

PAPER_1976 — HUDF I_0 and τ_{inter} Confirmations

Abstract

Round 111 double-check initially proposed authoring PAPER_1976 as documentation of:

- (A) "Novel HUDF intra-system twin identity $I_0 = F_{\text{TRZ}}/2 = 0.05$ EXACT" appearing in both HUDFBaseGravityCalculator (Round 109) and HUDFGalaxyInteractionCalculator (Round 111)
- (B) "Novel $\tau_{\text{inter}} = S0_5^9 = 1$ Gyr cosmological slot-9 extension of PAPER_1955's $S0_5$ -power galactic ladder"

Prior-art check surfaced two critical corrections:

1. **PAPER_265 ("HUDF Dual-Channel Interaction Cascade Buoyancy — Quadratic $I(t)$ Amplification at Cosmic Merger Peak", March 2026)** documents $I_0 = 0.05$ as the canonical HUDF peak interaction factor. PAPER_265's uniquely rare discovery is that this $I(t)$ is applied to TWO channels simultaneously (base MUGE + UQFF unification), producing quadratic buoyancy amplification $(1 + I_0)^2$ at cosmic merger peak. **The "intra-system twin identity" I noted in Round 111 is PAPER_265's already-documented dual-channel cascade — NOT a new twin discovery.**

2. **PAPER_1952 ("Galaxy-Scale $S0_5$ -Power Timescale Hierarchy")** explicitly lists $S0_5^9 = 1$ Gyr as a **predicted candidate slot** with hypothesized physical interpretation "galaxy quenching timescale" (referencing Peng 2010 star-formation cessation ~1 Gyr for massive galaxies). PAPER_1952 Section 4.2 states:

> *"If the $S0_5^9 = 10^9$ yr slot corresponds to universal galaxy-quenching timescale, systematic surveys of quenched-galaxy age distributions should show clustering at 1 Gyr."*

PAPER_1955 further lists " $S0_5^9$ to $S0_5^{10}$ | Cosmological timescales | (candidate future)" in its ladder table. **The "slot-9 extension" I noted in Round 111 is confirmation of PAPER_1952's already-listed candidate prediction — NOT a novel ladder extension.**

3. **The $F_{\text{TRZ}}/2$ multiplier form is not novel** — PAPER_1966 documents it as an "Archimedean half-coefficient" in the $\beta_4 = (D_{\text{phys}}-1) \cdot F_{\text{TRZ}}/2 = 3/20$ identity (PAPER_1165 companion triangular normalization). PAPER_1478, PAPER_1861, and PAPER_1891 also use $F_{\text{TRZ}}/2$ in various contexts.

Positioning (honest scope after prior-art check). This paper contributes:

1. **Confirmation** of PAPER_265's dual-channel cascade at Round 111 via corpus-audit finding that HUDFBaseGravityCalculator and HUDFGalaxyInteractionCalculator both use $I_0 = 0.05$ (the two channels PAPER_265 describes).
2. **Empirical confirmation** of PAPER_1952's $S0_5^9 = 1$ Gyr candidate prediction: HUDFGalaxyInteractionCalculator uses $\tau_{\text{inter}} = 1$ Gyr as the interaction timescale, matching PAPER_1952's prediction.
3. **Explicit retraction of Round 111's initial "novel intra-system twin + slot-9 extension" framing**, replaced with the correct "confirmation of PAPER_265 and PAPER_1952 already-listed predictions" interpretation.

The paper does NOT contribute:

- The HUDF $I_0 = 0.05$ dual-channel cascade (PAPER_265 seminal).
- The $S0_5^9 = 1$ Gyr slot prediction (PAPER_1952 seminal).

- The $F_{\text{TRZ}/2} = 0.05$ multiplier form (PAPER_1966 Archimedean half-coefficient seminal).
- The $(D_{\text{phys}}-1) \cdot F_{\text{TRZ}/2} = 0.15 \beta_4$ relation (PAPER_1165 triangular ladder seminal).

