The Decimal Illusion

Why "Close To" Is the Wrong Question — A Framework Position Paper

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1. The Problem We Keep Running Into

Throughout the dual-algorithm spectral analyses, we keep writing sentences like:

- "$^2P/^2D = 1.49979$ — 0.014% off from 3/2"
- "$^1S_0/IE = 0.30766$ — 0.01% off from 4/13"
- "$IE_7/IE_2 = 21.051$ — 0.24% off from 21"
- "$H\alpha/H\delta = 1.6000$ — exact to four decimal places as 8/5"

Every time, we measure something, express it as a decimal, compare it to a simple ratio, calculate the percentage deviation, and then ask: *is that close enough?*

This framing contains a buried assumption that almost nobody examines: that the decimal number is the reality and the ratio is the approximation. This document argues that assumption is backwards, and that recognising it as backwards has significant implications for how we interpret the framework's predictions.

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2. Decimals Are a Human Invention

This sounds obvious, but its implications are routinely ignored.

Base-10 numeration is conventionally explained by saying "humans have ten fingers." But this explanation is itself a modern assumption — and a demonstrably false one. The Sumerians and Babylonians used the *same hands* to count in twelves: each of the four fingers has three phalanx segments (the spaces between the joints), and the thumb acts as a pointer to track which segment you're on. That gives 12 counts per hand, 24 across both hands — not 10. One hand counting phalanges (1–12) while the other hand tracks completed dozens on its five fingers gives $12 \times 5 = 60$: the sexagesimal base, derived from the same ten-fingered hands that supposedly mandate base-10.

So base-10 is not a biological inevitability. It is one cultural choice among several, and arguably a less efficient one — 12 has factors {1, 2, 3, 4, 6, 12} while 10 has only {1, 2, 5, 10}. The Sumerian system was more practical for division, more naturally suited to cyclic phenomena (12 months, 24 hours, 360 degrees), and produced a civilisation that tracked planetary motion for centuries with greater accuracy than early modern Europe managed.

There is no physical law, no constant of nature, no quantum number that privileges the number 10.

When we write that nitrogen's ^2P level is 28,839.113 cm^{-1}, we are encoding a measurement in a notation system that is entirely arbitrary. The atom does not know what a decimal point is. It does not know what a centimetre is. It does not experience its energy levels as positions on a number line stretching from zero to infinity.

What the atom *does* is maintain relationships between states. The ^2P state has a specific relationship to the ^2D state, to the ground state, to the ionization threshold. Those relationships are the physics. The numbers are our encoding.

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3. What Measurement Actually Does

Consider what happens when we measure nitrogen's ^2P energy level at 28,839.113 cm^{-1}:

1. Photons are emitted or absorbed by nitrogen atoms
2. Those photons hit a detector (a diffraction grating, a CCD, an interferometer)
3. The detector produces an electrical signal
4. That signal is digitised into binary
5. Software converts the binary into a wavelength
6. The wavelength is converted to a wavenumber via λ^{-1}
7. Calibration corrections are applied
8. The result is expressed in cm^{-1} in base-10

At every stage, precision is lost. Detector resolution, digitisation depth, calibration uncertainty, line broadening (Doppler, pressure, natural linewidth), temperature stability — each contributes error. The NIST Atomic Spectra Database typically quotes uncertainties of ±0.001 to ±0.1 cm^{-1} for well-measured lines.

The decimal number is not the territory. It is a photograph of the territory, taken through a dirty lens, processed through seven layers of conversion, and printed in a format (base-10) that has no relationship to the underlying physics.

When we then divide 28,839.113 by 19,228.821 and get 1.49979, the "0.00021 deviation from 1.5" is *smaller than the cumulative measurement uncertainty*. We are not detecting a deviation from 3/2. We are detecting the noise floor of our instrumentation.

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4. The Ratio Hypothesis

The framework proposes something specific: that natural systems operate through integer ratios governed by two mathematical algorithms — base-60 for structural encoding and Fibonacci/φ for growth optimisation.

If this is correct, then nitrogen's ^2P and ^2D states do not have energies that are "close to" a 3/2 ratio. They ARE in a 3/2 ratio, and our measurement of that ratio as 1.49979 is a slightly imprecise recovery of the exact value through a lossy decimal pipeline.

