Fancy thesis title

Optional Subtitle

Proefschrift

ter verkrijging van de graad van doctor
aan de Technische Universiteit Delft,
op gezag van de Rector Magnificus prof. ir. T.H.J.J. van der Hagen,
voorzitter van het College voor Promoties,
in het openbaar te verdedigen op ...dag ... om ... uur

door

Albert Einstein

Fachlehrer für Mathematik und Physik,
Eidgenössische Polytechnische Schule, Zürich, Zwitserland,
geboren te Ulm, Duitsland.

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Keywords: statistical physics, kinetic theory of gases, Brownian motion

Printed by: Ipskamp Printing, Enschede

Front & Back: Albert Einstein

Casimir PhD Series, Delft-Leiden 1905-01

ISBN 000-00-0000-000-0

An electronic version of this dissertation is available at
`http://repository.tudelft.nl/`.

Science is a wonderful thing
if one does not have to earn one's living at it.

Albert Einstein

Contents

Summary

I discovered special and general relativity, explained the photoelectric effect, Brownian motion and $E = mc^2$ in 1905. I am sure that I will win the Nobel Prize in 1921.
...

Samenvatting

Ik heb in 1905 de speciale en algemene relativiteitstheorie ontdekt en het fotoelektrisch effect, Brownse beweging en $E = mc^2$ verklaard. Ik weet zeker dat ik in 1921 de Nobelprijs zal winnen. ...

Preface

Only two things are infinite, the universe and human stupidity, and I'm not sure about the former.
Imagination is more important than knowledge.
If you can't explain it simply, you don't understand it well enough.
Life is like riding a bicycle. To keep your balance you must keep moving.
God does not play dice with the universe.
I have no special talent. I am only passionately curious.

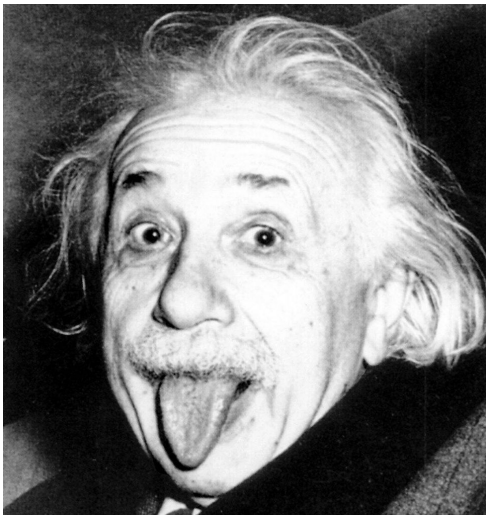

Figure 0.1: Portrait of the artist as a not-so-young man.

Albert Einstein
Delft, December 2019

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Introduction

Albert Einstein

Nature and nature's laws lay hid in the night;
God said 'Let Newton be!' and all was light.

Alexander Pope

It did not last: the devil shouting 'Ho.
Let Einstein be!' restore the status quo.

Sir John Collings Squire

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Parts of this chapter have been published in Annalen der Physik **324**, 289 (1906) [1].

1

This document is intended to be both an example of the TU Delft dissertation template for LaTeX, as well as a short introduction to its use. It is not intended to be a general introduction to LaTeX itself,[1] and we will assume the reader to be familiar with the basics of creating and compiling documents.

Instructions on how to use this template under Windows and Linux, and which LaTeX packages are required, can be found in `README.txt`.

1.1. Document Structure

Since a dissertation is a substantial document, it is convenient to break it up into smaller pieces. In this template we therefore give every chapter its own file. The chapters (and appendices) are gathered together in `dissertation.tex`, which is the master file describing the overall structure of the document. `dissertation.tex` starts with the line

```
\documentclass{dissertation}
```

which loads the dissertation template. The template is based on the LaTeX `book` document class and stored in `dissertation.cls`. The document class accepts several comma-separated options. By default, hyperlinks are shown in cyan, which is convenient when reading the dissertation on a computer, but can be expensive when printing. They can be turned black with the `print` option. This will also turn the headers dark gray instead of cyan. Moreover, it will add a 3 mm bleed around the page including crop marks. This will help the printer with the thumb indices, since they run right up to the page borders. Finally, the `nativefonts` option can be used to override the automatic font selection (see below).

A dissertation is a big document, which makes it easy to miss warnings about the layout in the LaTeX output. In order to locate problem areas, add the `draft` option to the `\documentclass` line. This will display a vertical bar in the margins next to the paragraphs that require attention.

