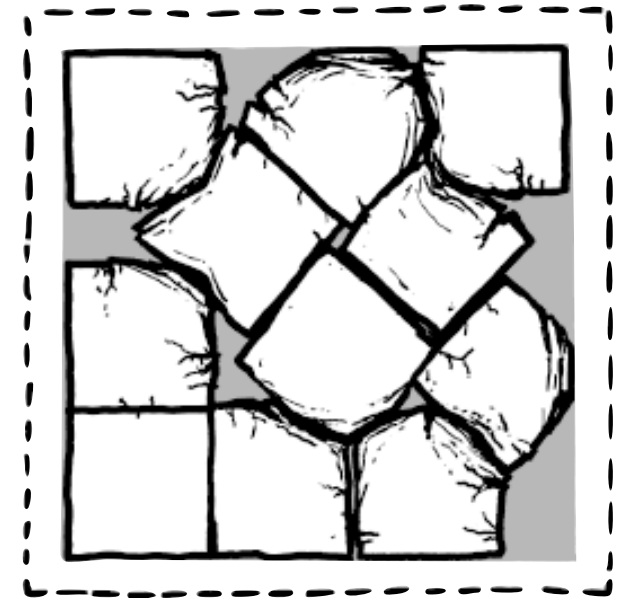


# 10 common misconceptions

about L<sup>A</sup>T<sub>E</sub>X



BAPTISTE AUGUIÉ

SCPS 03/2023



I sent you the manu-  
s c r i p t



in L<sup>A</sup>T<sub>E</sub>X, right?



in L<sup>A</sup>T<sub>E</sub>X, right?

# A template for Physics Hons reports

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<sup>4</sup>École Normale Supérieure

<sup>5</sup>University of Paris

<sup>6</sup>Institut du Radium

March 13, 2023

## Abstract

Lorem ipsum dolor sit amet, iudicabit posidonium theophrastus ne nec, atqui dolor ex pro. Porro debitis his eu. Zril diceret nominati quo ei, et vel ludus nonumy vidisse. Ex tota meliore persecuti mel, sea ne nonumes blandit liberavisse. Mea rebum discere ea, utamur constituto ei usu, mei quas laoreet ea. Nemore quaeque ne mea, alii tritani sit at. Vix eu aequae iuvaret, cu inani nulla mediocrem sed, cum at nostro pertinax. At per agam vocent periculis.

## Contents

1	Introduction	2
2	Methods	2
3	Results	2
3.1	Subsection title	3
3.2	Subsection title	3
4	Discussion	3
5	Conclusions	4
	References	4
A	Appendix: derivation	4

## 1 Introduction

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$$\nabla \times \mathbf{B} = \frac{1}{c} \left( 4\pi \mathbf{J} + \frac{\partial \mathbf{E}}{\partial t} \right) \quad (1)$$

Mea rebum discere ea, utamur constituto ei usu, mei quas laoreet ea. Nemore quaeque ne mea, alii tritani sit at. Vix eu aequae iuvaret, cu inani nulla mediocrem sed, cum at nostro pertinax. At per agam vocent periculis (Eq. 1).

Eu ignota epicuri voluptatibus sit  $E = mc^2$ . Solum labores aliquando te usu, vim vide justo eu, ad nec dicta ridens. Nisl aliquip no ius, decore fierent nam ut, et dolorum disputando dissentiunt est. In nam sonet adipisci temporibus. Ut enim summo argumentum pri, ea detraxit adolescens intellegam sed [2–5].

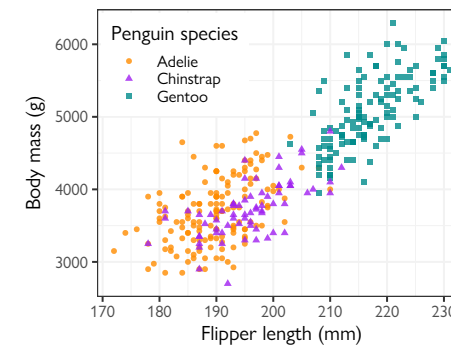


Figure 1: Lorem ipsum dolor sit amet, iudicabit posidonium theophrastus ne nec, atqui dolor ex pro. Porro debitis his eu. Zril diceret nominati quo ei, et vel ludus nonumy vidisse. Ex tota meliore persecuti mel, sea ne nonumes blandit liberavisse.

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## 2 Methods

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Table 1: Lorem ipsum dolor sit amet, iudicabit posidonium theophrastus ne nec, atqui dolor ex pro. Porro debitis his eu.

Models	Metric 1		Metric 2	
	precision	$\alpha$	$\beta \neq \alpha$	$\gamma \geq \alpha$
model 1	0.67	0.8	0.729	0.75
model 2	0.8	0.9	0.847	0.85

Mea rebum discere ea, utamur constituto ei usu, mei quas laoreet ea. Nemore quaeque ne mea, alii tritani sit at. Vix eu aequae iuvaret, cu inani nulla mediocrem sed, cum at nostro pertinax. At per agam vocent periculis.

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Ex nisl fierent comprehensam per. No his omnis laoreet nominavi, ex fabulas splendide sed, sed commune phaedrum ad. Ea vitae maiestatis cum, id eos labore habemus, mei ei indoctum postulant. Alii everti admodum ne usu. Facete animal eam at, has graece accusamus rationibus ea. Nam ut unum sonet (Fig. 2).

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## 3 Results

Lorem ipsum dolor sit amet, iudicabit posidonium theophrastus ne nec, atqui dolor ex pro. Porro debitis his eu. Zril diceret nominati quo ei, et vel ludus



# 1. TOO DIFFICULT TO INSTALL

The screenshot displays the Overleaf web editor interface. The browser address bar shows 'overleaf.com'. The document title is 'Hons project report'. The left sidebar includes a 'Menu' button, a home icon, and a file explorer showing 'fig1.pdf', 'fig1.png', 'fig2.pdf', 'fig2.png', 'main.tex' (selected), and 'refs.bib'. Below the file explorer is a 'File outline' section with a tree view containing 'Introduction', 'Methods', 'Results', 'Subsection title', 'Discussion', 'Conclusions', 'Acknowledgments', and 'Appendix: derivation'. The main editor area is split into 'Source' and 'Rich Text' modes, with 'Source' selected. The source code shows LaTeX commands for centering, including graphics, captions, labels, and sections. A table is defined with columns for 'Models', 'Metric 1', and 'Metric 2', and rows for 'model 1' and 'model 2'. A scatter plot titled 'Penguin species' is included, showing 'Body mass (g)' on the y-axis and 'Flipper length (mm)' on the x-axis, with data points for Adelle, Chinstrap, and Gentoo species. The right pane shows the rendered PDF output, including sections for Introduction, Methods, and Results, a table of metrics, and a scatter plot of penguin species data. The page number '2' is visible at the bottom right of the rendered output.

