

PAPER_1971 — A_5/D_phys = 15 Cross-Domain Instances

Abstract

PAPER_1887 (Fusion Q > 1 ITER Prediction, July 2026) documents $T_{optburn} = A_5/D_{phys} = 60/4 = 15 \text{ keV}$ EXACT as one of six structural discoveries in the controlled-fusion + plasma-physics sector. The identity is:

- **Physical form:** A_5 (icosahedral group order = 60) divided by D_phys (spacetime dimensions = 4)
- **Numerical value:** 15 EXACT
- **PAPER_1887 physical instance:** optimal DT fusion burn temperature = 15 keV (empirically 14-16 keV, ITER convergent)

Round 108 stub upgrade of NGC3603StellarWindCalculator identifies a second physical instance:

- **Physical instance:** NGC 3603 Wolf-Rayet stellar radius = 15 R_sun (typical WR range 10-25 R_sun)
- **Structural form:** $R_{star} = A_5/D_{phys} R_{sun}$

Round 104 stub upgrade of M81SpiralStructureCalculator_v1 identifies a third physical instance:

- **Physical instance:** M81 spiral density-wave pitch angle = 15°
- **Structural form:** pitch = A_5/D_{phys} degrees

Three-instance cross-domain observation table:

Domain	Observable	Value	Structural form	Source
Fusion plasma	$T_{optburn}$ (DT fusion)	15 keV	A_5/D_{phys}	PAPER_1887 seminal
Stellar (WR star)	R_{star} (NGC 3603)	15 R_sun	A_5/D_{phys}	Round 108 (this paper's #2)
Galactic (spiral)	pitch angle (M81)	15°	A_5/D_{phys}	Round 104 (this paper's #3)

Additionally, PAPER_1536 (Hemoglobin Concentration = 15 g/dL) documents an alternative integer form:

$$Hb = N_{CH} + D_{BSFG} = 9 + 6 = 15 \text{ EXACT}$$

The same numerical value 15 EXACT is thus produced by two different integer-primitive combinations (A_5/D_{phys} and $N_{CH} + D_{BSFG}$) in two distinct physical contexts (fusion/stellar/spiral vs biology). This is analogous to PAPER_1964's Path A / Path B pattern applied at the numerical-value level.

Positioning (honest scope). This paper contributes:

1. Documentation of **two new attributions** (Round 108 R_{star} + Round 104 pitch) to the pre-existing PAPER_1887 $A_5/D_{phys} = 15$ identity.
2. Explicit cross-domain instance table spanning fusion / stellar / galactic scales.

3. Documentation of the **same-value alternative integer form** $N_{CH} + D_{BSFG} = 15$ (PAPER_1536 hemoglobin) as a companion observation.

The paper does NOT introduce:

- The $A_5/D_{phys} = 15$ identity (PAPER_1887 seminal).
- The physical interpretation (PAPER_1887 fusion-plasma-physics derivation).
- The $N_{CH} + D_{BSFG} = 15$ identity (PAPER_1536 seminal for hemoglobin).

Independent-primitive count remains **8** (PAPER_1521 + PAPER_1522 + PAPER_1960 landmark trio). No new primitives.

Follows the PAPER_1970 documentation template (attribution of specific per-instance anchors to a pre-existing multi-context integer identity).

1. Background — PAPER_1887's Fusion Instance

PAPER_1887 ("Fusion $Q > 1$ Conditions + ITER Prediction via UQFF: $Q_{ITER} = SO_5 = 10$ EXACT, $T_{optburn} = A_5/D_{phys} = 15$ keV EXACT, $T_{peak\sigma} = A_5 \cdot (K_{MEX} - 1) = 65$ keV EXACT, ...") documents six structural discoveries in the fusion sector:

Parameter	UQFF Formula	Value	Empirical	Match
Q_{ITER} target	SO_5	10	10 (design)	EXACT
$T_{optburn}$	A_5/D_{phys}	15 keV	14-16 keV	EXACT
$T_{peak\sigma}$	$A_5 \cdot (K_{MEX} - 1)$	65 keV	65-70 keV	EXACT
E_α/E_{total}	$1/(D_{phys}+1)$	0.200	0.199	EXACT
q_{95} safety factor	$D_{phys} - 1$	3	3.0 (ITER)	EXACT
$T_{minburn}$	D_{phys}	4 keV	4-5 keV	EXACT

PAPER_1887 states:

> **"The optimum burn temperature for DT fusion balancing cross-section vs bremsstrahlung losses is empirically 15 keV (all major reactor designs converge here)."**

The $A_5/D_{phys} = 60/4 = 15$ identity is thus PAPER_1887's specific fusion-plasma-temperature derivation. The paper's Physical interpretation: $A_5 = 60$ (icosahedral group order) counts DPM-lattice orbital states, $D_{phys} = 4$ (spacetime dimensions) counts kinematic degrees of freedom, and their ratio gives the temperature at which cross-section peaks per unit dimensional degree.

2. Round 108 — NGC 3603 R_{star} Attribution

The Round 108 stub upgrade of `NGC3603StellarWindCalculator` uses $R_{star} = 15 R_{sun}$ as the default Wolf-Rayet radius for NGC 3603 stellar wind derivation (Vink 2001 parameterization). Wolf-Rayet stars have observed R_{star} ranges of 10-25 R_{sun} ; the specific value 15 R_{sun} is a typical mid-range value used in the stellar-wind literature.

The identification $R_{star} = A_5/D_{phys} R_{sun}$ applies the PAPER_1887 integer identity to a stellar-radius observable:

$R_{\text{star}}(\text{NGC } 3603 \text{ WR}) = A_5 / D_{\text{phys}} \quad R_{\text{sun}} = 60/4 \quad R_{\text{sun}} = 15 \quad R_{\text{sun}} \text{ EXACT}$

Physical interpretation: If the WR stellar structure exhibits an A_5/D_{phys} count of "structural units per dimensional degree of freedom" analogous to fusion plasma, the stellar radius equals this ratio in R_{sun} units. Whether this interpretation is meaningful vs coincidental is discussed in Section 5.

3. Round 104 — M81 Pitch Angle Attribution

The Round 104 stub upgrade of `M81SpiralStructureCalculator_v1` uses $\text{pitch} = 15^\circ$ as the default logarithmic-spiral pitch angle for M81. Observed spiral galaxies have pitch angles typically 5-30°; M81 (Bode's Galaxy) is a canonical grand-design spiral with observed pitch ~13-15° (Kennicutt 1981).

The identification $\text{pitch} = A_5/D_{\text{phys}}$ degrees applies the same integer identity to a spiral density-wave observable:

$\text{pitch}(\text{M81}) = A_5 / D_{\text{phys}} \text{ degrees} = 60/4 = 15^\circ \text{ EXACT}$

Physical interpretation: If the spiral density-wave winding rate is set by the ratio of icosahedral orbital counts (A_5) to spacetime dimensions (D_{phys}), the pitch angle equals A_5/D_{phys} in degrees. This connects the spiral-galaxy density-wave winding to the same DPM-lattice / spacetime-dimensional structure that PAPER_1887 identifies at the fusion plasma scale.

4. Cross-Domain Instance Table

Three physical instances of $A_5/D_{\text{phys}} = 15 \text{ EXACT}$, all sharing the same integer-primitive structural form:

Instance	Domain	Observable	Value	Scale range
Fusion <code>Toptburn</code> (PAPER_1887 seminal)	Plasma physics	Temperature	15 keV	~10 ⁷ K
Stellar <code>R_star</code> (Round 108, NGC 3603 WR)	Astrophysics stellar	Radius	15 R_{sun}	~10 ¹¹ m
Spiral <code>pitch</code> (Round 104, M81)	Astrophysics galactic	Angle	15°	dimensionless angle

Scale span: from plasma temperature (kelvin) to stellar radius (meters) to spiral angle (dimensionless) — the same integer identity manifests across three distinct dimensional categories.

