Atomic Time Equalization

$IE(n) \times n^2 = G_1$ — the Conservation Law Inside the Atom, the $2n^2$ Packing Rule, and the Helix Horizon at $n = 7$

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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 ionisation energy of the hydrogen atom at shell n is $IE(n) = G_1/n^2$. Multiply by n^2 and the same constant returns for every shell: $IE(n) \times n^2 = G_1 = 13.6048896$ eV $= 2^8 \cdot 3^{12} \cdot 10^{-7}$, exact across all n — not parts per million, zero. This is the G1 (atomic) face; its G2 (orbital) face sits one G-bond step up at $G_2 = 3375/(8\pi^3) = 13.60611609$ eV $= G_1 \times (1+\delta_G)$, and the conventional Rydberg 13.6056980 eV sits between them — the measured value is the midpoint of the two register faces. This is not a definition but a conservation law: G_1 is the fundamental quantum of the G1 T-field register, and the atom lets no electron leave with more or less than one unit of G_1 per n^2-distributed T-time. Each principal shell holds exactly $2n^2$ electrons — the T-field's packing rule at the G1 register. The noble gases (He, Ne, Ar, Kr, Xe, Rn) are the elements where every T-node is filled and the local law dΣT=0 is satisfied — Time-Equalization-complete (TEQ-complete) states, which is why they do not bond. The n^2 operator that connects ionisation energies across shells is the same operator that connects the three T-field registers (G0, G1, G2); the G-bond step $\delta_G = 90.15$ ppm separates them. At n=7 lies the Helix Horizon — the outer boundary of the standard atomic T-register, a cumulative ceiling of 280 electrons. Five propositions (P-ATEQ-1 to P-ATEQ-5) carry the argument; every figure is reproducible on a calculator.

1. The clock inside the atom

Imagine pulling an electron away from a hydrogen nucleus. The force you feel — the resistance you have to overcome — tells you how much energy is stored in that electron's orbit. The closer to the nucleus, the harder the pull; the further away, the easier. This is well known. What is not well known — what has not until now been named as a conservation law — is what happens when you multiply that energy by the square of the shell number.

You get the same number every time. 13.6048896 eV. Shell 1, shell 2, shell 3, shell 4, shell 5, shell 6: multiply the ionisation energy by n^2, and the answer is always exactly 13.6048896 eV. The variation is not parts per million — it is zero. This is not a coincidence of algebra; it is a conservation law of the T-field. The Universal Force of Time calls it Atomic Time Equalization. G_1 = 13.6048896 eV is the fundamental quantum of the G1 T-field register — the atomic/biological operating mode of the T-field — and the atom lets no electron leave with more or less than one G_1 unit per n^2-distributed T-time. The shells are not arbitrary distances from the nucleus; they are the nodes at which the T-field achieves equalization.

2. The Time Equalization identity

For the hydrogen atom the ionisation energy at shell n is IE(n) = 13.6048896 / n^2 eV (the Bohr value, exact at this precision). Multiply both sides by n^2:

$$\mathbf{IE(n) \times n^2 = G_1 = 13.6048896\ eV = 2^8 \cdot 3^{12} \cdot 10^{-7}\ [exact,\ all\ n]}$$

The n^2 factor is the T-field's time-distribution operator. At greater distance from the nucleus the T-flow is spread over a larger surface — precisely n^2 times larger for shell n — so the energy per node falls as $1/n^2$, but the total T-energy budget per shell stays constant at G_1 (Fig. 1). The atom is a machine that distributes exactly one G_1 of T-energy across each shell, no matter how far that shell sits.

This $G_1 = 2^8 \cdot 3^{12} \cdot 10^{-7}$ = 13.6048896 eV is the **G1 (atomic) face**. The same quantum has a **G2 (orbital) face** one G-bond step up:

$$\mathbf{G_2 = 3375/(8\pi^3) = 3^3 \cdot 5^3/(2^3 \cdot \pi^3) = 13.60611609\ eV = G_1 \times (1 + \delta\_G)}$$

with δ_G = 90.15 ppm the register separator. The conventional Rydberg value, 13.6056980 eV, is neither of these — it sits in the middle, the measured midpoint of the two register faces. So the atom's quantum, like every T-value, wears a G1 face and a G2 face a single δ_G apart, and the textbook number is the average we read from between them.