<https://www.overleaf.com/read/ptfwfrfbpjvn>

## 2. WRITING ANYTHING IS SUPER COMPLICATED

---

```
\documentclass{article}  
\begin{document}
```

This is all I have to say.

```
\end{document}
```

## 3. THE SYNTAX IS OBSCURE

---

<b>Title</b>	<code>\title{} , \author{} , \date{} </code>
<b>Sections</b>	<code>\chapter{} , \section{} , \subsection{} </code>
<b>Formatting</b>	<code>\textit{} , \textbf{} </code>
<b>Math</b>	<code>\int_0^{\infty} \frac{\alpha}{x^2} dx </code>
<b>Bibliography</b>	<code>\cite{} , \bibliography{} </code>
<b>References</b>	<code>\label{} , \ref{} </code>
<b>Figures</b>	<code>\includegraphics{figure.png} </code>



# 4. ANYTHING YOU PRODUCE WILL LOOK GREAT

## Making scientific posters easily with L<sup>A</sup>T<sub>E</sub>X

Author A & Author B  
University College London

### > Introduction

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### > Method

Sift the flour and salt into a large mixing bowl with a sieve held high above the bowl so the flour gets a airing. Now make a well in the centre of the flour and break the eggs into it. Then begin whisking the eggs - any sort of whisk or even a fork will do - incorporating any bits of flour from around the edge of the bowl as you do so.

Next gradually add small quantities of the milk and water mixture, still whisking (don't worry about any lumps as they will eventually disappear as you whisk). When all the liquid has been added, use a rubber spatula to scrape any elusive bits of flour from around the edge into the centre, then whisk once more until the batter is smooth, with the consistency of thin cream. Now melt the 50g/2oz of butter in a pan. Spoon 2 tsp of it into the batter and whisk it in, then pour the rest into a bowl and use it to lubricate the pan, using a wedge of kitchen paper to smear it round before you make each pancake.

Now get the pan really hot, then turn the heat down to medium and, to start with, do a test pancake to see if you're using the correct amount of batter. 1 find 2 tsp is about right for an 18cm/7in pan. It's also helpful if you spoon the batter into a ladle so it can be poured into the hot pan in one go. As soon as the batter hits the hot pan, tip it around from side to side to get the base evenly coated with batter. It should take only half a minute or so to cook; you can lift the edge with a palette knife to see if it's tinged gold as it should be. Flip the pancake over with a pan slice or palette knife - the other side will need a few seconds only - then simply slide it out of the pan onto a plate. Stack the pancakes as you make them between sheets of greaseproof paper on a plate fitted over simmering water, to keep them warm while you make the rest.

To serve, sprinkle each pancake with freshly squeezed lemon juice and caster sugar, fold in half, then in half again to form triangles, or else simply roll them up. Serve sprinkled with a little more sugar and lemon juice and extra sections of lemon.

### > Maths

Malthusian growth model:

$$P(t) = P_0 e^{rt}$$

Verhulst equation:

$$P(t) = \frac{K P_0 e^{rt}}{K - P_0 (e^{rt} - 1)}$$

Lotka-Volterra equations:

$$\frac{dx}{dt} = x(a - \beta y)$$
$$\frac{dy}{dt} = -y(\gamma - \delta x)$$

Michaelis-Menten:

$$\frac{d[P]}{dt} = V_{max} \frac{[S]}{K_m + [S]}$$

### > Lists and tables

Itemize:

- Item 1
- Item 2
- Item 3

Description:

**Domain** Eukaryota

**Kingdom** Animalia

**Phylum** Chordata

**Class** Mammalia

**Order** Primates

**Family** Hominidae

**Genus** *Homo*

**Species** *H. Sapiens*

Five-day forecast:

Day	Summary	Max day	Min night	Wind (mph)	Visibility
Saturday	Sun/cloud	16	10	6	poor
Sunday	Rain	14	7	3	poor
Monday	Showers	13	6	21	poor
Tuesday	Sun	15	9	7	good
Wednesday	Showers	17	12	6	moderate

### > Discussion

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# PENGUIN SLIDING

A POSTER WITH QUARTO • MARKDOWN • KNITR • PANDOC • YAML • LUA • XELATEX

Chin Strap  
Gen Too  
Adé Lie

10/23/22

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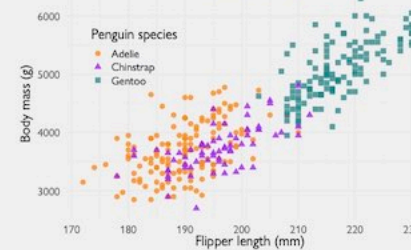
$$\alpha = \beta \tag{1}$$

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## AN ANCIENT ART

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Penguin size, Palmer Station LTER  
Flipper length and body mass for Adélie, Chinstrap and Gentoo



## Everything is on the table

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species	length	depth	flipper	mass	sex	year
Adelie	39.1	18.7	181	3750	male	2007
Adelie	39.5	17.4	186	3800	female	2007
Adelie	40.3	18.0	195	3250	female	2007
Adelie	NA	NA	NA	NA	NA	2007
Adelie	36.7	19.3	193	3450	female	2007
Adelie	39.3	20.6	190	3650	male	2007

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## TECHNICALLY SPEAKING

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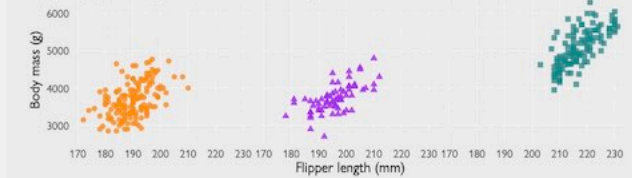
$$\begin{aligned}
 E &= T + U \\
 &= -\frac{GmM}{|r|} + \frac{1}{2}m|\mathbf{v}|^2 \\
 &= m\left(-\frac{GM}{|r|} + \frac{|\omega \times \mathbf{r}|^2}{2}\right) \\
 &= -\frac{GmM}{2|r|}
 \end{aligned}$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

$$dP(1 - M^2) = \rho V^2 \left(\frac{dA}{A}\right) \tag{2} \quad \iiint Q dV + \iint F d\mathbf{A} = 0$$

Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur (Equation 2).

Penguin size, Palmer Station LTER  
Flipper length and body mass for Adélie, Chinstrap and Gentoo



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## OUTLOOK

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## RECENT DEVELOPMENTS

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Mollit anim id est laborum,  

```

{r}
head(penguins) > tail()

```

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Acknowledgments  
Thanks for that.



