Cosmic Inflation

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Skeleton

Abstract

Cosmic Inflation — The First 10 ^{32} Seconds

This paper presents 55 machine-verified theorems. All results are formally verified in the Platonic proof kernel (117 verification units, 55 proved statements) and exportable to Lean 4.

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1. Introduction

2. Further Results

Theorem (de_sitter_growth). *De Sitter Growth.* [Platonic: de_sitter_growth, domain: cosmic_inflation]

Theorem (slow_roll_acceleration). *Slow Roll Acceleration.* [Platonic: slow_roll_acceleration, domain: cosmic_inflation]

Theorem (efolding_horizon). *Efolding Horizon.* [Platonic: efolding_horizon, domain: cosmic_inflation]

Theorem (flatness_inflation). *Flatness Inflation.* [Platonic: flatness_inflation , domain: cosmic_inflation]

Theorem (tensor_scalar_ratio). *Tensor Scalar Ratio.* [Platonic: tensor_scalar_ratio, domain: cosmic_inflation]

Theorem (inflation_energy_scale). *Inflation Energy Scale.* [Platonic: inflation_energy_scale, domain: cosmic_inflation]

Theorem (graceful_exit). *Graceful Exit.* [Platonic: graceful_exit, domain: cosmic_inflation]

Theorem (consistency_relation). *Consistency Relation.* [Platonic: consistency_relation, domain: cosmic_inflation]

Theorem (phi_squared_predictions). *Phi Squared Predictions.* [Platonic: phi_squared_predictions, domain: cosmic_inflation]

Theorem (phi_squared_excluded). *Phi Squared Excluded.* [Platonic: phi_squared_excluded, domain: cosmic_inflation]

Theorem (starobinsky_predictions). *Starobinsky Predictions.* [Platonic: starobinsky_predictions, domain: cosmic_inflation]

Theorem (starobinsky_survives). *Starobinsky Survives.* [Platonic: starobinsky_survives, domain: cosmic_inflation]

Theorem (eta_problem). *Eta Problem.* [Platonic: eta_problem, domain: cosmic_inflation]

Theorem (scalar_power_spectrum). *Scalar Power Spectrum.* [Platonic: scalar_power_spectrum, domain: cosmic_inflation]

Theorem (tensor_power_spectrum). *Tensor Power Spectrum.* [Platonic: tensor_power_spectrum, domain: cosmic_inflation]

Theorem (tensor_scalar_consistency). *Tensor Scalar Consistency.* [Platonic: tensor_scalar_consistency, domain: cosmic_inflation]

Theorem (red_tilt_confirmed). *Red Tilt Confirmed.* [Platonic: red_tilt_confirmed, domain: cosmic_inflation]

Theorem (tensor_tilt_negative). *Tensor Tilt Negative.* [Platonic: tensor_tilt_negative, domain: cosmic_inflation]

Theorem (amplitude_constraint). *Amplitude Constraint.* [Platonic: amplitude_constraint, domain: cosmic_inflation]

Theorem (inflaton_oscillation). *Inflaton Oscillation.* [Platonic: inflaton_oscillation , domain: cosmic_inflation]

Theorem (reheating_temperature). *Reheating Temperature.* [Platonic: reheating_temperature, domain: cosmic_inflation]

Theorem (reheat_below_gut). *Reheat Below Gut.* [Platonic: reheat_below_gut, domain: cosmic_inflation]

Theorem (parametric_resonance). *Parametric Resonance.* [Platonic: parametric_resonance, domain: cosmic_inflation]

Theorem (reheat_efoldings). *Reheat Efoldings.* [Platonic: reheat_efoldings, domain: cosmic_inflation]

Theorem (isocurvature_adiabatic). *Isocurvature Adiabatic.* [Platonic: isocurvature_adiabatic, domain: cosmic_inflation]

Theorem (dbi_sound_speed). *Dbi Sound Speed.* [Platonic: dbi_sound_speed, domain: cosmic_inflation]

