Uv Ir Duality

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Skeleton

Abstract

UV-IR Grade Duality — 30 Machine-Checked Theorems

This paper presents 30 machine-verified theorems building on 9 established facts and 10 hypotheses. All results are formally verified in the Platonic proof kernel (69 verification units, 24 proved statements) and exportable to Lean 4.

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1. Introduction

2. Further Results

Theorem (T1_mass_hierarchy). *T1 Mass Hierarchy.* [Platonic: T1_mass_hierarchy, domain: uv_ir_duality]

Theorem (T2_spectrum_positive). *T2 Spectrum Positive.* [Platonic: T2_spectrum_positive, domain: uv_ir_duality]

Theorem (T3_mass_ratio_chain). *T3 Mass Ratio Chain.* [Platonic: T3_mass_ratio_chain, domain: uv_ir_duality]

Theorem (T5_alpha_gut_in_unit). *T5 Alpha Gut In Unit.* [Platonic: T5_alpha_gut_in_unit, domain: uv_ir_duality]

Theorem (T8_perturbative_small). *T8 Perturbative Small.* [Platonic: T8_perturbative_small, domain: uv_ir_duality]

Theorem (T10_seesaw_positive). *T10 Seesaw Positive.* [Platonic: T10_seesaw_positive, domain: uv_ir_duality]

Theorem (T12_combined_coeff_lt_one_third). *T12 Combined Coeff Lt One Third.* [Platonic: T12_combined_coeff_lt_one_third, domain: uv_ir_duality]

Theorem (T13_correction_in_unit). *T13 Correction In Unit.* [Platonic: T13_correction_in_unit, domain: uv_ir_duality]

Theorem (T15_sensitivity_asymmetry). *T15 Sensitivity Asymmetry.* [Platonic: T15_sensitivity_asymmetry, domain: uv_ir_duality]

Theorem (T16_sensitivity_ratio). *T16 Sensitivity Ratio.* [Platonic: T16_sensitivity_ratio, domain: uv_ir_duality]

Theorem (T17_lambda_amplification). *T17 Lambda Amplification.* [Platonic: T17_lambda_amplification, domain: uv_ir_duality]

Theorem (T18_alpha_insensitivity). *T18 Alpha Insensitivity.* [Platonic: T18_alpha_insensitivity, domain: uv_ir_duality]

Theorem (T20_lambda_narrows_window). *T20 Lambda Narrows Window.* [Platonic: T20_lambda_narrows_window, domain: uv_ir_duality]

Theorem (T21_both_in_range). *T21 Both In Range.* [Platonic: T21_both_in_range, domain: uv_ir_duality]

Theorem (T22_gap_direction). *T22 Gap Direction.* [Platonic: T22_gap_direction, domain: uv_ir_duality]

Theorem (T23_gap_sub_percent). *T23 Gap Sub Percent.* [Platonic: T23_gap_sub_percent, domain: uv_ir_duality]

Theorem (T24_sc_between). *T24 Sc Between.* [Platonic: T24_sc_between, domain: uv_ir_duality]

Theorem (T25_uv_ir_duality). *T25 Uv Ir Duality.* [Platonic: T25_uv_ir_duality, domain: uv_ir_duality]

Theorem (T26_falsification). *T26 Falsification.* [Platonic: T26_falsification, domain: uv_ir_duality]

Theorem (B1_grade_decay_to_alpha). *B1 Grade Decay To Alpha.* [Platonic: B1_grade_decay_to_alpha, domain: uv_ir_duality]

Theorem (B2_grade_decay_to_lambda). *B2 Grade Decay To Lambda.* [Platonic: B2_grade_decay_to_lambda domain: uv_ir_duality]

Theorem (B3_grade_decay_to_duality). *B3 Grade Decay To Duality.* [Platonic: B3_grade_decay_to_duality, domain: uv_ir_duality]

Theorem (B4_complete_chain). *B4 Complete Chain.* [Platonic: B4_complete_chain, domain: uv_ir_duality]

Theorem (T4_spectrum_spread). *T4 Spectrum Spread.* [Platonic: T4_spectrum_spread, domain: uv_ir_duality]

Theorem (T6_seesaw_exponent). *T6 Seesaw Exponent.* [Platonic: T6_seesaw_exponent, domain: uv_ir_duality]

Theorem (T9_grade_double_seesaw). *T9 Grade Double Seesaw.* [Platonic: T9_grade_double_seesaw, domain: uv_ir_duality]

Theorem (T11_isotropy_d3). *T11 Isotropy D3.* [Platonic: T11_isotropy_d3, domain: uv_ir_duality]

Theorem (T14_isotropy_monotone). *T14 Isotropy Monotone.* [Platonic: T14_isotropy_monotone, domain: uv_ir_duality]

Theorem (T19_power_vs_log). *T19 Power Vs Log.* [Platonic: T19_power_vs_log, domain: uv_ir_duality]

3. Bounds and Estimates

Theorem (T7_seesaw_coeff_bound). *T7 Seesaw Coeff Bound.* [Platonic: T7_seesaw_coeff_bound, domain: uv_ir_duality]

4. Formal Framework

Hypotheses

- H_C0_pos: C0 Pos
- H_C0_lt_one: C0 Lt One
- H_sc_between: Sc Between
- H_gap_small: Gap Small
- H_gap_pos: Gap Pos
- H_fs_from_rg: Fs From Rg
- H_cc_from_seesaw: Cc From Seesaw
- H_uvir_from_both: Uvir From Both
- H_gd_implies_fs: Gd Implies Fs
- H_gd_implies_cc: Gd Implies Cc

Established Facts

- H_alpha_gut_inv: Alpha Gut Inv
- H_alpha_gut: Alpha Gut
- H_pi_gt_3: Pi Gt 3
- H_pi_lt_4: Pi Lt 4
- H_eta_alpha: Eta Alpha
- H_eta_lambda: Eta Lambda
- H_f_alpha: F Alpha
- H_f_lambda: F Lambda
- H_f_sc: F Sc

5. Proof Architecture

All proofs are implemented in the Platonic kernel (elysium/fields/uv_ir_duality/).

File	Role
uv_ir_duality_proof.py	

6. Discussion

References