# 5. IT WILL SAVE YOU TIME

## Gandalf the Grey

Wizard • pointy-hatted • pipe smoker

Maia, bearer of Narya

Born before Arda was created

LOCATION	Valinor, Arda
MOBILE	flying moths
EMAIL	mithrandir@istari.me
SKYPE	gandalf
WEBSITE	lotr.wikia.com/wiki/gandalf

*Sent by the Valar to combat the threat of Sauron upon Middle-Earth. Out of activity since the Third Age. A true wizard when it comes to fireworks, dragons and Balrogs, I also enjoy a good smoke. When things get too hot even for me, I know to delegate.*

### WORK EXPERIENCE

Fourth Age

RETIRED WIZARD

MANWÉ'S TEAM, VALINOR

Smoking and reminiscing about the great battles of the past  
Hanging out with Bilbo and Frodo, Lady Galadriel, Elrond, and many elves

Third Age

GREY, THEN WHITE WIZARD

POLICY ADVISER & GUIDE, MIDDLE EARTH

Sent by the Valar to help Men and Elves in the fight against Sauron  
Advised the rulers of Middle-Earth, often against their bad judgment  
Collaborated with Elrond, Lady Galadriel, and Aragorn  
Argued with a Balrog that they *shall not pass*  
Sent back with a white cape to finish the job

# 5. IT WILL SAVE YOU TIME

## The letter S

Donald E. Knuth

*The Mathematical Intelligencer* 2, 114–122 (1980)

```
x1 = 4.5u; y1 = 9u;  
x2 = 6u; y2 = 5.5u =  
  sqrt((3.5u)(3.5u) - (x2 - 4.5u)(x2 - 4.5u));  
draw 1{y1 - 5.5u, 4.5u - x1}..  
  2{y2 - 5.5u, 4.5u - x2};  
x3 = 6.5u; y3 = 8.5u;  
x4 = 6u; y4 = 7u;  
x5 = (6 +  $\frac{16}{17}$ )u; y5 = (8 +  $\frac{13}{17}$ )u;  
draw 3{9u - y3, x3 - 6.5u}..  
  5{9u - y5, x5 - 6.5u};  
draw 4..5;  
x6 = 4u; y6 = 9u;  
x7 = 3u; y7 = 7u =  
  sqrt((2u)(2u) - (x7 - 4u)(x7 - 4u));  
draw 6{7u - y6, x6 - 4u}..7{7u - y7, x7 - 4u};  
x8 = 5u; y8 = 4u; draw 7..8;  
x9 = 3.5u; y9 = 6u;  
x15 = 4.5u; y15 = 7.125u =  
  sqrt((x9 - 4.5u)(x9 - 4.5u) +  
  (y9 - 7.125u)(y9 - 7.125u));  
draw 4{7.125u - y4, x4 - 4.5u}..15..  
  9{7.125u - y9, x9 - 4.5u};  
x10 = 6u; y10 = 4.5u; draw 9..10;  
x11 = 3u; y11 = .5u;
```

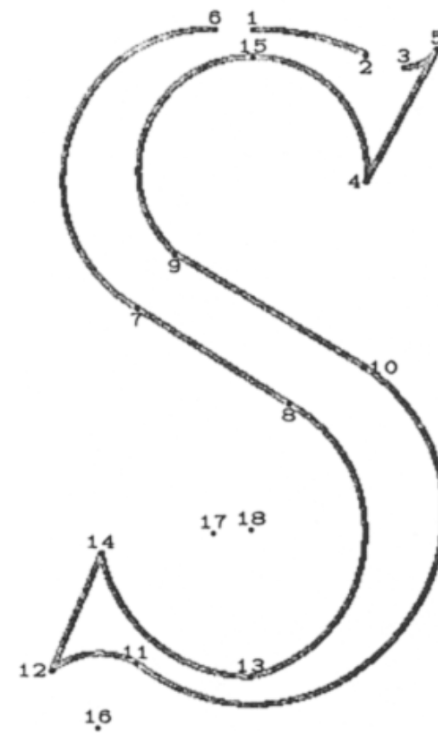


Fig. 3. The METAFONT program in the text will produce this rendition of Torniello's S.



# 6. FONTS / TABLES / LAYOUT /... look ugly

Orc	LVL	LDR	ATT	DEF	INI	SPD	HP	DMG
Goblin	2	35	16	10	4	2	20	2-4
Furious Goblin	2	40	14	14	6	3	38	3-8
Orc	3	60	16	17	4	2	65	7-10
Catapult	3	120	33	15	4	2	80	5-9
Veteran Orc	4	140	25	25	6	3	110	15-20
Shaman	4	200	24	32	5	3	160	15-18

Neutral	LVL	LDR	ATT	DEF	INI	SPD	HP	DMG
Thorn-Hunter	1	8	4	1	2	3	5	1-2
Thorn-Warrior	1	8	4	3	4	3	8	1-3
Fire Dragonfly	1	9	3	1	5	3	6	1-3
Lake Dragonfly	1	9	3	1	6	4	6	1-3
Devilfish	1	12	6	4	6	3	10	1-3
Venomous Spider	1	12	5	1	4	3	10	2-3
Cave Spider	1	14	4	4	2	3	14	2-4
Hyena	2	20	8	8	4	3	14	3-4
Pirate	2	25	8	4	4	3	20	3-5
Swamp Snake	2	28	12	8	4	2	25	3-5
Fire Spider	2	30	12	12	6	3	27	4-5
Snake	2	30	14	8	5	2	28	3-6

8	1	6
3	5	7
4	9	2

		Rank				Total
		A	B	C	Other	
Type	type 1	10	21	6	3	40
	type 2	8	14	5	2	29
Total		18	35	11	5	69

---

*name*      *foo*

---

Models	A	B	C	D
Model X	X1	X2	X3	X4
Model Y	Y1	Y2	Y3	Y4

---

## 6. FONTS / TABLES / LAYOUT /... look ugly

---

fire flower fjörd

Aa AB Bc Cd

*Aspice, astice, lactosio, Islam, affissia*

*Aspice, astice, lactosio, Islam, affissia*

MEet me for a @ffee

After the Lecture

*droog droog droog droog*

*droog droog droog droog*





# 7. CANNOT WORK COLLABORATIVELY

## Investigating the convergence of the T-matrix method beyond free of numerical instabilities for spheroids

W. R. C. Somerville,<sup>1</sup> B. Auguie,<sup>1</sup> and E. C. Le Ru<sup>1,\*</sup>

<sup>1</sup>*The MacDiarmid Institute for Advanced Materials and Nanotechnology, School of Chemical and Physical Sciences, Victoria University of Wellington, PO Box 600, Wellington 6140, New Zealand.*

compiled: November 28, 2014

The convergence behavior of the  $T$ -matrix method as calculated by the extended boundary condition method (EBCM) is studied, in the case of light scattering by spheroidal particles. By making use of a new formulation of the EBCM integrals ~~that specifically~~ specifically designed to avoid numerical cancellations, we are able to obtain accurate matrices up to high multipole order, and study the effect of changing this order on both the ~~matrix entries~~ individual matrix elements, as well as ~~calculated physical properties~~ derived physical observables. Convergence of near- and far-field scattering properties with a relative ~~accuracy error~~ of  $10^{-15}$  is demonstrated over a large parameter space in terms of size, aspect ratio, and particle refractive index. This study demonstrates the capability of the ~~T-matrix~~  $T$ -matrix/EBCM method for fast, efficient, and numerically stable electromagnetic calculations on spheroidal particles with an accuracy ~~rivaling that of Mie theory for sphere~~ comparable to Mie theory.