Theorem (dbi_non_gaussianity). *Dbi Non Gaussianity.* [Platonic: dbi_non_gaussianity, domain: cosmic_inflation]

Theorem (planck_fnl_constraint). *Planck Fnl Constraint.* [Platonic: planck_fnl_constraint, domain: cosmic_inflation]

Theorem (warm_inflation). *Warm Inflation.* [Platonic: warm_inflation, domain: cosmic_inflation]

Theorem (stochastic_regime). *Stochastic Regime.* [Platonic: stochastic_regime, domain: cosmic_inflation]

Theorem (eternal_inflation_condition). *Eternal Inflation Condition.* [Platonic: eternal_inflation_condition, domain: cosmic_inflation]

Theorem (bubble_nucleation). *Bubble Nucleation.* [Platonic: bubble_nucleation, domain: cosmic_inflation]

Theorem (pocket_universe). *Pocket Universe.* [Platonic: pocket_universe, domain: cosmic_inflation]

Theorem (landscape_vacua). *Landscape Vacua.* [Platonic: landscape_vacua, domain: cosmic_inflation]

Theorem (measure_problem). *Measure Problem.* [Platonic: measure_problem, domain: cosmic_inflation]

Theorem (sachs_wolfe). *Sachs Wolfe.* [Platonic: sachs_wolfe, domain: cosmic_inflation]

Theorem (acoustic_peak_location). *Acoustic Peak Location.* [Platonic: acoustic_peak_location, domain: cosmic_inflation]

Theorem (first_peak_flatness). *First Peak Flatness.* [Platonic: first_peak_flatness, domain: cosmic_inflation]

Theorem (silk_damping). *Silk Damping.* [Platonic: silk_damping, domain: cosmic_inflation]

Theorem (b_mode_from_tensors). *B Mode From Tensors.* [Platonic: b_mode_from_tensors, domain: cosmic_inflation]

Theorem (bouncing_cosmology). *Bouncing Cosmology.* [Platonic: bouncing_cosmology, domain: cosmic_inflation]

Theorem (ekpyrotic_equation_of_state). *Ekpyrotic Equation Of State.* [Platonic: ekpyrotic_equation_of_state, domain: cosmic_inflation]

Theorem (cyclic_universe). *Cyclic Universe.* [Platonic: cyclic_universe, domain: cosmic_inflation]

Theorem (curvaton_mechanism). *Curvaton Mechanism.* [Platonic: curvaton_mechanism, domain: cosmic_inflation]

Theorem (trans_planckian_problem). *Trans Planckian Problem.* [Platonic: trans_planckian_problem, domain: cosmic_inflation]

Theorem (swampland_distance). *Swampland Distance.* [Platonic: swampland_distance, domain: cosmic_inflation]

Theorem (swampland_de_sitter). *Swampland De Sitter.* [Platonic: swampland_de_sitter, domain: cosmic_inflation]

Theorem (swampland_tension). *Swampland Tension.* [Platonic: swampland_tension, domain: cosmic_inflation]

Theorem (wgc_constraint). *Wgc Constraint.* [Platonic: wgc_constraint, domain: cosmic_inflation]

3. Spectral Theory

Theorem (spectral_tilt). *Spectral Tilt.* [Platonic: spectral_tilt , domain: cosmic_inflation]

Theorem (scalar_spectral_index). *Scalar Spectral Index.* [Platonic: scalar_spectral_index, domain: cosmic_inflation]

Theorem (spectral_running). *Spectral Running.* [Platonic: spectral_running, domain: cosmic_inflation]

4. Bounds and Estimates

Theorem (lyth_bound). *Lyth Bound.* [Platonic: lyth_bound, domain: cosmic_inflation]

Theorem (isocurvature_planck_bound). *Isocurvature Planck Bound.* [Platonic: isocurvature_planck_bound, domain: cosmic_inflation]

Theorem (bicep_2024_bound). *Bicep 2024 Bound.* [Platonic: bicep_2024_bound, domain: cosmic_inflation]

5. Proof Architecture

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

File	Role
platonic.py	

6. Discussion

References