The contents of the dissertation are included between the `\begin{document}` and `\end{document}` commands, and split into three parts by

1. `\frontmatter`, which uses Roman numerals for the page numbers and is used for the title page and the table of contents;
2. `\mainmatter`, which uses Arabic numerals for the page numbers and is the style for the chapters;
3. `\appendix`, which uses letters for the chapter numbers, starting with 'A'.

[1] We recommend `http://en.wikibooks.org/wiki/LaTeX` as a reference and a starting point for new users.

The title page is defined in `title.tex` in the `title` folder and included verbatim with `\include{title/title}`,[2] (see below). Additionally, it is possible to include a preface, containing, for example, the acknowledgements. An example can be found in `preface.tex`. The table of contents is generated automatically with the `\tableofcontents` command. Chapters are included after `\mainmatter` and appendices after `\appendix`. For example, `\include{chapter-1/chapter-1}` includes `chapter-1.tex`, which contains this introduction.

1.2. Title Page

The title pages are defined in `title/title.tex`, which you will have to modify according to your needs. Note that these pages are subject to the requirements of the *promotieregelement* and cannot be changed at will. Apart from the names and dates, most of the Dutch text is dictated literally.

Since the thesis title and name of the author appear several times throughout the document (on the title page, but also in, *e.g.*, the preface and cv), special commands are provided so they only have to be specified once. The title (and optional subtitle) can be specified with

```
\title[Optional subtitle]{Title}
```

The name of the author is specified with

```
\author{First name}{Last name}
```

Note that the first and last name are separate arguments, since they may be printed in different font shapes. The `\title` and `\author` commands also ensure that the title and author appear in the metadata of the final PDF.

See `title/title.tex` for detailed documentation on the comment and layout of the title pages. Logos of institutes that have contributed financially to the dissertation may be included on reverse side of the title page. A few example logos can be found in the `title/logos` folder.

1.3. Chapters

Each chapter has its own file. For example, the LaTeX source of this chapter can be found in `chapter-1.tex`. A chapter starts with the command

```
\chapter{Chapter title}
```

[2] Note that it is not necessary to specify the file extension.

This starts a new page, prints the chapter number and title and adds a link in the table of contents. If the title is very long, it may be desirable to use a shorter version in the page headers and the table of contents. This can be achieved by specifying the short title in brackets:

```
\chapter[Short title]{Very long title with many words which could
not possibly fit on one line}
```

Unnumbered chapters, such as the preface, can be created with `\chapter*{Chapter title}`. Such a chapter will not show up in the table of contents or in the page header. To create a table of contents entry anyway, add

```
\addcontentsline{toc}{chapter}{Chapter title}
```

after the `\chapter` command. To print the chapter title in the page header, add

```
\setheader{Chapter title}
```

If (parts of) the chapter have already been published elsewhere, it is customary to add a reference. This can be done with the special unnumbered footnote command `\blfootnote`. For example,

```
\blfootnote{Parts of this chapter have been published in An-
nalen der Physik \textbf{324}, 289 (1906) \cite {Einstein1906}.}
```

generates the footnote at the beginning of this chapter. Because this footnote is unnumbered, the `hyperref` package may throw a warning, which safely be ignored.

If multiple people have contributed significantly to this chapter, they can be lister with the `\authors` command. This can be followed by a quotation using `\epigraph` as shown above. Finally, it is customary for a dissertation to include an abstract for every chapter (except perhaps the introduction). This can be accomplished with the `abstract` environment. The abstract should be followed by `\newpage` to start the chapter text on a new page.

In a dissertation, each chapter has its own list of references. These can be generated with the special command `\references{dissertation}` from `dissertation.bib` at the end of the chapter. Note that this means that you need to run a command like `bibtex chapter-1/chapter-1` for each chapter. The bibliography style is specified in `dissertation.bst`, which is a modified version of `apsrev4-1.bst` (from REVTeX) designed to also display the titles of referenced articles. The template will automatically generate clickable hyperlinks if a URL or DOI (digital object identifier) is present for the reference. Although it is possible to manage the bibliography by hand, we recommend using EndNote (available from Blackboard) or JabRef (available from `http://jabref.sourceforge.net/`).

Chapters are subdivided into sections, subsections, subsubsections, and, optionally, paragraphs and subparagraphs. All can have a title, but only sections and subsections are numbered. As with chapters, the numbering can be turned off by using `\section*{...}` instead of `\section{...}`, and similarly for the subsection.