OCIS codes: (290.0290) Scattering; (290.4020) Mie theory; (290.5850) Scattering, particles; (000.4430) Numerical approximation and analysis ; (260.2110) Electromagnetic optics .

<http://dx.doi.org/10.1364/XX.99.099999>

### 1. Introduction

The  $T$ -matrix method, as ~~calculated by the originally~~ formulated by Waterman [1], also known as extended boundary condition method (EBCM, ~~also called the~~) or null-field method), is considered ~~as to be~~ one of the most efficient semi-analytical approaches for calculations of to model electromagnetic scatter-

conservation [13]. As shown recently, the convergence properties of Mie theory are relatively simple and highly accurate results (e.g.  $10^{-15}$  relative ~~precision error~~ error in double precision) can be straightforwardly obtained over a large parameter range (of size and material) [14]. In contrast to Mie theory however, the EBCM suffers from a number of numerical instabili-


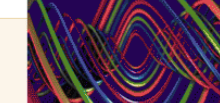
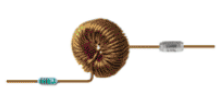




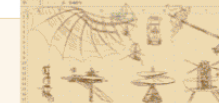

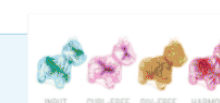


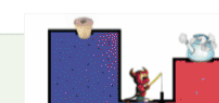
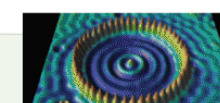

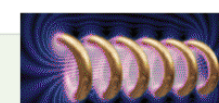

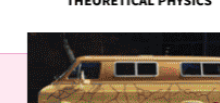
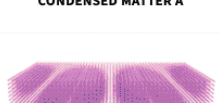
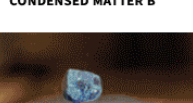


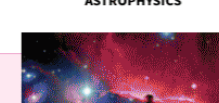

# 7. CANNOT WORK COLLABORATIVELY

```
95 -\subsection{Dimer of interacting dyes}
96 -\label{subsec:dimer}
97 -%
98
99 \begin{figure}[!htpb]
100 \centering
101 \includegraphics[width=\columnwidth]{fig2}
102 \caption{Source}\label{fig:dimer}
103 \end{figure}
104
105 -Cf J-aggregates, and related work on infinte planar
    layers.
```

```
94 +% \subsection{Dimer of interacting dyes}
95 +% \label{subsec:dimer}
96 +%The coupled-dipole equations governing the optical
    response of point dipoles in a homogeneous, isotropic,
    and non-absorbing medium are derived in Appendix A. We
    first consider a dimer configuration, with the two
    molecules described by uniaxial tensors (Fig 2).
97
98 \begin{figure}[!htpb]
99 \centering
100 \includegraphics[width=\columnwidth]{fig2}
101 \caption{Source}\label{fig:dimer}
102 \end{figure}
103
104 +% Cf J-aggregates, and related work on infinte planar
    layers.
105 +%This configuration has been studied extensively, as many
    dye molecules tend to dimerise at sufficiently high
    concentrations. The resulting dimers are known as J- or
    H-aggregates, depending on the relative orientation of
    the two interacting dipoles. With decreasing separation,
    the molecular resonances interact and hybridise; the
    spectral lineshape exhibits a red-shift (a) or a blue-
```



