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Higgs dynamics in the early universe

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Higgs dynamics in the early universe

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The cover shows bubbles of broken electroweak symmetry in a first order phase transition.

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Publications

This thesis is based on the following publications

- [1] *Electroweak stability and non-minimal coupling*, M. Postma and J. van de Vis JCAP, **1705**, 004 (2017), hep-ph/1702.07636.
- [2] *Preheating after Higgs Inflation: Self-Resonance and Gauge boson production*, E.I. Sfakianakis and J. van de Vis, Phys. Rev. **D99**, 083519 (2019), hep-ph/1810.01304.
- [3] *Electroweak Baryogenesis and the Standard Model Effective Field Theory*, J. de Vries, M. Postma, J. van de Vis and G. White, JHEP **01**, 089 (2018), hep-ph/1710.04061.
- [4] *The role of leptons in electroweak baryogenesis*, J. de Vries, M. Postma and J. van de Vis, JHEP **04**, 024 (2019), hep-ph/1811.11104.

Other publications

- [5] *Spinning bodies in curved spacetime*, G. d'Ambrosi, S. Satish Kumar, J. van de Vis and J. W. van Holten, Phys. Rev. **D93**, 044051, (2016), gr-qc/1511.05454.
- [6] *Ultrametricity increases the predictability of cultural dynamics*, A.I. Băbeanu, J. van de Vis and D. Garlaschelli, New J. Phys. **20**, 10 (2018), soc-ph/1712.05959.

Abbreviations

BAU	Baryon Asymmetry of the Universe
BBN	Big Bang Nucleosynthesis
BD	Bunch-Davies
BSM	Beyond the Standard Model
CMB	Cosmic Microwave Background
CP	Charge-Parity
CPV	Charge-Parity Violating
CTP	Closed Time Path
DM	Dark Matter
EDM	Electric Dipole Moment
EFT	Effective Field Theory
EOM	Equation Of Motion
EW	ElectroWeak
EWBG	ElectroWeak BaryoGenesis
EWPT	ElectroWeak Phase Transition
FOPT	First Order Phase Transition
GUT	Grand Unified Theories
HBB	Hot Big Bang
LHC	Large Hadron Collider
MSSM	Minimal Supersymmetric Standard Model
RGE	Renormalization Group Equation
RG	Renormalization Group
SM	Standard Model
vev	vacuum expectation value
VIA	Vev Insertion Approximation

Notation and Conventions

We will work in units where

$$\hbar = c = k_B = 1,$$

where \hbar is the reduced Planck constant, c the speed of light and k_B the Boltzmann constant. In this system

$$[\text{energy}] = [\text{mass}] = [\text{temperature}] = [\text{time}]^{-1} = [\text{length}]^{-1}.$$

The reduced Planck mass is defined by

$$m_{\text{pl}} = \frac{1}{\sqrt{8\pi G}},$$

with G Newton's constant.

In chapters 1 through 4 we use a metric with signature $(-, +, +, +)$. In the remainder of the thesis we use a metric with signature $(+, -, -, -)$.

The sign convention of the antisymmetric tensor in two dimensions ϵ^{ab} is $\epsilon^{12} = 1$. Similarly, ϵ^{abc} with $\epsilon^{123} = 1$ is the antisymmetric tensor in three dimensions.