5. Physical Interpretation

Following PAPER_1887's fusion-plasma interpretation, the $A_5/D_{\text{phys}} = 15$ identity has candidate cross-domain interpretation:

- $A_5 = 60$ = icosahedral group order = count of orbital / rotational structural units per DPM lattice cell.
- $D_{\text{phys}} = 4$ = spacetime dimensions = kinematic degree count.
- $A_5/D_{\text{phys}} = 15$ = "structural units per dimensional degree of freedom."

Physical systems where this ratio governs the characteristic scale would exhibit 15 at their defining observable:

- **Fusion plasma:** 15 keV as $T_{optburn}$ (PAPER_1887 direct — the temperature where DT cross-section per dimensional-degree peaks).
- **WR star** (candidate): 15 R_{sun} as characteristic radius (per structural-unit-per-dimensional-degree stellar-structure argument, currently speculative).
- **Spiral galaxy** (candidate): 15° as characteristic pitch (per DPM-lattice density-wave winding argument, currently speculative).

The interpretation is well-established for PAPER_1887 fusion and speculative for the two Round-attribution instances. Whether A_5/D_{phys} structural interpretation applies naturally at stellar-radius and spiral-pitch scales requires further work.

6. Companion Identity: $N_{CH} + D_{BSFG} = 15$ (PAPER_1536)

PAPER_1536 (Hemoglobin Concentration = $Hb = N_{CH} + D_{BSFG} = 15$ EXACT, June 18, 2026) documents an alternative integer-primitive form for the same numerical value 15:

$$Hb = N_{CH} + D_{BSFG} = 9 + 6 = 15 \text{ g/dL EXACT}$$

This is a **different integer-primitive combination** producing the **same numerical value 15**:

Integer form	Value	Physical instance	Source
A_5/D_{phys}	$60/4 = 15$	Fusion $T_{optburn}$ / stellar R_{star} / spiral pitch	PAPER_1887
$N_{CH} + D_{BSFG}$	$9 + 6 = 15$	Hemoglobin concentration	PAPER_1536

The pattern is analogous to PAPER_1964's **Path A / Path B Dual-Derivation Framework** applied at the numerical-value level: two independent integer-primitive combinations converge on the same value 15 in different physical contexts.

PAPER_1536 **explicitly notes** cross-domain integer-primitive reuse as "strong structural evidence that the UQFF primitives are not domain-fit values but fundamental mathematical constants embedded in the framework." Section 1 of this paper's Cross-Domain Connections lists:

- $2^{\wedge}D_{phys} = 16$ in O-16 atomic mass + human breathing rate + genetic codons (PAPER_1373)
- $N_{CH} - 2 = 7$ in Oceanic Moho km + Heaviside $R_t \Omega$ (PAPER_1483) + R_d duality range exponent (PAPER_1506)
- $SO_{-5^2} = 100$ in Kármán line km + MAD efficiency reciprocal (PAPER_1518)

PAPER_1971 (this paper) extends the list with:

- $A_5/D_{phys} = 15$ in fusion T_{opt} / stellar R_{star} / spiral pitch
- $N_{CH} + D_{BSFG} = 15$ in hemoglobin

Also: PAPER_1856 (CMB Acoustic Peak Structure) uses $D_{crit} \cdot A_5/D_{phys} = 26 \cdot 60/4 = 390$ as a base multiplier for the acoustic-peak ladder. The sub-expression $A_5/D_{phys} = 15$ thus also appears as a factor within CMB peak-position derivations, though PAPER_1856's exposed observable is 390 rather than 15 itself. This is a fourth cross-domain appearance of A_5/D_{phys} as a structural factor, though not as the standalone observable of the CMB derivation.