# 8. OVERKILL FOR SIMPLE DOCUMENTS

<p><b>SPCE101</b> INTRODUCTION TO SPACE SCIENCE</p>  <p>Overview of Space Science</p> <p>Overview of Space Science</p> <p>Our place in space - the solar system - life in space - the world - space in our lives - the future of space</p> <p>Science in space</p> <p>International space station and other space stations</p> <p>Space exploration for space - international space station for space - light and in space</p> <p>Space science</p> <p>The solar system - solar cycle - introduction to space weather - life in space</p>	<p><b>ENGR141</b> ENGINEERING SCIENCE</p>  <p>Concepts and role of science in modern engineering</p> <p>Concepts and role of science in modern engineering</p> <p>Science in engineering</p> <p>Science in engineering</p> <p>Science in engineering</p> <p>Science in engineering</p> <p>Science in engineering</p> <p>Science in engineering</p> <p>Science in engineering</p> <p>Science in engineering</p>	<p><b>ENGR142</b> ENGINEERING PHYSICS</p>  <p>Physics theory and practice relevant to electronics and computer systems engineering</p> <p>Physics theory and practice relevant to electronics and computer systems engineering</p> <p>Physics theory and practice relevant to electronics and computer systems engineering</p> <p>Physics theory and practice relevant to electronics and computer systems engineering</p> <p>Physics theory and practice relevant to electronics and computer systems engineering</p>	<p><b>PHYS101</b> INTRODUCTION TO PHYSICS</p>  <p>Physical phenomena, problem-solving techniques and practical skills in mathematics</p> <p>Physical phenomena, problem-solving techniques and practical skills in mathematics</p> <p>Physical phenomena, problem-solving techniques and practical skills in mathematics</p> <p>Physical phenomena, problem-solving techniques and practical skills in mathematics</p> <p>Physical phenomena, problem-solving techniques and practical skills in mathematics</p>	<p><b>PHYS131</b> ENERGY &amp; ENVIRONMENTAL PHYSICS</p>  <p>Basic physical concepts studied in the contexts of energy, Earth's resources and the environment</p> <p>Basic physical concepts studied in the contexts of energy, Earth's resources and the environment</p> <p>Basic physical concepts studied in the contexts of energy, Earth's resources and the environment</p> <p>Basic physical concepts studied in the contexts of energy, Earth's resources and the environment</p> <p>Basic physical concepts studied in the contexts of energy, Earth's resources and the environment</p>	<p><b>SPCE102</b> INTRODUCTION TO THE UNIVERSE</p>  <p>An introduction to astronomy and astrophysics</p> <p>An introduction to astronomy and astrophysics</p> <p>An introduction to astronomy and astrophysics</p> <p>An introduction to astronomy and astrophysics</p> <p>An introduction to astronomy and astrophysics</p>	<p><b>PHYS142</b> CALCULUS-BASED PHYSICS</p>  <p>Physical laws of mechanics and electromagnetism using vectors and calculus</p> <p>Physical laws of mechanics and electromagnetism using vectors and calculus</p> <p>Physical laws of mechanics and electromagnetism using vectors and calculus</p> <p>Physical laws of mechanics and electromagnetism using vectors and calculus</p> <p>Physical laws of mechanics and electromagnetism using vectors and calculus</p>	<p><b>PHYS145</b> PRACTICAL SKILLS FOR SCIENTISTS: APPLICATIONS IN PHYSICS</p>  <p>Introduction to numerical computing, data analysis, physics and mathematical skills for scientists</p> <p>Introduction to numerical computing, data analysis, physics and mathematical skills for scientists</p> <p>Introduction to numerical computing, data analysis, physics and mathematical skills for scientists</p> <p>Introduction to numerical computing, data analysis, physics and mathematical skills for scientists</p> <p>Introduction to numerical computing, data analysis, physics and mathematical skills for scientists</p>
<p><b>PHYS241</b> QUANTUM MECHANICS &amp; KINETIC THEORY</p>  <p>Quantum mechanics and its applications; microscopic foundations of thermodynamics</p> <p>Quantum mechanics and its applications; microscopic foundations of thermodynamics</p> <p>Quantum mechanics and its applications; microscopic foundations of thermodynamics</p> <p>Quantum mechanics and its applications; microscopic foundations of thermodynamics</p> <p>Quantum mechanics and its applications; microscopic foundations of thermodynamics</p>	<p><b>PHYS242</b> ELECTROMAGNETISM</p>  <p>Electromagnetic theory using vector calculus - applications to electrical circuits, electromagnetic waves</p> <p>Electromagnetic theory using vector calculus - applications to electrical circuits, electromagnetic waves</p> <p>Electromagnetic theory using vector calculus - applications to electrical circuits, electromagnetic waves</p> <p>Electromagnetic theory using vector calculus - applications to electrical circuits, electromagnetic waves</p> <p>Electromagnetic theory using vector calculus - applications to electrical circuits, electromagnetic waves</p>	<p><b>PHYS243</b> CLASSICAL MECHANICS &amp; RELATIVITY</p>  <p>An introduction to classical mechanics and Relativity</p> <p>An introduction to classical mechanics and Relativity</p> <p>An introduction to classical mechanics and Relativity</p> <p>An introduction to classical mechanics and Relativity</p> <p>An introduction to classical mechanics and Relativity</p>	<p><b>PHYS245</b> METHODS OF EXPERIMENTAL PHYSICS</p>  <p>Acquisition, analysis, and presentation of experimental data</p> <p>Acquisition, analysis, and presentation of experimental data</p> <p>Acquisition, analysis, and presentation of experimental data</p> <p>Acquisition, analysis, and presentation of experimental data</p> <p>Acquisition, analysis, and presentation of experimental data</p>	<p><b>PHYS305</b> THERMAL &amp; STATISTICAL PHYSICS</p>  <p>Statistical mechanics, thermodynamics and nuclear decays applied to thermal radiation, heat engines, and astrophysics</p> <p>Statistical mechanics, thermodynamics and nuclear decays applied to thermal radiation, heat engines, and astrophysics</p> <p>Statistical mechanics, thermodynamics and nuclear decays applied to thermal radiation, heat engines, and astrophysics</p> <p>Statistical mechanics, thermodynamics and nuclear decays applied to thermal radiation, heat engines, and astrophysics</p> <p>Statistical mechanics, thermodynamics and nuclear decays applied to thermal radiation, heat engines, and astrophysics</p>	<p><b>PHYS307</b> QUANTUM MECHANICS</p>  <p>Formalism and applications of modern quantum physics</p> <p>Formalism and applications of modern quantum physics</p> <p>Formalism and applications of modern quantum physics</p> <p>Formalism and applications of modern quantum physics</p> <p>Formalism and applications of modern quantum physics</p>	<p><b>PHYS345</b> EXPERIMENTAL PHYSICS II</p>  <p>Advanced methods of experimental physics</p> <p>Advanced methods of experimental physics</p> <p>Advanced methods of experimental physics</p> <p>Advanced methods of experimental physics</p> <p>Advanced methods of experimental physics</p>	<p><b>PHYS304</b> ELECTROMAGNETISM II</p>  <p>Electromagnetism and wave optics</p> <p>Electromagnetism and wave optics</p> <p>Electromagnetism and wave optics</p> <p>Electromagnetism and wave optics</p> <p>Electromagnetism and wave optics</p>
<p><b>PHYS411</b> QUANTUM MECHANICS</p>  <p>Advanced quantum mechanics</p> <p>Advanced quantum mechanics</p> <p>Advanced quantum mechanics</p> <p>Advanced quantum mechanics</p> <p>Advanced quantum mechanics</p>	<p><b>PHYS412</b> THEORETICAL PHYSICS</p>  <p>Theoretical tools and methods for many-body physics</p> <p>Theoretical tools and methods for many-body physics</p> <p>Theoretical tools and methods for many-body physics</p> <p>Theoretical tools and methods for many-body physics</p> <p>Theoretical tools and methods for many-body physics</p>	<p><b>PHYS413</b> CONDENSED MATTER A</p>  <p>Structure, dynamics and electronic transport of solid state materials</p> <p>Structure, dynamics and electronic transport of solid state materials</p> <p>Structure, dynamics and electronic transport of solid state materials</p> <p>Structure, dynamics and electronic transport of solid state materials</p> <p>Structure, dynamics and electronic transport of solid state materials</p>	<p><b>PHYS414</b> CONDENSED MATTER B</p>  <p>Selected topics in materials physics</p> <p>Selected topics in materials physics</p> <p>Selected topics in materials physics</p> <p>Selected topics in materials physics</p> <p>Selected topics in materials physics</p>	<p><b>PHYS415</b> ELECTROMAGNETISM</p>  <p>Topics in classical electrodynamics</p> <p>Topics in classical electrodynamics</p> <p>Topics in classical electrodynamics</p> <p>Topics in classical electrodynamics</p> <p>Topics in classical electrodynamics</p>	<p><b>PHYS416</b> RELATIVITY &amp; ELECTRODYNAMICS</p>  <p>Advanced concepts of special relativity and elements of field theory</p> <p>Advanced concepts of special relativity and elements of field theory</p> <p>Advanced concepts of special relativity and elements of field theory</p> <p>Advanced concepts of special relativity and elements of field theory</p> <p>Advanced concepts of special relativity and elements of field theory</p>	<p><b>PHYS417</b> ASTROPHYSICS</p>  <p>Selection of topics in modern astrophysics</p> <p>Selection of topics in modern astrophysics</p> <p>Selection of topics in modern astrophysics</p> <p>Selection of topics in modern astrophysics</p> <p>Selection of topics in modern astrophysics</p>	<p><b>PHYS490/491</b> RESEARCH PROJECT</p>  <p>Introduction to physics research</p> <p>Introduction to physics research</p> <p>Introduction to physics research</p> <p>Introduction to physics research</p> <p>Introduction to physics research</p>

# 8. OVERKILL FOR SIMPLE DOCUMENTS

```
---  
title: "Melting in extreme environments"  
author: "Dr Elke Pahl"  
affiliation:  
  - "Department of Physics"  
  - "The University of Auckland"  
venue: "LBLT118"  
event: "Friday 28 February, 12pm"  
---
```

Strong magnetic fields and extremely high pressures change the properties of materials, drastically challenging our everyday intuition. Under high pressure, nature is quite inventive in finding more compact structures, and eventually, everything, including hydrogen becomes metallic. In the last years, high-pressure research has led to several unexpected discoveries like close to room-temperature superconductivity in hydrogen-rich materials. While high pressure of up to about 300 GPa can be explored in labs on Earth, we have to move to outer space to discover magnetic field strengths comparable to electrostatic forces. The needed magnetic fields of about  $10^5$  Tesla can, for example, be found on magnetic white dwarves. Here, we expect to encounter 'alien-like' ellipsoid atoms. Chemical bonds that are very weak under normal condition like those found in rare gas dimers become strengthened by a new binding mechanism, the so-called paramagnetic bonding.