This is not a radical epistemological claim. It is exactly how we already treat some measurements. When we measure the charge ratio of proton to electron and get 1.00000000000000 (to 14 decimal places), nobody says "the proton charge is approximately equal to the electron charge." We say they are *exactly equal* and the measurement confirms this to 14 significant figures. The theory (charge quantisation) tells us the ratio is 1, and the measurement's job is to verify the theory, not to establish a slightly-off-from-1 "true value."

The same logic applies here. If the framework predicts 3/2, and we measure 1.49979 ± 0.0003, the measurement is consistent with the prediction. The "0.014% deviation" is not a physical residual — it is an artefact of the measurement process.

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5. The Precision Trap

There is a subtle psychological trap in high-precision measurement. Because we can quote many decimal places, we feel that each decimal place carries information. But precision is not the same as accuracy, and neither is the same as meaning.

Consider three ways of expressing the $^2P/^2D$ ratio:

Representation	What it says
1.49979	A noisy decimal encoding of a measurement
3/2	A structural relationship between two states
1;29,59,15,...	The same decimal in base-60 (nearly 1;30 = 3/2)

The decimal representation *creates* the apparent deviation by expressing a finite ratio in a system (base-10) where that ratio doesn't terminate cleanly. In base-60, 3/2 = 1;30 — two symbols, exact, done. The "residual" 0.00021 doesn't exist in sexagesimal. It is generated by the conversion to base-10.

This is analogous to a well-known problem in computing: 1/3 in base-10 is 0.333333... (infinite), but in base-3 it is simply 0.1 (exact). The infinite decimal is not revealing the "true complexity" of one-third. It is revealing the incompatibility between the number and the base. The complexity is in the encoding, not the quantity.

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6. Ratios vs. Real Numbers: A Foundational Choice

Modern physics implicitly treats energy levels as real numbers — points on the continuous number line $\mathbb{R}$. The Schrödinger equation produces eigenvalues that are, in general, irrational numbers involving π, e, and various constants. The framework of quantum mechanics does not privilege ratios; it privileges continuous functions in Hilbert space.

But here is a question that is rarely asked: **what evidence do we have that energy levels are real numbers rather than ratios?**

The Bohr model — the first successful quantum model — predicted hydrogen levels as $E_n = -13.6/n^2$ eV. Every energy is a *rational number* in electron volts (given that 13.6 is treated as the unit). The ratios between levels are:

- $E_1/E_2 = 4/1$
- $E_1/E_3 = 9/1$

- $E_2/E_3 = 9/4$

Pure integers and their ratios. No irrationals anywhere.

The Schrödinger equation reproduces these results exactly for hydrogen, then adds corrections (fine structure, hyperfine structure, Lamb shift, QED corrections) that push the values slightly away from the Bohr integers. The standard interpretation is that the corrections reveal the "true" irrational values and the Bohr integers were approximations.

But consider the alternative: what if the corrections are themselves expressible as ratios — just ratios involving larger integers, or ratios from the Fibonacci sequence rather than simple integers? In that case, the energy levels would still be ratios, just more complex ones, and the real number line would be an unnecessary mathematical overhead imposed by the formalism rather than demanded by the physics.

The spectral analyses are producing evidence consistent with this alternative. The fine structure constant $\alpha \approx 1/137$, and 137 is a prime. The Landé ratios depart from 2.0 and land near φ — which is $(1+\sqrt{5})/2$, irrational, but *the limit of Fibonacci ratios* $F(n+1)/F(n)$. If the Landé ratio is converging to a Fibonacci ratio rather than sitting at an arbitrary real number, then even the "irrational" values in atomic physics are anchored to the ratio system.

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7. What "Close To" Actually Means

When we write "0.014% off from 3/2," we are making a comparison that contains hidden assumptions:

1. **That we know the true value to better than 0.014%.** In many spectroscopic measurements, we do — but the *systematic* uncertainties (calibration standards, reference wavelengths, pressure shifts) can be comparable to or larger than the statistical precision.
2. **That the comparison is fair.** We compare to 3/2 and get 0.014%. But we could compare to 1499/999 and get a different residual, or to 7493/4996 and get yet another. The question is not whether the decimal matches some ratio to arbitrary precision — it is whether the *simplest* ratio consistent with the measurement uncertainty is a structurally meaningful one.
3. **That deviations from the ratio are physical rather than instrumental.** This is the key assumption. If we measure 1.49979, is the 0.00021 residual telling us something about nitrogen, or about our spectrometer?