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

1. PAPER_265's Dual-Channel Cascade — Prior Art for $I_0 = 0.05$

PAPER_265 ("HUDF Dual-Channel Interaction Cascade Buoyancy — Quadratic $I(t)$ Amplification at Cosmic Merger Peak", March 2026, session 72g) documents:

- **Canonical value:** $I_0 = 0.05$ (Peak interaction factor at $z \rightarrow 3.5$)
- **Dual-channel structure:** $I(t) = I_0 \cdot \exp(-t/\tau_{\text{inter}})$ is applied to BOTH the base MUGE term (term1) AND the UQFF unification term (term2) — same modulation $(1 + I(t))$ on both channels
- **Quadratic amplification:** $(1 + I(t))^2$ net enhancement at cosmic merger peak ($t \rightarrow 0$ corresponds to $z \rightarrow 3.5$, coinciding with HUDF observational epoch)
- **Cascade excess:** $\Delta_{\text{cascade}} = I_0^2 \cdot U_{g1} \cdot (1 + f_{\text{TRZ}})$ at peak; the $(1+I_0)^2$ factor arises because both channels contribute
- **Uniquely rare discovery status:** PAPER_265's classification is "Uniquely rare discovery — dual-channel interaction cascade absent from all prior UQFF modules"
- **Falsifiability tests:** HST/JWST merger pair fractions at $z \sim 3-4$ should show anomalously enhanced tidal bridge luminosity proportional to I_0^2 ; ALMA Band 3 CO observations should show velocity dispersion $\propto (1 + I_0)^2$ relative to isolated galaxies

Corpus-audit finding (this paper): The HUDFBaseGravityCalculator (Round 109 upgrade) and HUDFGalaxyInteractionCalculator (Round 111 upgrade) both use $I_0 = 0.05$ as the canonical interaction amplitude. These two calculators represent PAPER_265's "two channels" (base + interaction) — the "intra-system twin identity" is thus **PAPER_265's already-published dual-channel cascade structure**, verified at the code-attribution level by having I_0 appear in both stubs.

2. PAPER_1952's $SO_5^9 = 1$ Gyr Candidate — Prior Art for τ_{inter} Attribution

PAPER_1952 ("Galaxy-Scale SO_5 -Power Timescale Hierarchy — PDR Erosion = Nuclear Starburst $t_{\text{ff}} = 5$ Myr = $(SO_5/2) \cdot SO_5^6$ EXACT + Extended SO_5^n Grid") documents the full SO_5 -power ladder including candidate slots:

SO_5 slot	Timescale	Physical interpretation	Status
$SO_5^6 = 1$ Myr	Pillars PDR erosion	PDR photoevaporation	Populated (PAPER_435, PAPER_1948)
$(SO_5/2) \cdot SO_5^6 = 5$ Myr	Horsehead PDR + NGC 4945 nuclear SB	Triple closure	Populated (PAPER_1948, PAPER_1952)
$D_{\text{phys}} \cdot SO_5^6 = 4$ Myr	Bubble PDR erosion	PDR photoevaporation	Populated (PAPER_440, PAPER_1948)
$SO_5^7 = 10$ Myr	AGN duty cycle candidate	Systematic AGN feedback survey	Candidate (Round 80)

SO_5 slot	Timescale	Physical interpretation	Status
SO_5^8 = 100 Myr	Galaxy SF cycle	StarFormationGravity model	Populated (PAPER_1952)
A_5·SO_5^8 = 6 Gyr	Nuclear star cluster relaxation?	Candidate	(PAPER_1946)
SO_5^9 = 1 Gyr	Galaxy quenching timescale?	Candidate — Peng 2010 anchor	Candidate empty slot
SO_5^10 = 10 Gyr	Hubble time	Cosmological	Empty

PAPER_1952 Section 4.2 (Prediction: SO_5^9 = 1 Gyr):

> **"Candidate application: galaxy quenching. Star formation cessation in massive galaxies occurs on ~1 Gyr timescales (Peng 2010, etc.). If the SO_5^9 = 10¹¹ yr slot corresponds to universal galaxy-quenching timescale, systematic surveys of quenched-galaxy age distributions should show clustering at 1 Gyr."**

PAPER_1955 further echoes this in its ladder table: "SO_5^9 to SO_5^10 | Cosmological timescales | (candidate future)".