1.4. \section{...}

1.4.1. \subsection{...}

\subsubsection{...}

\paragraph{...} Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

1.5. Fonts and Colors

The fonts used by this template depend on which version of LaTeX you use. Regular LaTeX, *i.e.*, if you compile your document with with `latex`, `pslatex` or `pdflatex`, will use KP-Fonts, with Latin Modern as a fallback. However, if you want to adhere to the TU Delft house style, you will need to use XeLaTeX, as it supports TrueType and OpenType fonts. Compiling with `xelatex` will use Bookman Old Style for titles, Tahoma for text, Courier New for monospace and Cambria for math. If you want to use XeLaTeX, but do not want to use the TU Delft house style fonts, you can add the `nativefonts` option to the document class.

This template supports the use of drop caps, a large colored initial at the beginning of a chapter or section, via the `\dropcap` command:

```
\dropcap{L}{orem} ipsum...
```

The first argument is the capital that will be printed on two lines (in the title color), and the second argument is the rest of the word. Depending on the font, the latter may be printed in small caps.

The original TU Delft template extensively used the corporate colors cyan, black and white. This adapted version has only black text by default. However, if you are wish to use the TU Delft colors, you can access them through commands such as `\color{tudelft-cyan}`, `\color{tudelft-black}` (which differs slightly from the

1

default `black`) and `\color{tudelft-white}`. Apart from these three, the house style defines the basic colors

- `tudelft-sea-green`,
- `tudelft-green`,
- `tudelft-dark-blue`,
- `tudelft-purple`,
- `tudelft-turquoise` and
- `tudelft-sky-blue`,

as well as the accent colors

- `tudelft-lavendel`,
- `tudelft-orange`,
- `tudelft-warm-purple`,
- `tudelft-fuchsia`,
- `tudelft-bright-green` and
- `tudelft-yellow`.