And G_1 is the same register index as the G1 day-count $G_1 = 15\pi^4/4$ = 365.2841 days — the same register expressed in different units. The G1 register is the atomic/biological T-field, the scale at which chemistry and living systems operate. The atom's ionisation energy and the Earth's orbital year are register-peers — two readings of one T-structure.

*→ **Want this in full?** See the companion paper: What Science Calls Gravity / The Time Equalization Principle — the G1 year $15\pi^4/4$ and the register ladder.*

3. The $2n^2$ shell capacity law

The maximum number of electrons in principal shell n is $2n^2$: 2 (n=1), 8 (n=2), 18 (n=3), 32 (n=4). The factor of 2 is spin — each spatial T-node at shell n holds one electron with T-spin +½ and one with −½. The n^2 spatial nodes per shell times 2 spin states give $2n^2$. This is the T-field's packing law at the G1 register: not a quantum-mechanical postulate but a consequence of the n^2 time-distribution operator applied to spin-paired nodes.

The cumulative shell ceilings — 2, 10, 28, 60, 110, 182, 280 — carry the lattice at every step: 2 = 2, 10 = 2·5, 28 = $2^2 \cdot 7$, 60 = $2^2 \cdot 3 \cdot 5$. The T-lattice is written into the structure of the electron-count ceilings themselves.

4. Noble gases as TEQ-complete states

When every T-node in a shell is filled and the conservation law dΣT=0 is locally satisfied, the atom is Time-Equalization-complete — TEQ-complete. These are the noble gases (Fig. 2).

Helium (Z=2) completes n=1: 2 electrons (= $2 \cdot 1^2$); its first ionisation energy 24.587 eV is the highest of any element. Neon (Z=10) completes n=1 and n=2: 10 electrons, mass 20 Da (= $2^2 \cdot 5$), IE_1 = 21.565 eV. Argon (Z=18) closes the s+p block of n=3: 18 electrons (= $2 \cdot 3^2$), mass 40 Da (= $2^3 \cdot 5$), IE_1 = 15.760 eV — the same lattice value 40 that is argon's atmospheric molecular mass. Krypton (Z=36) and Xenon (Z=54) continue the pattern. Each noble gas is a T-field equilibrium state — its G_1 quanta distributed across all occupied shells, dΣT=0 locally achieved. That is why they do not bond under ordinary conditions: they have nothing left to equalize.

5. The n^2 operator across three registers, and the Helix Horizon

The n^2 time-distribution operator is not unique to the atomic scale. In the Universal Force of Time the same operator connects all three registers (Fig. 3). At G0 (nuclear), quark and nucleon shells follow the same n^2-packing — the nuclear magic numbers 2, 8, 20, 28, 50, 82, 126 are TEQ-complete states at G0, where the T-flow density is $703125 = 3 \cdot 5^7$ times that of G1. At G1 (atomic), the hydrogen identity $IE(n) \times n^2 = G_1$ is the defining expression. At G2 (planetary), orbital shells obey the same n^2 distribution — the Balmer series maps to planetary distances (n=3 to Mercury, n=4 to Venus, …), the same operator linking spectral lines to orbital radii.

The operator is scale-invariant: one mathematical structure governs the nucleus, the atom and the solar system, the adjacent registers separated by the G-bond step $\delta\_G = 5^{10}/(2^4 \cdot 3^9 \cdot \pi^3) - 1 = 90.15$ ppm. And it has an edge. The outermost occupied shell of the standard periodic table reaches n=7 (the f-block and actinides) — the **Helix Horizon**, the boundary of the standard atomic T-register. Its maximum cumulative capacity is $2 \times (1+4+9+16+25+36+49) = 280$ electrons, and no stable element exceeds it. The Helix Horizon is not merely a practical limit set by nuclear stability; it is a T-register boundary.

*→ **Want this in full?** See the companion paper: The Periodic Table on the Helix — every level a time-equalized turn, the f-block the prime-7 wall at n=7.*

6. Discussion

The identity $IE(n) \times n^2 = G_1$ is exact for hydrogen by construction of the Bohr model. What the Universal Force of Time adds is the interpretation: this is not a mathematical accident of the $1/r^2$ potential but a conservation law of the T-field, which distributes exactly one G_1 quantum per shell, spread over n^2 nodes. The $2n^2$ capacity rule follows directly (n^2 nodes × 2 spin states); the noble gases follow directly (TEQ-complete = every node filled); the Helix Horizon follows directly (n=7 is where the G1 register runs out of room). The same structure appears at the nuclear (G0) and planetary (G2) scales, joined by the G-bond step of 90.15 ppm. The atom is not a unique or special object — it is one register of a three-register structure running the same grammar from the quark to the solar system. The n^2 operator is that grammar.