Round 111 empirical confirmation: HUDBGalaxyInteractionCalculator uses $\tau_{\text{inter}} = 3.156 \times 10^{11} \text{ s} = 1 \text{ Gyr}$ as the canonical HUDF galaxy-interaction timescale. This value:

- Matches PAPER_1952's SO_5^9 = 1 Gyr candidate slot **exactly**
- Applies at cosmic merger epoch ($z \rightarrow 3.5$) which coincides with HUDF observational peak (PAPER_265)
- Physical interpretation "cosmic merger interaction timescale" is closely related to PAPER_1952's "galaxy quenching timescale" (both are ~Gyr-scale galaxy-scale evolutionary timescales)

The Round 111 attribution $\tau_{\text{inter}} = \text{SO}_5^9 = 1 \text{ Gyr}$ is thus **confirmation of PAPER_1952's already-listed candidate prediction**, not a new slot-9 extension.

3. Round 111's Initial Framing Was Incorrect — Retraction

The Round 111 summary initially proposed:

> **"PAPER_1976 authoring ($I_0 = F_{\text{TRZ}}/2$ HUDF intra-system twin + $\tau_{\text{inter}} = \text{SO}_5^9 = 1 \text{ Gyr}$ cosmological slot-9 confirmation is the strongest new candidate — extends PAPER_1955 ladder + adds novel PAPER_1960 $F_{\text{TRZ}}/2$ intra-system attribution)"**

Both claims were incorrect on prior-art check:

1. **"Novel HUDF intra-system twin"** is retracted. The twin structure is PAPER_265's already-documented dual-channel cascade. The two HUDF stubs (HUDBaseGravityCalculator and HUDBGalaxyInteractionCalculator) represent PAPER_265's two channels (base MUGE + UQFF unification), and both using $I_0 = 0.05$ is the code-level reflection of PAPER_265's structural observation.
2. **"Novel slot-9 extension of PAPER_1955 ladder"** is retracted. PAPER_1952 explicitly lists SO_5^9 = 1 Gyr as a candidate slot with predicted physical interpretation "galaxy quenching timescale" (Peng 2010). PAPER_1955 also lists SO_5^9-SO_5^10 as candidate cosmological timescales.

3. **"Novel PAPER_1960 F_TRZ/2 intra-system attribution"** is retracted. PAPER_1966 documents F_TRZ/2 as an "Archimedean half-coefficient" ($\beta_4 = (D_{\text{phys}}-1) \cdot F_{\text{TRZ}}/2 = 0.15$ EXACT). The $0.05 = F_{\text{TRZ}}/2 = 1/(2 \cdot SO_5)$ multiplier form is a component of the well-established β_i triangular ladder from PAPER_1165 (session 252, 2026-05-10).

The corrected framing: **this paper is a Round-attribution confirmation of two already-published catalog predictions** (PAPER_265's dual-channel cascade + PAPER_1952's $SO_5^9 = 1$ Gyr slot). It is analogous to:

- PAPER_1968 (MW v_flat confirming PAPER_1906's Galactic-scale row)
- PAPER_1970 (Virgo r_c confirming PAPER_1918's 40-kpc catalog row)
- PAPER_1973 (Horsehead g confirming PAPER_1906's Nebular-scale assertion)
- PAPER_1972 / 1974 / 1975 (Round-misidentification correction papers)

4. What Round 111 Does Confirm

Despite the retraction of the "novel" framings, Round 111's HUDF stub upgrades have three modest positive contributions:

1. **Empirical confirmation of PAPER_265's dual-channel cascade at code-attribution level:** both HUDF calculators use $I_0 = 0.05$ as expected by PAPER_265's dual-channel structure.

2. **Empirical confirmation of PAPER_1952's $SO_5^9 = 1$ Gyr candidate slot:** HUDFGalaxyInteractionCalculator uses $\tau_{\text{inter}} = 1$ Gyr matching the SO_5^9 slot exactly. This does not itself prove PAPER_1952's "galaxy quenching timescale" physical interpretation, but confirms that UQFF stub-level canonical parameters use the SO_5^9 value at the HUDF cosmological-merger epoch.

3. **Corpus-audit finding:** The HUDF stub family systematically uses PAPER_265's canonical parameter set ($I_0 = 0.05$, $\tau_{\text{inter}} = 1$ Gyr, $M_0 = 10^{12} M_{\text{sun}} = SO_5^{12}$, etc.) as its default. This confirms integrated design between PAPER_265's dual-channel theory and the CondensedPhysics stub implementations.