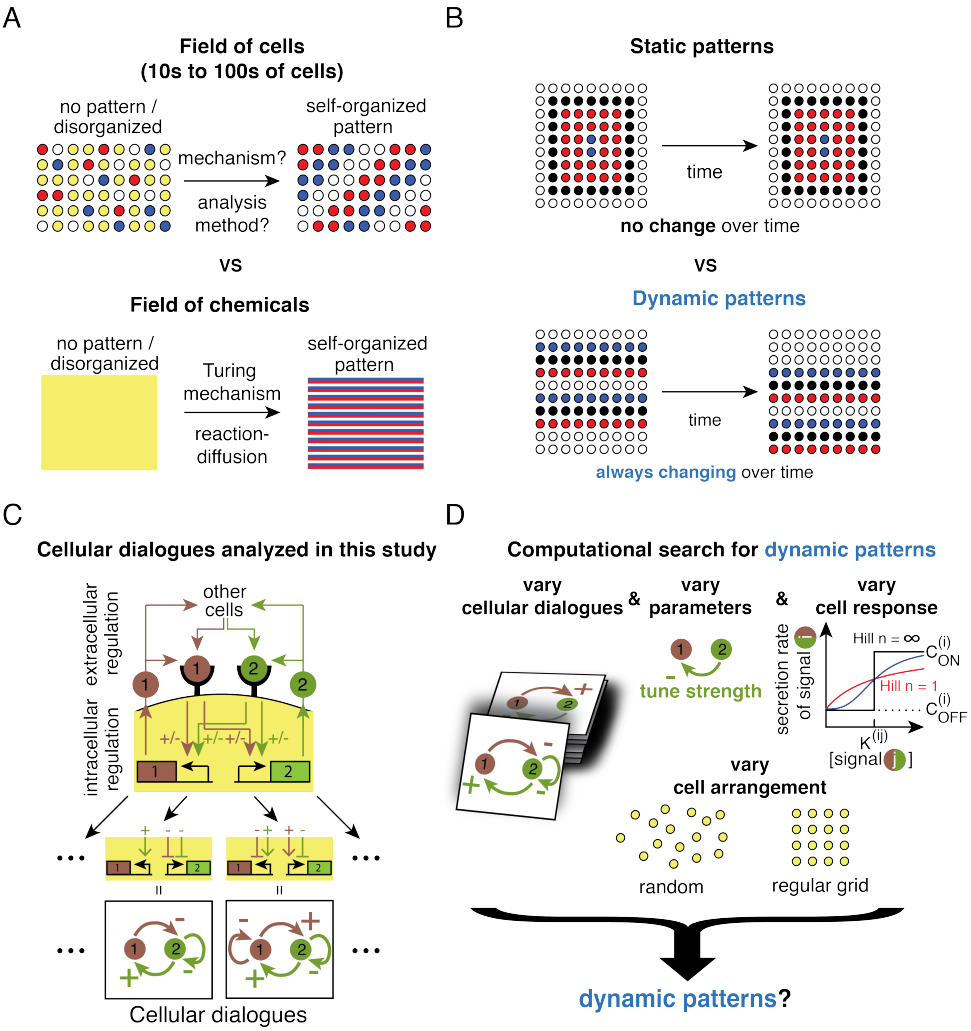


Figure 1.1: A random figure from another thesis. Computationally screening cellular dialogues to find ones that enable dynamic patterns form. (A) Pattern formation by cells versus chemicals. (Top) Mechanisms by which an initially disordered field of a mesoscopic number of cells (~hundreds to thousands) (left panel) become more ordered through cell-cell communication (right panel) remain poorly understood, as is the method to analyze this complex self-organization dynamics. (Bottom) A field of chemicals or a continuum of cells (large number of tightly packed cells) initially having no pattern (left) can form a pattern (right) without pre-existing morphogens. This is usually modelled by reaction-diffusion equations and can be understood through the Turing mechanism. **(B)** Static versus dynamic patterns. (Top) Static patterns do not change over time. (Bottom) In dynamic patterns, a structure changes over time without ever stopping (e.g., shown here is a traveling wave). (*Caption continued on next page.*)

Figure 1.1 ***(previous page)*****: For large pictures, break up caption into multiple pages with fltpage package. (C)** Schematic of cellular dialogues. Brown (molecule 1) and green (molecule 2) circles are ligands that bind to their cognate receptors on the cell membrane. Ligand-bound receptors trigger intracellular signal transductions that either positively or negatively regulate the production and secretion of molecules 1 and 2 (molecule 1 can self-promote or self-repress its own secretion while also regulating the secretion of molecule 2, and vice versa). Bottom row shows graphic representation of cellular dialogues. **(D)** Elements that we varied in simulations: cellular dialogues of all possible topologies, the values of the parameters for each cellular dialogue, and spatial arrangement of cells. Our study first begins with an infinite Hill coefficient (i.e., digital response to each of the two signaling molecules) and a regular lattice. After reporting the outcomes of these simulations, we report the result of relaxing these two constraints and well as other elements not depicted.