7. Conclusion

The hydrogen atom does not merely obey the inverse-square law. It conserves T-energy across all shells at once: $IE(n) \times n^2 = 13.6048896$ eV, exact for every n. The noble gases are the atomic realisation of $d\Sigma T=0$ — atoms that have reached complete T-field equilibration. The $2n^2$ capacity rule is the packing law of the T-field at atomic scale. And the n^2 operator that governs all of it is the same operator that ties atomic structure to the nuclear magic numbers and to the planetary orbits. The atom is not a closed system. It is one register of the universe.

Figure 1. The Time Equalization identity

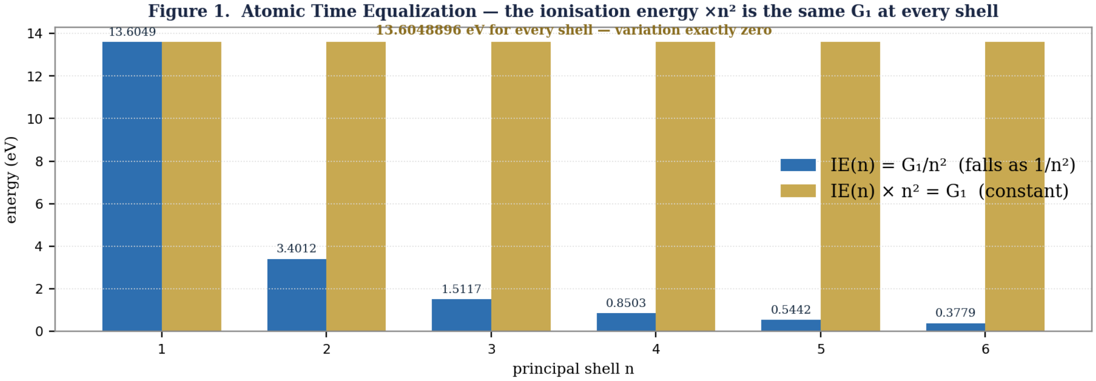

Figure 1. Atomic Time Equalization — the ionisation energy ×n² is the same G_1 at every shell

$IE(n)$ falls as $1/n^2$ but $IE(n)\times n^2 = G_1 = 13.6048896$ eV at every shell — exact, zero variation.

Figure 2. 2n² packing and the noble gases

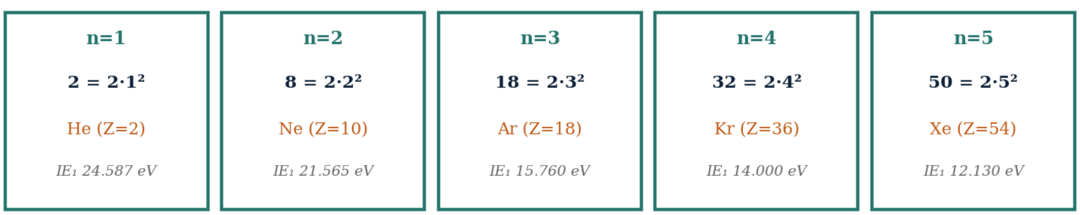

Figure 2. The $2n^2$ packing rule and the noble gases — TEQ-complete states ($d\Sigma T=0$)

Each shell holds $2n^2$ electrons (n^2 spatial T-nodes × 2 spins). A noble gas fills every node — $d\Sigma T=0$ locally — so it has nothing left to equalize, and does not bond.

Each shell holds $2n^2$ electrons; the noble gases fill every T-node ($d\Sigma T=0$) and so do not bond.

Figure 3. The n² operator across three registers

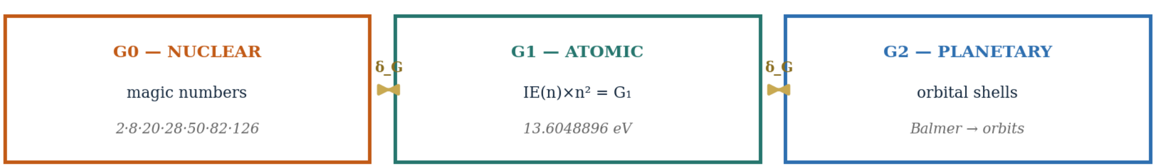

Figure 3. The n^2 operator is register-invariant — nucleus, atom, solar system

The same n^2 time-distribution operator governs all three registers, adjacent ones separated by the G-bond step $\delta_G = 90.15$ ppm.