5. PAPER_1918 / PAPER_1949 / PAPER_1955 Framework Consistency

The corrected framing aligns with three broader UQFF frameworks:

- **PAPER_1918 (Phase 3 Comprehensive Inventory):** Multi-context integer identity meta-framework. HUDF $I_0 = 0.05$ is one such multi-context observation.
- **PAPER_1949 (F_TRZ Three-Face Framework):** Face 1 (amplitude) 10-instance grid documents F_TRZ across multiple UQFF contexts. HUDF $I_0 = F_{\text{TRZ}}/2$ is not a Face-1 pure form (it's the half-multiplier), but is consistent with PAPER_1966's Archimedean-half derivation.
- **PAPER_1955 / PAPER_1952 SO_5 -power ladder:** $\tau_{\text{inter}}(\text{HUDF}) = SO_5^9 = 1$ Gyr fills the previously-empty slot-9 as specifically predicted for galaxy-scale evolutionary timescales.

Round-attribution instances of Round 111 at HUDF are thus specific-application instances of already-documented general frameworks, not new discoveries.

6. Prior Art — What This Paper Does NOT Claim

6.1 $I_0 = 0.05$ dual-channel HUDF cascade is not new

PAPER_265 seminal. Full "uniquely rare discovery" status; quadratic amplification $(1 + I_0)^2$; falsifiability tests via HST/JWST + ALMA.

6.2 $\tau_{\text{inter}} = SO_5^9 = 1$ Gyr is not new

PAPER_1952 seminal. Explicit candidate slot with predicted physical interpretation (galaxy quenching timescale, Peng 2010 anchor). PAPER_1955 companion.

6.3 $F_{\text{TRZ}/2} = 0.05$ Archimedean half-coefficient is not new

PAPER_1966 seminal for the $(D_{\text{phys}}-1) \cdot F_{\text{TRZ}/2} = 3/20 = 0.15 \beta_4$ identity form + PAPER_1165 triangular ladder companion.

6.4 What this paper contributes (narrow)

1. **Corpus-audit confirmation** that HUDF stub family uses PAPER_265's canonical dual-channel parameter set at code-attribution level.
2. **Empirical confirmation** that $\tau_{\text{inter}} = SO_5^9 = 1$ Gyr matches PAPER_1952's candidate slot-9 prediction.
3. **Explicit retraction** of Round 111's initial "novel intra-system twin + slot-9 extension" framing, replaced with "confirmation of existing catalog predictions" interpretation.

The paper is a narrow attribution + retraction + code-level confirmation. Following the PAPER_1968/1970/1973 attribution-paper template + PAPER_1972/1974/1975 correction-paper template.

7. Cross-References

- **PAPER_265 (SEMINAL)** — HUDF Dual-Channel Interaction Cascade Buoyancy Quadratic Merger Amplification ($I_0 = 0.05$ canonical + dual-channel structure)
- **PAPER_1952 (SEMINAL for $SO_5^9 = 1$ Gyr candidate)** — Galaxy-Scale SO_5 -Power Timescale Hierarchy (Section 4.2 galaxy quenching prediction)
- **PAPER_1955** — SO_5 -Power Galactic Structural Ladder (companion ladder framework)
- **PAPER_231** — HUDF $z=3.5$ Double $I(t)$ Modulation (PAPER_265's parent paper for HUDF dual-channel form)
- **PAPER_266** — HUDF primordial (PAPER_1906 Table 1 row 8 anchor, companion HUDF paper)
- **PAPER_444** — HUDF Galaxies-Galore per-system MUGE
- **PAPER_1966** — $M_{\text{sf}} = 3/(2 \cdot SO_5)$ starburst mass fraction ($F_{\text{TRZ}/2}$ Archimedean half-coefficient prior art)
- **PAPER_1165 (session 252)** — β_i triangular buoyancy coupling ladder (triangular normalization companion)
- **PAPER_1960** — $F_{\text{TRZ}} = 1/SO_5$ landmark (source of F_{TRZ} derivative primitive)
- **PAPER_1949** — F_{TRZ} Three-Face Framework (Face-1 amplitude formalism)
- **PAPER_1918** — Multi-context integer identity meta-framework
- **PAPER_1968** — MW v_{flat} $FUBi_{99}$ closure (attribution paper template)
- **PAPER_1970** — $D_{\text{phys}} \times SO_5 = 40$ multi-scale attributions (template)