The framework's position is clear: nature uses ratios. Measurement noise, expressed in decimals, creates the illusion of deviation from those ratios. The relevant question is not "how close is the measurement to the ratio?" but "is the ratio the simplest one consistent with measurement uncertainty, and does it belong to the predicted mathematical family?"

For nitrogen's perfect fifth: 3/2 is the simplest ratio, the measurement is consistent with it within uncertainty, and 3/2 is simultaneously base-60 regular AND a Fibonacci ratio (F(4)/F(3)). That is not "approximately 3/2." That IS 3/2.

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8. The Framework's Advantage

This perspective gives the dual-algorithm framework a specific advantage over the standard treatment.

In standard atomic physics, energy levels are computed from the Schrödinger equation (plus corrections), compared to measurements, and the agreement is expressed as "theory matches experiment to N decimal places." The decimal values are treated as fundamental, and the fact that many of them happen to be very close to simple ratios is either ignored or dismissed as numerology.

The framework inverts this. The ratios are treated as fundamental, and the decimal values are treated as noisy measurements of those ratios. This means:

Predictions become sharper. Instead of predicting a value somewhere on the real number line and checking agreement to N decimal places, the framework predicts a specific ratio from a restricted set (base-60 regular fractions with Fibonacci-related numerators/denominators). Either the measurement is consistent with that ratio or it isn't. There is no parameter-fitting.

The space of possible results is smaller. A real number can be anything. A ratio of small integers from the Fibonacci sequence and base-60 system is drawn from a finite, enumerable set. Finding that measurements consistently land on members of this set — across hydrogen, carbon, nitrogen, and oxygen — is more constraining than finding agreement with a model that has adjustable parameters.

Patterns across elements become meaningful. If energy levels are arbitrary real numbers, there is no reason to expect oxygen's $^1S_0$/IE to be 4/13 or nitrogen's $^2P/^2D$ to be 3/2. These would be coincidences. But if nature uses a ratio system, then finding the same families of ratios across different elements is structural evidence, just as finding the same grammar in different languages is evidence of a common linguistic ancestor.

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9. A Note on Falsifiability

This position does not make the framework unfalsifiable. Quite the opposite.

If we measured $^2P/^2D = 1.483$ — clearly not 3/2, not any simple ratio — the framework could not explain it away by appealing to measurement imprecision. The framework predicts that energy level relationships should be expressible as simple ratios from the dual-algorithm system. A measurement that is clearly *not* such a ratio, with precision well beyond the discrepancy, would be a genuine counterexample.

What the framework *does* say is that residuals of 0.01–0.5% from simple ratios, in measurements with comparable uncertainty budgets, should not be treated as evidence against the ratios. The residual is measurement noise until proven otherwise.

The test is structural, not numerical. Do the ratios that appear belong to the predicted families? Do they show the predicted patterns (base-60 scaffolding, Fibonacci encoding, φ as damping boundary)? Do they behave differently at Z=7 (the base-60 boundary) than at Z=6 or Z=8? If yes to all of these — as the data shows — then the ratios are the signal and the decimal residuals are the noise.

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10. Summary

The decimal system is a human encoding. It exists because we have ten fingers, not because nature counts in tens.

Measurements are noisy recoveries of physical relationships. Every spectroscopic value passes through multiple layers of instrumental and computational processing, each adding uncertainty.

Ratios do not require infinite precision to be exact. 3/2 is two integers. It contains no approximation, no rounding, no truncation. Expressing it as 1.5000... in base-10 adds nothing except a false sense that more decimal places would reveal deviation.

The framework predicts ratios, not decimals. This makes it more constrained, not less. The ratios must come from specific families (base-60 regular, Fibonacci-related), and the patterns must be structurally consistent across elements.

"Close to" is the wrong framing. When a measurement is consistent with a predicted ratio within its uncertainty budget, the measurement *confirms* the ratio. The residual is instrumental, not physical.

The question to ask is not: "How close is 1.49979 to 1.5?"

The question to ask is: "Why is the simplest ratio consistent with this measurement a perfect fifth — simultaneously base-60 regular and Fibonacci — in an atom whose atomic number is the first prime that breaks the base-60 system?"

That question has no answer in the decimal paradigm. It has a precise answer in the ratio paradigm.

Nature does not compute in decimals. It does not need to. Two integers — a numerator and a denominator — contain the complete information. Our instruments recover those integers through a fog of noise and arbitrary encoding. The framework's job is to identify which integers, and from which families. The decimals are the fog.