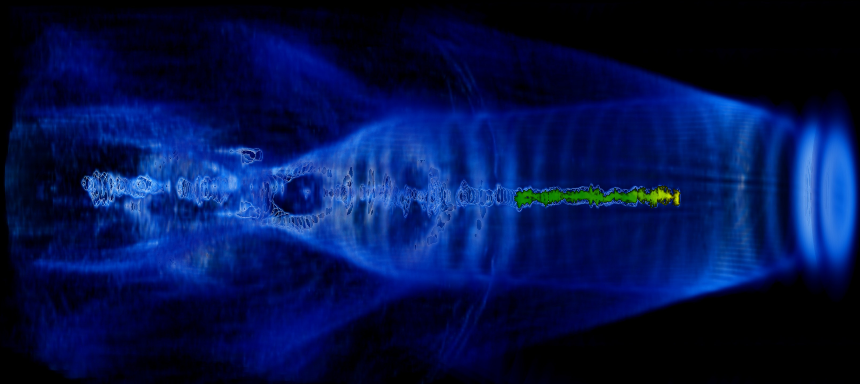

# A compact plasma beam dump for next generation particle accelerators

Master's thesis in Physics and Astronomy


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School of Physics and Astronomy
THE UNIVERSITY OF MANCHESTER
Manchester, United Kingdom 2019

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Cover: Wind visualization constructed in Matlab showing a surface of constant wind speed along with streamlines of the flow.

Typeset in LaTeX

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## Abstract

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Keywords: Plasma wakefield acceleration, deceleration, beam dump, ILC, EuPRAXIA

#### Acknowledgements

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Name Familyname, Gothenburg, Month Year

# Contents

# List of Figures

# List of Tables

# 1

# Introduction

This chapter presents the section levels that can be used in the template.

## 1.1 Motivation

## 1.2 Thesis Outline

The following table presents an overview of the section levels that are used in this document. The number of levels that are numbered and included in the table of contents is set in the settings file `Settings.tex`. The levels are shown in Section 1.3.

| Name | Command |
|---|---|
| Chapter | `\chapter{`*`Chapter name`*`}` |
| Section | `\section{`*`Section name`*`}` |
| Subsection | `\subsection{`*`Subsection name`*`}` |
| Subsubsection | `\subsubsection{`*`Subsubsection name`*`}` |
| Paragraph | `\paragraph{`*`Paragraph name`*`}` |
| Subparagraph | `\paragraph{`*`Subparagraph name`*`}` |

## 1.3 Section

### 1.3.1 Subsection

#### 1.3.1.1 Subsubsection

##### 1.3.1.1.1 Paragraph

###### 1.3.1.1.1.1 Subparagraph

# 2

# Theory

## 2.1 PWFA - Linear Regime

Perturbation due to beam $n(r,\xi) \rightarrow n(r,\xi) + \tilde{n}(r,\xi)$, use Maxwell's equations and continuity equation.

$$-\frac{1}{k_p^2}\left(\frac{\partial^2}{\partial \xi^2} + k_p^2\right)\tilde{n}(r,\xi) = n_b(r,\xi) \quad , \quad \tilde{n}(r,\xi<0) = 0 \tag{2.1}$$

$$\mathcal{L}_\xi \tilde{n}(r,\xi) = n_b(r,\xi) \quad \Rightarrow \quad \mathcal{L}_\xi G(\xi,\xi') = \delta(\xi) \tag{2.2}$$

$$G(\xi,\xi') = \begin{cases} 0, & -\infty < \xi < 0 \\ A\sin((k_p\xi) + B\cos(k_p\xi), & 0 < \xi < \infty \end{cases} \tag{2.3}$$

where the Green's function obeys the same b.c as the density perturbation, i.e it is continuous across the boundary with a discontinuous derivative across the boundary. Integrate across discontinuity at $\xi = 0$

$$\lim_{\epsilon\to 0}\int_{-\epsilon}^{\epsilon} \mathcal{L}_\xi G(\xi,\xi')\,\mathrm{d}\xi = \lim_{\epsilon\to 0}\int_{-\epsilon}^{\epsilon}\delta(\xi)\,\mathrm{d}\xi = 1 \quad \Rightarrow \quad \lim_{\epsilon\to 0}\left[-\frac{1}{k_p^2}\frac{\partial G}{\partial \xi}\right]_{-\epsilon}^{\epsilon} = 1 \tag{2.4}$$

$$G(\xi,\xi') = -k_p\sin(k_p\xi)\,\Theta(\xi) \quad \Rightarrow \quad \tilde{n}(r,\xi) = \int_{-\infty}^{\infty} G(\xi,\xi')\,n_b(r,\xi')\,\mathrm{d}\xi' \tag{2.5}$$

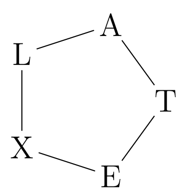
## 2.2 Equation

## 2.3 Table

**Table 2.1:** Values of $f(t)$ for $t = 0, 1, \ldots 5$.

| $t$ | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $f(t)$ | 1 | 1 | 4 | 9 | 16 | 25 |

## 2.4 Chemical structure



## 2.5 List

1. The first item
   (a) Nested item 1
   (b) Nested item 2
2. The second item
3. The third item
4. ...

## 2.6 Source code listing

```
% Generate x- and y-nodes
x=linspace(0,1); y=linspace(0,1);

% Calculate z=f(x,y)
for i=1:length(x)
 for j=1:length(y)
  z(i,j)=x(i)+2*y(j);
 end
end
```

## 2.7 To-do note

The `todo` package enables to-do notes to be added in the page margin. This can be a very convenient way of making notes in the document during the process of writing. All notes can be hidden by using the option *disable* when loading the package in the settings.

mple of a to-do
e.

# 3 Methods

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# 4

# Results

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# 5

# Conclusion

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# Bibliography

[1] Frisk, D. (2016) A Chalmers University of Technology Master's thesis template for LaTeX. Unpublished.

# A

# Appendix 1

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