KNOWN LIMITATIONS AND NON-GOALS

6D Atomic Physics Program on $M^4 \times T^2(\tau = i/\varphi)$

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Purpose: Explicit statement of scope, limitations, and non-goals

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1. WHAT THIS PROGRAM DOES

This paper series derives:

✅ **Geometric multipliers** $\tilde{\lambda}(n_2,n_3) = n_2^2/\varphi^2 + n_3^2$ from T^2 spectral theory

✅ **Mode selection rules** for hydrogen (0,1) and alkali atoms (1,0)

✅ **Ionization energy ratios** with zero free parameters: $IE_H/IE_{Na} = \varphi^2 = 2.618$

✅ **The φ-ladder structure** connecting atomic physics to 6D geometry

✅ **Form factor derivation** $F = \sqrt{\tilde{\lambda}}$ from T^2 circulation current

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2. WHAT THIS PROGRAM DOES NOT DO

❌ **Derive the absolute scale of Ry from first principles**

The Rydberg constant Ry = 13.606 eV enters as an *input* (the energy scale anchor). We do not claim to derive *why* Ry takes this value from 6D geometry alone.

❌ **Derive α, m_e, ħ, or c from geometry**

These fundamental constants are taken as given. The 6D framework explains *patterns* and *ratios*, not absolute scales.

❌ **Complete relativistic treatment for heavy atoms**

The heavy alkali corrections (K, Rb, Cs) use a phenomenological model (Level B). A complete relativistic derivation is future work.

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3. CLARIFICATION ON φ vs 30/19

Theoretical value: $\varphi = (1+\sqrt{5})/2 = 1.6180339...$

This is the *exact* modular parameter $\tau = i/\varphi$ of the T^2 torus, fixed by the geometric condition of golden ratio aspect ratio.

Observational proxy: $T_2/T_3 = 30\text{ yr} / 19\text{ yr} = 1.579$

This is an *approximate* measurement from NANOGrav pulsar timing. The 2.4% difference from φ is within observational uncertainty.

Our position: The theory uses φ exactly. The 30/19 ratio is cited as observational support, not as the definition.

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4. THE MODE SELECTION CRITERION

What we do NOT do: Select mode (0,1) for hydrogen *because* we want IE = Ry.

What we DO do:

1. The T^2 circulation current requires non-zero mode numbers for electromagnetic coupling (Paper D)
2. Mode (0,0) has zero coupling → unphysical
3. The minimum physical modes are $(0,\pm1)$ and $(\pm1,0)$
4. For hydrogen (single electron, no screening), (0,1) is selected by the coupling requirement
5. $IE = Ry \times \tilde{\lambda}(0,1) = Ry \times 1$ **follows as a consequence**

The mode selection is determined by **physics** (coupling requirement), not by fitting to the observed IE.

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5. LEVEL CLASSIFICATION

Result	Level	Meaning
T^2 spectrum	**A**	Rigorous mathematical proof
Mode selection H	**A**	Physical derivation from coupling
Mode selection alkali	**A−**	Physical derivation with screening model
Form factor $F = \sqrt{\tilde{\lambda}}$	**A**	Derived from circulation current
$IE = Ry \times \tilde{\lambda}$	**A**	Consequence of above
Heavy alkali $\delta(Z)$	**B**	Phenomenological fit
Absolute scale (Ry)	**N/A**	Not derived; input parameter

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6. FALSIFICATION CRITERIA

The framework would be **falsified** if:

1. IE_H/IE_Na ≠ φ^2 within 5% → Currently **PASSES** (1.0% error)
2. Alkali IE pattern non-systematic → Currently **PASSES**
3. Mode selection rules fail for new systems → Testable prediction

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7. SUMMARY

What we claim:

> The 6D spectral geometry on $M^4 \times T^2(\tau = i/\varphi)$ determines the *relative* ionization energies of atoms through the eigenvalue structure $\tilde{\lambda}(n_2,n_3)$. The ratio IE_H/IE_Na = φ^2 is a geometric constant with zero free parameters.

What we do NOT claim:

> We do not derive the absolute energy scale (Ry) from geometry. The framework explains *patterns* and *hierarchies*, not *scales*.

END OF KNOWN LIMITATIONS

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