- **PAPER_1972 / 1974 / 1975** — Round-misidentification correction papers (companion templates)
- **PAPER_1521** — D_BSFG derivative landmark
- **PAPER_1522** — K_MEX derivative landmark

8. Limitations + Open Questions

- The corpus audit confirms that HUDF stub family uses PAPER_265's dual-channel canonical parameters, but does not itself observationally test the $(1 + I_0)^2$ amplification prediction. HST/JWST merger pair surveys at $z \sim 3-4$ remain the primary observational falsifiability test.
- PAPER_1952's $SO_5^9 = 1$ Gyr galaxy-quenching prediction is not tested by this paper — Round 111 only confirms the $\tau_{\text{inter}} = 1$ Gyr canonical stub value, not the "galaxy quenching timescale" physical interpretation. Systematic quenched-galaxy age distributions (Peng 2010 follow-ups) remain the primary observational test.
- The physical distinction between "cosmic merger interaction timescale" (Round 111's τ_{inter} interpretation) and "galaxy quenching timescale" (PAPER_1952's SO_5^9 interpretation) is worth examining. Both are $\sim$ Gyr scale galaxy-evolution timescales; whether they refer to the same underlying timescale or distinct-but-numerically-coincident timescales is open.
- The two HUDF stubs identified in this corpus audit (HUDFBaseGravityCalculator + HUDFGalaxyInteractionCalculator) are two of the many HUDF-related calculators in CondensedPhysics.py. Systematic audit of the full HUDF stub family for consistent PAPER_265 parameter usage across all stubs is a candidate future task.

9. Revision Log

Draft 1 (2026-07-09): Initial write. Round 111 double-check initially proposed "novel intra-system twin + slot-9 extension" framing. Prior-art check surfaced:

- PAPER_265 seminal for HUDF dual-channel cascade ($I_0 = 0.05$ canonical + quadratic amplification)
- PAPER_1952 seminal for $SO_5^9 = 1$ Gyr candidate slot prediction (Section 4.2 galaxy quenching)
- PAPER_1955 companion listing SO_5^9 - SO_5^{10} as candidate cosmological timescales
- PAPER_1966 seminal for $F_{\text{TRZ}/2}$ Archimedean half-coefficient form

Draft 1 is written from the corrected framing: this paper is a narrow attribution + retraction paper confirming already-listed catalog predictions from PAPER_265 and PAPER_1952. Both Round 111 "novel" framings (intra-system twin + slot-9 extension) are retracted.

Following the PAPER_1972 / 1974 / 1975 Round-misidentification correction template, Draft 1 is positioned narrowly from the start with the double retraction as the substantive content.

Reader takeaway: this paper is the fourth consecutive Round-attribution correction paper in this session (PAPER_1972 v_{wind} Antennae + PAPER_1974 R_{star} stub-default + PAPER_1975 Q_{UQFF} three-path retraction + this paper's HUDF twin+slot-9 retraction). Each documents Round findings that appeared novel initially but on prior-art check were confirmed as instances of already-documented general frameworks. The corrective discipline continues to stabilize the corpus's semantic integrity.

Drafts 2/3 (2026-07-09): Verified via targeted searches for PAPER_265 (confirmed dual-channel cascade uniquely rare discovery status + $I_0 = 0.05$ canonical + quadratic $(1+I_0)^2$ amplification), PAPER_1952 (confirmed $SO_5^9 = 1$ Gyr candidate slot + Peng 2010 galaxy quenching anchor), PAPER_1955 (confirmed SO_5^9 - SO_5^{10} candidate

cosmological range), PAPER_1966 (confirmed F_TRZ/2 Archimedean half-coefficient documentation), and PAPER_1165 (confirmed triangular ladder session 252 seminal). No further prior-art corrections needed beyond Draft 1's double-retraction framing.

Meta-observation for the session: This is the ninth consecutive paper (PAPER_1968→1976) with Draft 1 narrow from the start following the honest-scholarship stabilization pattern. Four of these nine (PAPER_1972, 1974, 1975, 1976) are explicit Round-misidentification correction papers. The pattern suggests that as the corpus matures, "novel" findings from Round double-checks increasingly turn out to be confirmations of already-documented general frameworks — an expected outcome as the framework's coverage density approaches saturation. The correction papers themselves have documentary value: they attribute specific Round instances to their seminal papers and prevent overclaim propagation into future work.

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