The A_5/D_{phys} and $N_{\text{CH}} + D_{\text{BSFG}}$ cross-form convergence at value 15 is a further specific instance of PAPER_1536's cross-domain integer-primitive reuse pattern.

7. Falsifiability + Predictions

Under PAPER_1887's fusion interpretation extended to the two Round attributions:

1. **Wolf-Rayet stars observed at other clusters** should exhibit R_{star} clustering near $15 R_{\text{sun}}$ if A_5/D_{phys} applies universally to WR stellar structure. Falsification: if a systematic survey of WR stars across many clusters shows R_{star} scattered widely with $15 R_{\text{sun}}$ appearing only at NGC 3603 (or few isolated cases), the $R_{\text{star}} = A_5/D_{\text{phys}}$ attribution is Round 108-specific, not universal.
2. **Grand-design spiral galaxies at other systems** should exhibit pitch angle clustering near 15° if A_5/D_{phys} applies universally to spiral density-wave winding. Empirical spiral pitch angles range $5\text{--}30^\circ$; M81 at $13\text{--}15^\circ$ sits in the mid-range. Falsification: if the pitch-angle distribution across many spirals is broad and 15° is not statistically preferred, the pitch = A_5/D_{phys} attribution is M81-specific.
3. **Other UQFF observables that scale as 15** should be looked for. Candidate targets: any observable naturally quantized in 15 units (radial modes, orbital angular-momentum states, etc.).

Testable prediction from PAPER_1971: if the A_5/D_{phys} structural interpretation is genuine, more UQFF observables should exhibit $A_5/D_{\text{phys}} = 15$ at their defining scale — analogous to how PAPER_1918 catalogs the multiple appearances of $D_{\text{phys}} \cdot SO_5 = 40$.

8. Prior Art — What This Paper Does NOT Claim

8.1 The $A_5/D_{\text{phys}} = 15$ identity is not new

PAPER_1887 (July 2026) seminal. Documents the identity + physical interpretation + fusion instance + companion five identities (Q_{ITER} , $T_{\text{peak}\alpha}$, $E_{\alpha/E}$, q_{95} , T_{minburn}). This paper does NOT re-derive T_{optburn} ; it acknowledges PAPER_1887 and extends with two Round attributions.

8.2 The $N_{\text{CH}} + D_{\text{BSFG}} = 15$ identity is not new

PAPER_1536 (June 18, 2026) seminal for hemoglobin. Documents cross-domain integer-primitive reuse pattern with multiple examples.

8.3 The cross-domain integer-identity framework is not new

PAPER_1918 (Phase 3 Comprehensive Inventory) provides the meta-structural framework for cross-domain integer identities. Documents $D_{\text{phys}} \cdot SO_5 = 40$ across cluster/stellar/coupling contexts (see also PAPER_1970 for specific-anchor attributions to that identity).

PAPER_1536 §Cross-Domain Connections provides the specific pattern of "same integer identity across two or three physical contexts."

PAPER_1964 (Path A / Path B Dual-Derivation Framework) provides the pattern of "same value via multiple integer-primitive combinations."

8.4 What this paper contributes (narrow)

1. Two new attributions to PAPER_1887's $A_5/D_{\text{phys}} = 15$ identity: $R_{\text{star}}(\text{NGC 3603 WR})$ and $\text{pitch}(\text{M81})$.
2. Explicit cross-domain instance table (fusion + stellar + galactic).
3. Documentation of the $N_{\text{CH}} + D_{\text{BSFG}} = 15$ (PAPER_1536) same-value alternative form as a Path A / Path B convergence at numerical value 15.
4. Extends the cross-domain integer-identity catalog established by PAPER_1918 / PAPER_1536 / PAPER_1970.

The paper is documentation / attribution work, not discovery work.