2

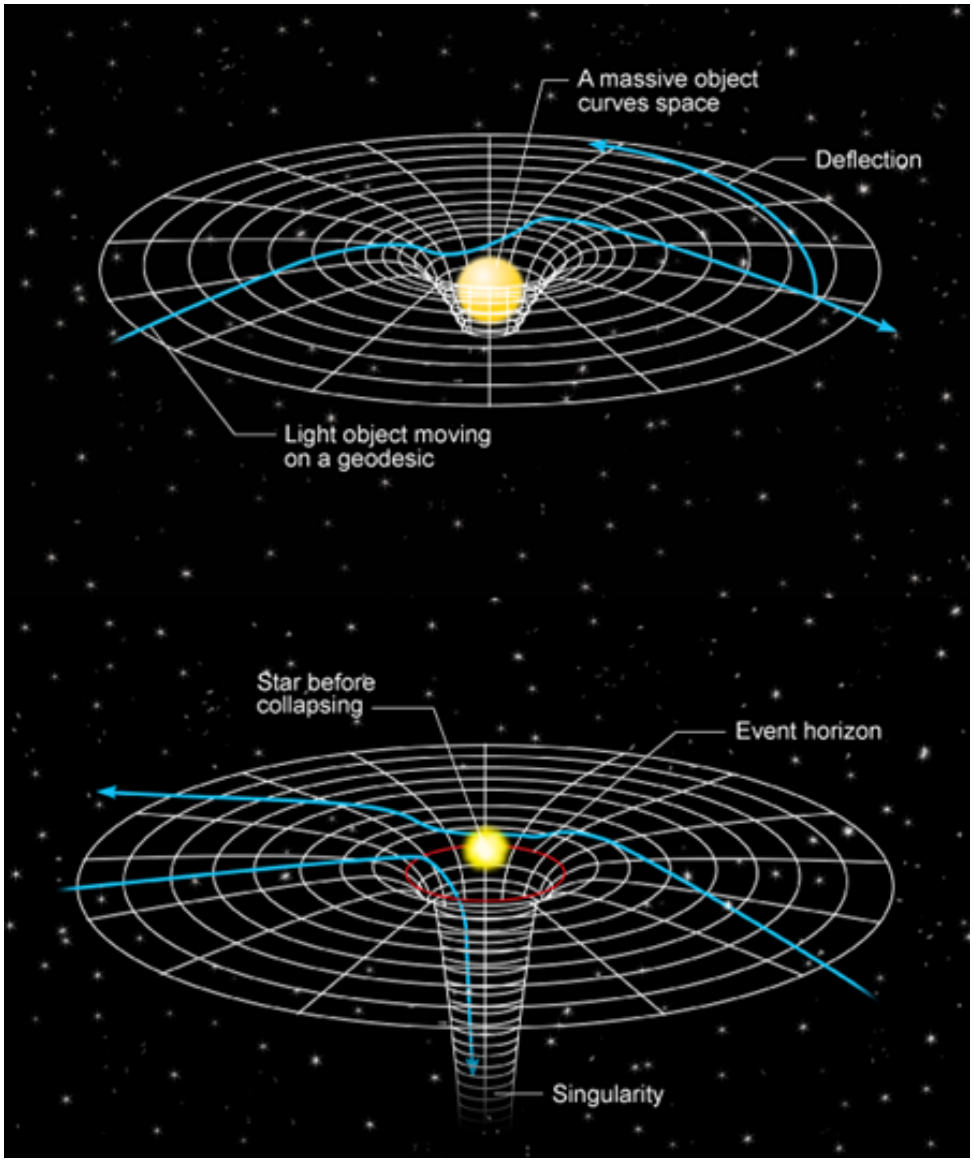
Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?

A. Einstein, B. Podolsky, N. Rosen

In a complete theory there is an element corresponding to each element of reality. A sufficient condition for the reality of a physical quantity is the possibility of predicting it with certainty, without disturbing the system. In quantum mechanics in the case of two physical quantities described by non-commuting operators, the knowledge of one precludes the knowledge of the other. Then either (1) the description of reality given by the wave function in quantum mechanics is not complete or (2) these two quantities cannot have simultaneous reality. Consideration of the problem of making predictions concerning a system on the basis of measurements made on another system that had previously interacted with it leads to the result that if (1) is false then (2) is also false. One is thus led to conclude that the description of reality as given by a wave function is not complete.

My name is Albert Einstein and I was a genius when I was alive.

$$E = mc^2 \tag{2.1}$$


A massive object
curves space
Deflection
Light object moving
on a geodesic
Star before
collapsing
Event horizon
Singularity

2

Figure 2.1 ***(preceding page)*****: Show caption of figure on the next page.**. A random figure about general relativity, not related to the rest of this thesis. (Top) In Einstein's general theory of relativity, gravity is nothing more than the curvature of spacetime. A massive object, such as the sun, causes a deformation of the spacetime grid, while another object such as a planet or a light beam follows the shortest path (a "geodesic") on this grid. To an observer, this looks like a deflection of the trajectory caused by gravity. (Bottom) A collapsing star can form a black hole so dense and massive that it creates a region of infinite curvature (a "singularity") so that — inside the event horizon — light cannot escape. Current research in gravitation is attempting to modify general relativity to account for such objects consistent with quantum theory.

3

Conclusion

My work on general relativity (not included in this thesis) will have wide societal impact and enable the development of the Global Positioning System (wait for it!).

Epilogue

Alea iacta est. Veni, vidi, vici.

Acknowledgements

I would like to thank my violin, my mom and my two cats.

Curriculum Vitæ

Albert Einstein

1999	Time magazine's person of the century
1929	Max Planck Medal
1925	Copley Medal
1922	Nobel Prize in Physics
1905	PhD. Physics Eidgenössische Polytechnische Schule Zürich
Thesis:	Eine neue Bestimmung der Moleküldimensionen
Promotor:	Prof. dr. A. Kleiner
1896–1900	Undergraduate in Mathematics & Physics Eidgenössische Polytechnische Schule Zürich
1892–1896	Grammar School Luitpold Gymnasium, Münich (1892–1895) Aurau, Switzerland (1895–1896)
14-03-1879	Born in Ulm, Germany.

List of Figures

References

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