SCHOOL OF CHEMICAL & PHYSICAL SCIENCES • TE WĀNANGA MATŪ  
FACULTY OF SCIENCE • TE WĀHANGA PŪTAIAO  
Victoria University of Wellington, PO Box 600, Wellington 6140, New Zealand  
PHONE +64 4 463 5335 • EMAIL [scps@vuw.ac.nz](mailto:scps@vuw.ac.nz) • WEB <http://www.victoria.ac.nz/scps>

Seminar:

## MELTING IN EXTREME ENVIRONMENTS

Dr Elke Pahl  
Department of Physics  
The University of Auckland

Strong magnetic fields and extremely high pressures change the properties of materials, drastically challenging our everyday intuition. Under high pressure, nature is quite inventive in finding more compact structures, and eventually, everything, including hydrogen becomes metallic. In the last years, high-pressure research has led to several unexpected discoveries like close-to-room-temperature superconductivity in hydrogen-rich materials. While high pressure of up to about 300 GPa can be explored in labs on Earth, we have to move to outer space to discover magnetic field strengths comparable to electrostatic forces. The needed magnetic fields of about  $10^5$  Tesla can, for example, be found on magnetic white dwarves. Here, we expect to encounter 'alien-like' ellipsoid atoms. Chemical bonds that are very weak under normal condition like those found in rare gas dimers become strengthened by a new binding mechanism, the so-called paramagnetic bonding.

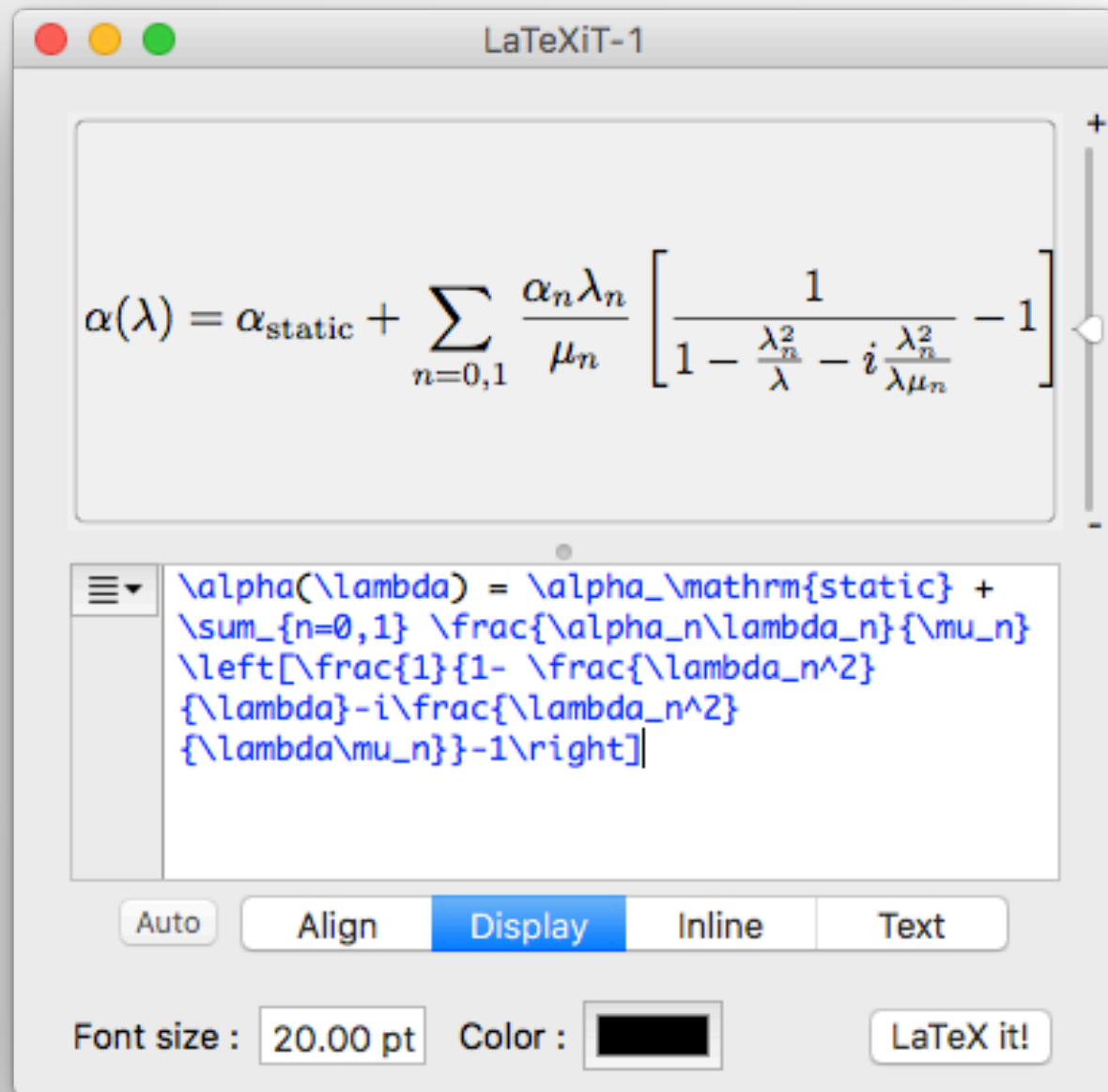
In this talk, I will concentrate on the study of the melting of rare gases in such extreme conditions through the use of computer simulations. In order to simulate the melting process, we need very accurate interaction potentials and have to explore the resulting potential landscapes extensively at a range of temperatures spanning the melting transition. While we use highly accurate quantum-chemical methods for the atomic interactions, so-called parallel-tempering Monte Carlo simulations allow for an efficient sampling of phase space. After an introduction in the methodology, results of Argon melting under high pressure and Neon melting in strong magnetic fields are presented.

