Annihilation Bias Leptogenesis

This repository contains the theoretical framework, equations, and preliminary simulation outputs for a proposed mechanism of baryogenesis via annihilation bias in a scalar field setting.

Overview

This toy model introduces an asymmetry during the re-materialization phase following particle-antiparticle annihilation in the early universe. A small bias parameter (ε) is introduced in the regeneration step, resulting in a net matter excess over time. This bias could potentially drive leptogenesis without requiring explicit CP violation in decay channels.

Files Included

- `Annihilation_Bias_Leptogenesis_via_Dynamic_Scalar_Bias.pdf`: Full theoretical writeup - `toy_baryogenesis_scan.csv`: Output CSV from parameter sweep simulations - `README.pdf`: This file

Main Concepts

- **Annihilation Bias**: Introduced through a small parameter ε, breaking perfect matter-antimatter symmetry in the regeneration step. - **Dynamic Reservoir**: Energy from annihilation is stored and reintroduced, driving biased re-creation. - **Equation System**: Toy ODEs model the interaction between pair density (P), matter excess (A), and reservoir (R). - **Entropy-Like Driver**: Scalar field model includes a "directional" memory mechanism that selects one branch of annihilation output. - **Expansion-Compatible**: Includes an H(t) term for universal expansion scaling, though it's a toy constant in this demo.

Purpose

This repository is intended to:

- Share the minimal working model of the theory - Provide testable simulation outputs - Offer an open framework for theoretical critique or expansion