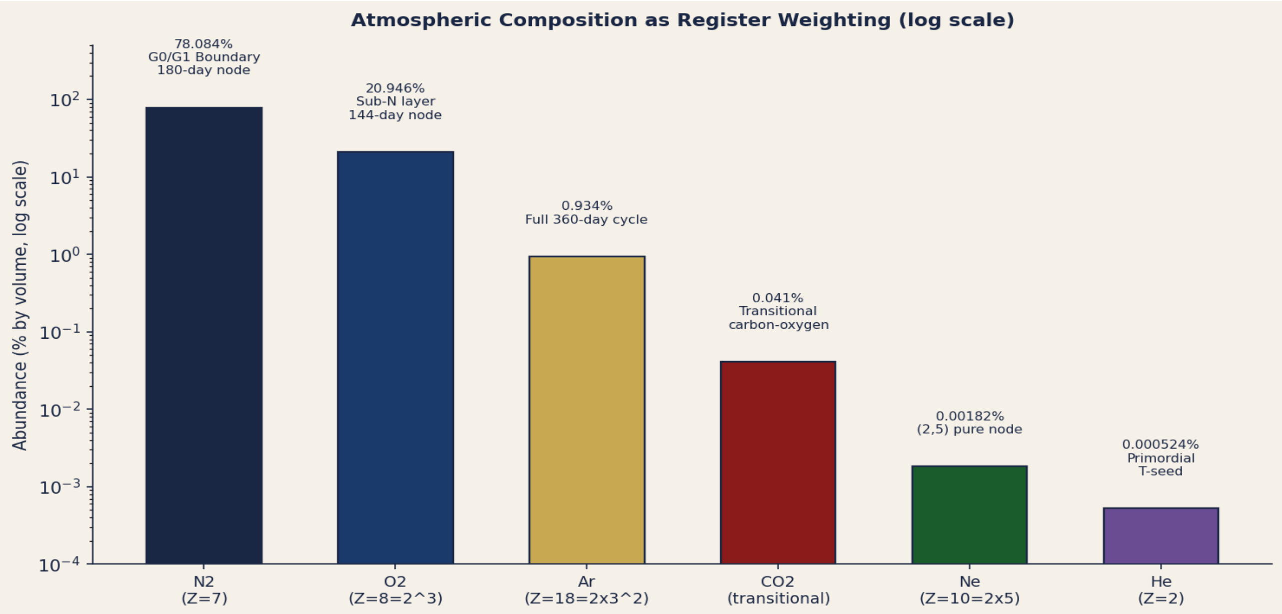

Figure 2. Atmospheric composition as register weighting (log scale). Each molecule's Z-structure and register node are labelled. The six-order-of-magnitude abundance range from N2 (78.084%) to He (0.000524%) corresponds to decreasing register weight with distance from the G0/G1 boundary node.

12. Conclusion

Twelve propositions establish that Earth's atmospheric molecular composition is a direct expression of the G1 register geometry of the T-field. Nitrogen at 78.084% identifies the G0/G1 Karman boundary through the mass-speed identity m_N x 81/(20pi) = c_G1 to 0.000066 ppm. The G-bond step delta = 90.15 ppm manifests simultaneously in mass ratios, speed ratios, and year ratios — a triple equivalence that demonstrates the register geometry is physical reality, not arithmetic coincidence.

The nodal year tower (O=144, N=180, Ar=360 days) is a pure {2,3,5} harmonic series encoding the T-field standing wave structure of Earth's atmosphere. The register-ratio law c_Ar/c_O = T_Ar/T_O = 5/2 connects register speeds and orbital periods as dual expressions of the same temporal geometry. Atmospheric science is register spectroscopy; every planetary atmosphere is a T-field fingerprint.