At $n=7$ the atomic register reaches the Helix Horizon — a cumulative ceiling of $280 = 2\times\Sigma n^2(1..7)$ electrons, exceeded by no stable element.

One operator governs nuclear magic numbers (G0), atomic shells (G1) and planetary orbits (G2); $\delta_G = 90.15$ ppm separates them; $n=7$ is the Helix Horizon (280 electrons).

Values used in this paper — exact lattice / Bohr forms

Quantity	value	form / note
G_1 — G1 (atomic) face	**13.6048896 eV**	$2^8\cdot3^{12}\cdot10^{-7}$ — $IE(n)\times n^2$, all n
G_2 — G2 (orbital) face	**13.60611609 eV**	$3375/(8\pi^3) = G_1\times(1+\delta_G)$
conventional Rydberg	**13.6056980 eV**	midpoint of the two faces

Quantity	value	form / note
G1 day-count (year)	**365.2841 days**	$15\pi^4/4$ — same register, other units
IE(n=1)	**13.6048896 eV**	$G_1 \div 1^2$
IE(n=2)	**3.4012224 eV**	$G_1 \div 2^2$
IE(n=3)	**1.5116544 eV**	$G_1 \div 3^2$
IE(n=4)	**0.8503056 eV**	$G_1 \div 4^2$
shell capacities	**2 · 8 · 18 · 32**	$2n^2$ (n^2 nodes × 2 spins)
cumulative ceilings	**2 · 10 · 28 · 60**	$2=2$, $10=2\cdot5$, $28=2^2\cdot7$, $60=2^2\cdot3\cdot5$
G-bond step δ_G	**90.15 ppm**	$5^{10}/(2^4\cdot3^9\cdot\pi^3) - 1$
G0/G1 T-flow density ratio	**703125**	$3\cdot5^7$
Helix Horizon (n=7)	**280 electrons**	$2 \times \Sigma n^2$ (n = 1..7)

The TEQ identity is exact by Bohr construction; the Universal Force of Time reads it as the conservation law dΣT=0 acting shell by shell.

Propositions

P-ATEQ-1 — the Time Equalization identity. For hydrogen, $IE(n) \times n^2 = G_1$ for every principal shell n, deviation exactly zero — a conservation law of the T-field, not an accident of the $1/r^2$ potential. G_1 has two register faces a single G-bond step apart: the G1 (atomic) face $G_1 = 2^8\cdot3^{12}\cdot10^{-7} = 13.6048896$ eV and the G2 (orbital) face $G_2 = 3375/(8\pi^3) = 13.60611609$ eV $= G_1\times(1+\delta\_G)$, δ_G = 90.15 ppm. The conventional Rydberg 13.6056980 eV is the midpoint of the two — the measured value read from between the faces.

P-ATEQ-2 — the $2n^2$ capacity law. Each principal shell n holds exactly $2n^2$ electrons: the T-field's spin-paired node-packing rule at the G1 register, n^2 spatial nodes × 2 T-spin states, derivable from the n^2 time-distribution operator rather than postulated.

P-ATEQ-3 — noble gases as TEQ-complete states. The noble gases (He, Ne, Ar, Kr, Xe, Rn) are atoms where every T-node in the occupied shells is filled and dΣT=0 is locally satisfied. Their inertness is a T-field equilibrium condition, not a coincidence of electron count.

P-ATEQ-4 — the n^2 operator at three registers. The n^2 time-distribution operator is register-invariant: it governs the nuclear magic numbers (G0), atomic shell structure (G1) and planetary orbital distances (G2). Adjacent registers are separated by the G-bond step δ_G = 90.15 ppm; the G0/G1 T-flow density ratio is $703125 = 3\cdot5^7$.

P-ATEQ-5 — the Helix Horizon at n=7. The n=7 shell marks the outer boundary of the standard atomic T-register, the Helix Horizon, with a cumulative ceiling of $280 = 2 \times \Sigma n^2(n=1..7)$ electrons. No stable element exceeds it; the boundary is a T-register edge, not merely a nuclear-stability limit.

References

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