LBLT118

Friday 28 February, 12pm



## 8. OVERKILL FOR SIMPLE DOCUMENTS



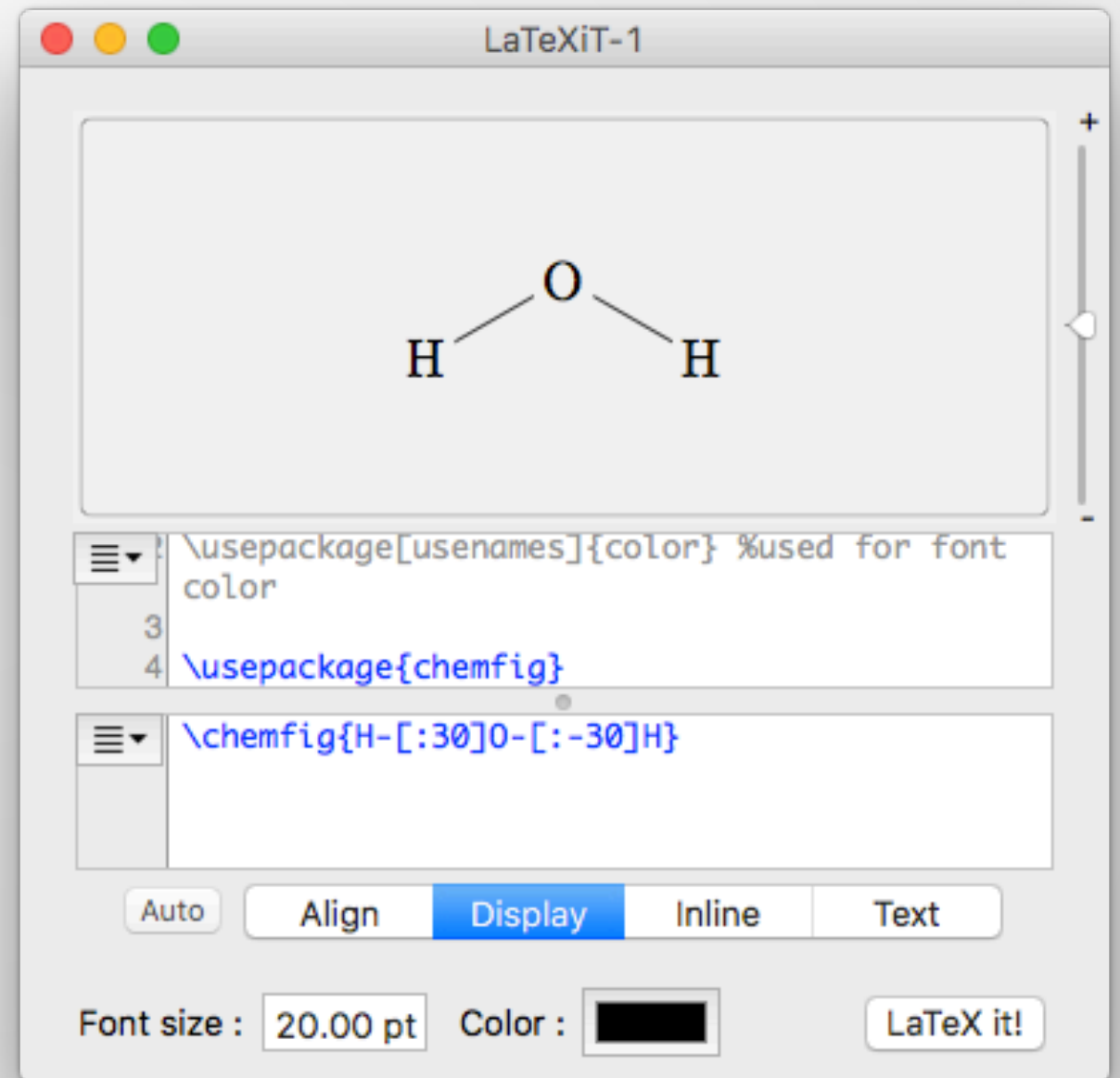
LaTeXiT-1

$$\alpha(\lambda) = \alpha_{\text{static}} + \sum_{n=0,1} \frac{\alpha_n \lambda_n}{\mu_n} \left[ \frac{1}{1 - \frac{\lambda_n^2}{\lambda} - i \frac{\lambda_n^2}{\lambda \mu_n}} - 1 \right]$$

```
\alpha(\lambda) = \alpha_{\mathrm{static}} +  
\sum_{n=0,1} \frac{\alpha_n \lambda_n}{\mu_n}  
\left[ \frac{1}{1 - \frac{\lambda_n^2}{\lambda} - i \frac{\lambda_n^2}{\lambda \mu_n}} - 1 \right]
```

Auto Align **Display** Inline Text

Font size : 20.00 pt Color : ██████ LaTeX it!



LaTeXiT-1

O

```
\usepackage[usenames]{color} %used for font  
color  
3  
4 \usepackage{chemfig}  
  
\chemfig{H-[:30]O-[:-30]H}
```

Auto Align **Display** Inline Text

Font size : 20.00 pt Color : ██████ LaTeX it!

```
\documentclass{standalone}
```

## 9. TOO MANY COMMANDS TO REMEMBER

```
% nablabla aliases
```

```
\newcommand{\Grad}{\nabla}
```

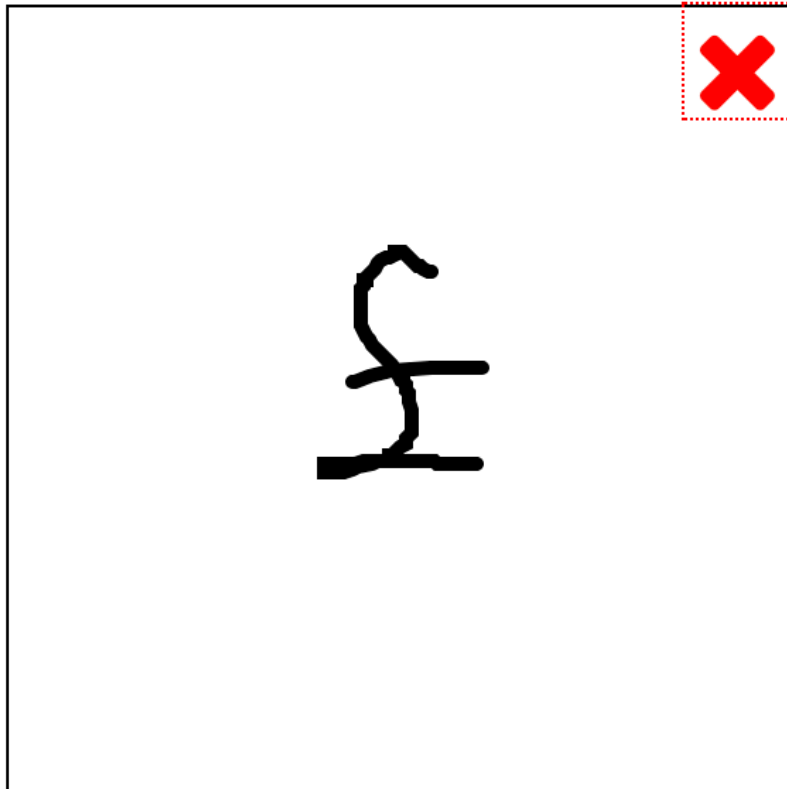
```
\newcommand{\Div}{\nabla\cdot}
```

```
\newcommand{\Curl}{\nabla\times}
```

### Detexify

classify

symbols



£

Score: 0.11180621726767692  
`\usepackage{ textcomp }`  
`\textsterling`  
textmode