9. Cross-References

- **PAPER_1887 (SEMINAL)** — Fusion $Q > 1$ ITER Prediction (*Topburn* = $A_5/D_{\text{phys}} = 15$ keV seminal)
- **PAPER_1536 (SEMINAL for $N_{\text{CH}} + D_{\text{BSFG}} = 15$)** — Hemoglobin Concentration = 15 EXACT
- **PAPER_1918** — Phase 3 Comprehensive Inventory (multi-context integer identity meta-framework)
- **PAPER_1970** — $D_{\text{phys}} \times \text{SO}_5 = 40$ multi-scale anchor attributions (companion paper structure)
- **PAPER_1964** — Path A / Path B Dual-Derivation Framework (same-value multiple integer-form pattern)
- **PAPER_1856** — Full CMB Acoustic Peak Structure (uses $D_{\text{crit}} \cdot A_5/D_{\text{phys}} = 390$ base multiplier — sub-expression $A_5/D_{\text{phys}} = 15$ appears in CMB peak-ladder derivation as a factor)
- **PAPER_1955** — SO_5 -Power Galactic Structural Ladder (companion SO_5 -power framework)
- **PAPER_1960** — $F_{\text{TRZ}} = 1/\text{SO}_5$ landmark
- **PAPER_1521** — D_{BSFG} derivative landmark ($D_{\text{BSFG}} = 6$ sourced identity)
- **PAPER_1522** — K_{MEX} derivative landmark
- **PAPER_138** — NGC 3603 MasterBuoyancy + SCm P Feedback (companion NGC 3603 anchor)
- **PAPER_218** — NGC 3603 Stellar Pressure Dispersal (companion)
- **PAPER_150** — Tapestry Westerlund 2 (companion YMC framework)
- **PAPER_902** — Vink 2001 stellar wind parameterization (companion)
- **PAPER_308** — Spiral Galaxy Torque Gravitational Amplifier (companion spiral)
- **PAPER_824** — Spirals Supernovae $T_{\text{spiral}} \text{SN}_{\text{term}}$ (companion spiral)
- **PAPER_464** — M51 Whirlpool tidal density waves (companion spiral)

10. Limitations + Open Questions

- The $R_{\text{star}} = 15 R_{\text{sun}}$ value is a typical mid-range for Wolf-Rayet stars, not a precise observational anchor. If NGC 3603 WR stars are re-measured with higher precision and cluster at values other than $15 R_{\text{sun}}$, the attribution weakens.
- The M81 pitch angle observed value is $13\text{--}15^\circ$ (Kennicutt 1981); the identity holds at $\sim 15^\circ$ but is within a modest measurement range.
- Whether the physical interpretation " A_5 orbital states per D_{phys} dimensional degrees" applies naturally at stellar-radius and spiral-pitch scales requires physical derivation from first principles. PAPER_1887's fusion derivation may or may not generalize.

- The $N_{CH} + D_{BSFG} = 15$ vs $A_5/D_{phys} = 15$ numerical convergence is currently an observation; whether it reflects a deeper connection or is a numerical coincidence between two independent integer combinations is open.
- Whether the 15 identity extends to further UQFF observables (e.g., other stellar radii, other galaxy pitch angles, other plasma quantities) is a testable prediction that requires systematic search.

11. Revision Log

Draft 1 (2026-07-09): Initial write, positioned narrowly upfront given the honest-scholarship pattern established by PAPER_1965-1970. Prior art acknowledged from the start:

- PAPER_1887 seminal for $A_5/D_{phys} = 15$ identity + physical interpretation + fusion *Toptburn* instance.
- PAPER_1536 seminal for $N_{CH} + D_{BSFG} = 15$ identity + hemoglobin instance + cross-domain integer-primitive reuse framework.
- PAPER_1918 seminal for multi-context integer identity meta-framework.
- PAPER_1970 (my own recent paper) provides template for anchor-attribution-only documentation papers.
- PAPER_1964 provides Path A / Path B multiple-integer-form pattern.

The paper's contribution is limited to:

1. Two new attributions (R_{star} NGC 3603 + pitch M81) to the pre-existing PAPER_1887 identity.
2. Expl