UNIVERSITY
OF OSLO

Master's thesis

Gravitational waves from topological defects

Any short subtitle

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CS: Astrophysics
60 ECTS study points

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Autumn 2023

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Contents

Notation

Constants and units. We use 'natural units' where $\hbar = c = 1$, where $\hbar$ is the reduced Planck constant and c is the speed of light in vacuum. The Newtonian constant of gravitation G_{N} is referenced explicitly, and we use Planck units such as the Planck mass $M_{\mathrm{Pl}} = (\hbar c/G)^{1/2} = G^{-1/2} \sim 10^{-8}$ kg.

Tensors. The metric signature $(-, +, +, +)$ is considered. A four-vector p^{μ} =

$$\begin{aligned} \lambda \quad \bar{\lambda}\hbar \quad \cancel{\mathrm{X}} - \\ \cancel{\mathrm{X}} \\ \lambda\!\!\!^{-} \equiv \lambda/(2\pi); (\lambda = 1/f) \iff k = 2\pi/\lambda = 1/\lambda\!\!\!^{-} \end{aligned} \tag{1}$$

Frequently used abbreviations

CDM	cold dark matter
CMB	cosmic microwave background (radiation)
DW	domain wall
GR	general relativity
GW	gravitational wave
ΛCDM	'Lambda' (cosmological constant) CDM (i.e. standard model of cosmology)

Nomenclature

In the table below is listed the most frequently used symbols in this paper, for reference.

Table 1: helo

Symbol	Referent	SI-value or definition
Natural constants		
G_{N}	Newtonian constant of gravitation	1.2 kg
k_{B}	Boltzmann's constant	1.2 K
Fiducial quantities		
h_0	Reduced Hubble constant	0.67
Subscripts		
Q_{gw}	Quantity Q related to gravitational wave	
Functions and operators		
$\Theta(\xi)$	Heaviside step function	$\begin{cases} 1 & \xi > 0 \\ 0 & \xi < 0 \end{cases}$
$\delta(\xi)$	Dirac-Delta function of $\xi \in \mathbb{R}^n$, $n \in \mathbb{N}$.	
$\delta^{\mu\nu}$	Kronecker delta.	

Part I

Introduction

Chapter 1

Introduction

We use the convention that $(-, +, +, +)$ is the metric signature.

SO(3) is a group

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The order $\mathcal{O}(1)$ is large

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The Planck unit M_{Pl}

We have a GW with ρ_{GW} or $\rho_{\mathrm{gw}} \ldots \rho_{\mathrm{gw}}$

$$\begin{aligned} f(x) &= \int \frac{d^4k}{(2\pi)^4}\, \mathrm{e}^{-\mathrm{i}k\cdot x} \tilde{f}(k) \\ \tilde{f}(k) &= \int d^4x\, \mathrm{e}^{\mathrm{i}k\cdot x} f(x) \end{aligned} \tag{1.1}$$

Chapter 2

Theoretical Background

In the context of . . . blah . . . blah

$$d^3, d^3x, \mathrm{d}x, d^2x \tag{2.1}$$

2.1 High-Performance Computing

Part II

Analytical work

Chapter 3

Dummy chapter

3.1 Dummy section

Hello this is a nice thesis

$$h_{ij} = \boldsymbol{a}^{\mathrm{S}}\!:\!\Box\ \widehat{=} \tag{3.1}$$

Nanna is cool

Alma is lame

(a) . **(b)** .

Figure 3.1: .

helo
[1, 2]
See Eq. (3.1). fdf [3]
Boltzmann equation

$$\hat{L}[f] = \hat{C}[f]; \quad \hat{L}[f] \equiv \frac{\mathrm{d}f}{\mathrm{d}\lambda} \tag{3.2}$$

$$\mathrm{e}^{\mathrm{i}\pi} \tag{3.3}$$

Hei jeg heter Nanna

Part III

Numerical work

Part IV

Finishing

Bibliography

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[3] Tanmay Vachaspati. *Kinks and Domain Walls: An Introduction to Classical and Quantum Solitons*. Cambridge University Press, Cambridge, 2006.