£

Score: 0.11404557365274032  
`\pounds`  
textmode & mathmode

£

Score: 0.11607222097002232  
`\textsterling`  
textmode

## 9. TOO MANY COMMANDS TO REMEMBER

## The Laplace and Poisson equations

- Combining  $\text{Div} \vec{E} = \rho / \epsilon_0$  and  $\vec{E} = -\text{Grad } V$ ,

$$\nabla^2 V = -\rho / \epsilon_0$$

- Solving for  $V$  is equivalent to solving simultaneously  $\text{Div} \vec{E} = \rho / \epsilon_0$  and  $\text{Curl} \vec{E} = \vec{0}$

### THE LAPLACE AND POISSON EQUATIONS

- Combining  $\nabla \cdot \mathbf{E} = \rho / \epsilon_0$  and  $\mathbf{E} = -\nabla V$ ,

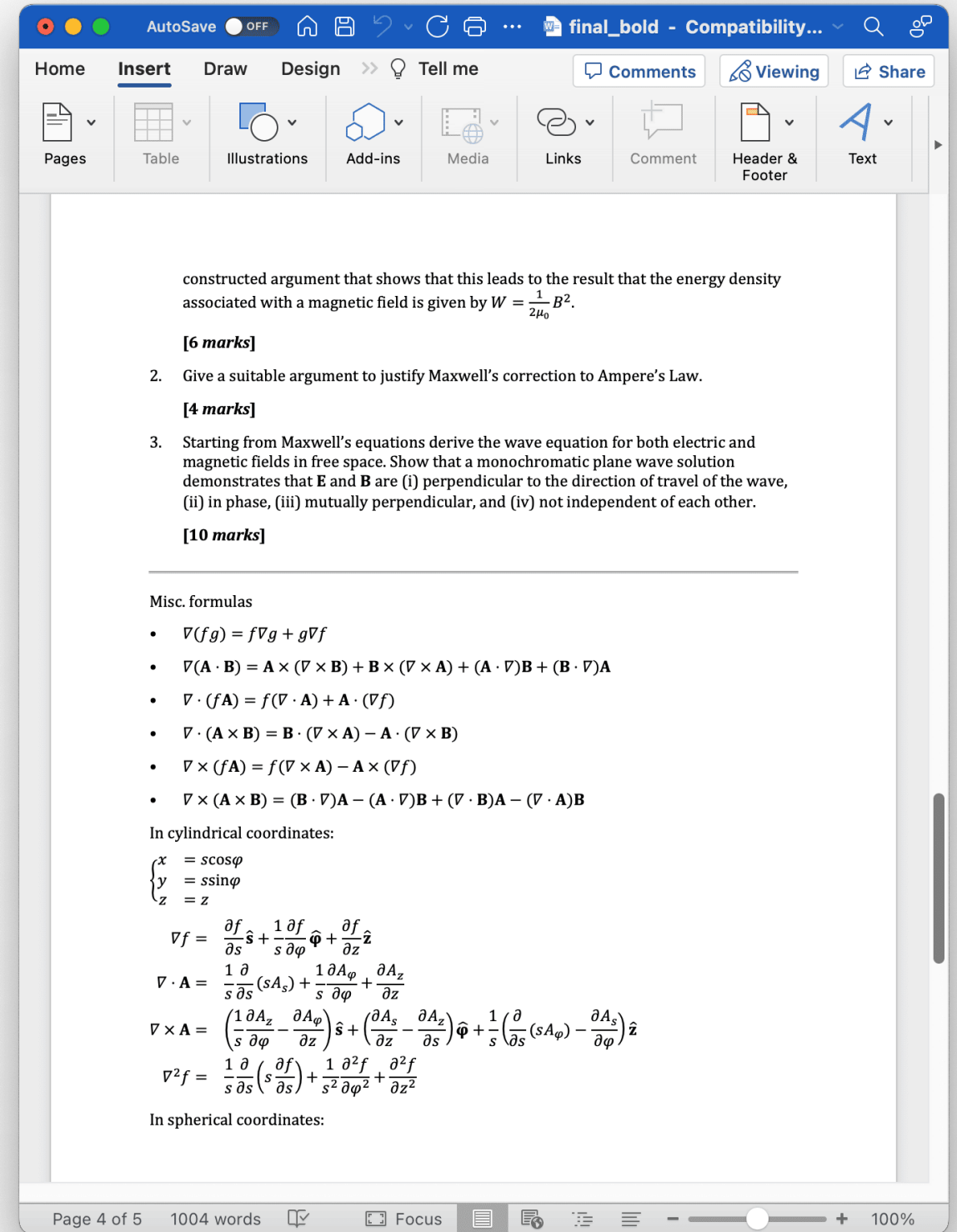
$$\nabla^2 V = -\rho / \epsilon_0$$

- Solving for  $V$  is equivalent to solving simultaneously  $\nabla \cdot \mathbf{E} = \rho / \epsilon_0$  and  $\nabla \times \mathbf{E} = \mathbf{0}$



# 10. COWORKERS WANT A .DOCX FILE

```
exam.tex 4 x
5 is given by  $W = \frac{1}{2\mu_0} B^2$ . \markingnl{6}
6
7 1. Give a suitable argument to justify Maxwell's correction to Ampere's Law. \
8
9 1. Starting from Maxwell's equations derive the wave equation for both electric
10 plane wave solution demonstrates that  $\vec{E}$  and  $\vec{B}$  are (i) perpendicular
11 the wave, (ii) in phase, (iii) mutually perpendicular, and (iv) not independent
12
13 ----
14
15 \pagebreak
16
17 Misc. formulas
18
19 -  $\text{Grad}(fg) = f\text{Grad}g + g\text{Grad}f$ 
20 -  $\text{Grad}(\vec{A}\cdot\vec{B}) = \vec{A}\times(\text{Curl}\vec{B}) + \vec{B}\times(\text{Curl}\vec{A})$ 
21
22 -  $\text{Div}(f\vec{A}) = f(\text{Div}\vec{A}) + \vec{A}\cdot(\text{Grad}f)$ 
23 -  $\text{Div}(\vec{A}\times\vec{B}) = \vec{B}\cdot(\text{Curl}\vec{A}) - \vec{A}\cdot(\text{Curl}\vec{B})$ 
24
25 -  $\text{Curl}(f\vec{A}) = f(\text{Curl}\vec{A}) - \vec{A}\times(\text{Grad}f)$ 
26 -  $\text{Curl}(\vec{A}\times\vec{B}) = (\vec{B}\cdot\text{Grad})\vec{A} - (\vec{A}\cdot\text{Grad})\vec{B}$ 
27
28 In cylindrical coordinates:
29
30  $\left\{\begin{aligned} x &= s \cos \varphi \\ y &= s \sin \varphi \\ z &= z \end{aligned}\right.$ 
31
32
33
34
35
36  $\begin{aligned}$ 
```



```
pandoc exam.tex -o exam.docx
```