

# Your Dissertation Title: A Contribution to Knowledge at the University of Limerick



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A dissertation submitted in partial fulfillment of  
the requirements for the degree of

Doctor of Philosophy

at the

University of Limerick

YYYY

Date of final oral examination: DD/MM/YYYY

The dissertation is approved by the following members of the Final Oral Committee:

**Advisor:** Faculty Name, Department, University of Limerick

**Advisor:** Faculty Name, Department, University

**Examiner:** Faculty Name, Department, University

**Examiner:** Faculty Name, Department, University

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*Your Dedications Go Here*

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# Declaration

I herewith declare that I have produced this paper without the prohibited assistance of third parties and without making use of aids other than those specified; notions taken over directly or indirectly from other sources have been identified as such. This paper has not previously been presented in identical or similar form to any other Irish or foreign examination board. The thesis work was conducted from Year YYYY to YYYY under the supervision of Prof./Dr. Name at University of Limerick.

Limerick, YYYY

# Acknowledgements

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# Abstract

The abstract should provide a brief summary of your research, including the problem, methodology, results, and conclusion.

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# Chapter 1

## Introduction

The introduction serves to set the stage for your research and helps the reader understand the context and significance of your work. The following sections should be included in the introduction:

- **Background and Context:** Provide an overview of the broad area your research is situated in. This is where you set the context for your work and explain why this area of study is important.
- **Research Problem:** Clearly define the specific research problem your thesis addresses. Describe the gap in existing knowledge that you aim to fill with your research.
- **Objectives and Research Questions:** State the specific objectives of your research. These are often framed as research questions or hypotheses you intend to explore throughout the thesis.

- **Methodology Overview:** Provide a brief summary of your research methods. This section should give an overview of the approach you used to gather data or conduct experiments, and how these methods align with the research objectives.
- **Significance of the Study:** Explain why your research matters. Discuss the potential contributions to the field, its relevance, and any practical applications of your findings.
- **Thesis Structure:** Outline the structure of your thesis. Briefly summarize the content of each chapter so the reader knows what to expect.

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# Chapter 2

## LaTeX Tutorial

This section provides a brief tutorial on how to use LaTeX to insert links, write mathematical equations, and include figures in your thesis. These are some of the essential skills for formatting your document effectively.

### 2.1 Inserting Links

To insert a hyperlink in your LaTeX document, use the `hyperref` package. This package allows you to add clickable links to URLs, references, and even email addresses. Here's how you can use it:

- **Inline Math Mode:** For short formulas within text, enclose the math expression with dollar signs:

This is an inline equation:

```
$ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
```

which renders as  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .

- **Displayed Math Mode:** For larger equations or equations that need to be centered on their own line, you can use the ‘equation’ environment.

```
\begin{equation}
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\end{equation}
```

This will display the equation on its own line and automatically number it, like this:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{2.1}$$

- **Multiple Equations with Alignment:** To display multiple equations and align them at specific points, such as the equals sign, you can use the ‘align’ environment, which requires the ‘amsmath’ package.

First, add the following to your preamble:

```
\usepackage{amsmath}
```

Then, use the ‘align’ environment:



```

\begin{align}
x &= \frac{-b + \sqrt{b^2 - 4ac}}{2a} \\
x &= \frac{-b - \sqrt{b^2 - 4ac}}{2a}
\end{align}

```

This will display two equations aligned at the equals sign, like this:

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

and

$$x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

The ‘align’ environment allows you to align multiple equations and gives each equation its own number.

## 2.2 Tables with natbib

The natbib package is commonly used for citation management in LaTeX, but it does not directly relate to tables. However, you can use it to cite sources in table captions.

To include the natbib package in your document, add the following in the preamble:

```

\usepackage{natbib}
\bibliographystyle{plainnat} % Or another style like abbrvnat

```

To create a table, use the tabular environment:

```
\begin{table}[h]
  \centering
  \begin{tabular}{|c|c|c|}
    \hline
    Column 1 & Column 2 & Column 3 \\
    \hline
    Data 1 & Data 2 & Data 3 \\
    Data 4 & Data 5 & Data 6 \\
    \hline
  \end{tabular}
  \caption{Example Table \citep{author2025book}}
  \label{tab:example}
\end{table}
```

This will create a table with three columns, as follows:

Column 1	Column 2	Column 3
Data 1	Data 2	Data 3
Data 4	Data 5	Data 6

Table 2.1: Example Table ([Author1 Given et al., 2025](#))

## 2.3 Adding Pictures

To include images, use the `graphicx` package:

```
\usepackage{graphicx}
```

Example:

```
\begin{figure}[h]  
  \centering  
  \includegraphics[width=0.5\textwidth]{assets/images.png}  
  \caption{The emblem of the University of Limerick.}  
  \label{fig:image}  
\end{figure}
```



Figure 2.1: The emblem of the University of Limerick.

To reference this image use ref as follows:

As shown in Figure `\ref{fig:image}`, the example...

## 2.4 Drawing with TikZ

The TikZ package allows for drawing detailed scientific diagrams such as spacetime graphs. To use it, include the package `tikz` in the preamble.

You can create various shapes and diagrams using LaTeX. For example, here is a spacetime diagram with vertical worldlines, light signals, and annotations. To find more information on how to create a similar diagram, visit [this link](#).

```
\begin{tikzpicture}

  % Axis
  \draw[->, thick] (0,0) -- (0,6) node[above] {\(ct\)};
  \draw[->, thick] (0,0) -- (6,0) node[right] {\(x\)};

  % Worldlines
  \draw[thick, red] (0,0) -- (0,5) node[above, xshift=2pt]
    {\textcolor{red}{\((x_A = 0)\)}};
  \draw[thick, green!70!black] (4,0) -- (4,5.5) node[above]
    {\textcolor{green!70!black}{\((x'_B = d)\)}};

  % Light paths
  \draw[->, thick, yellow!80!orange,
    decorate, decoration={snake, amplitude=0.7mm, segment length=2mm}]
    (0,0) -- (4,2.5);
  \draw[->, thick, yellow!80!orange,
```

```

decorate, decoration={snake, amplitude=0.7mm, segment length=2mm}]
(4,2.5) -- (0,5);

% Dotted lines
\draw[dashed, thick, red!70!black]
(0,2.5) -- (4,2.5) node[midway, above]
{\(ct_1 = \frac{ct_2}{2}\)};
\draw[dashed, thick, red!70!black]
(0,5) -- (4,5) node[midway, above] {\(ct_2\)};

% Events
\filldraw[red] (0,0) circle (2pt) node[below left] {A};
\filldraw[green!70!black] (4,0) circle (2pt) node[below right] {B};
\filldraw[orange!80!black] (4,2.5) circle (2pt);

% Grid (optional)
\draw[step=1cm, lightgray, very thin] (0,0) grid (6,6);
\end{tikzpicture}

```

This renders the following diagram:

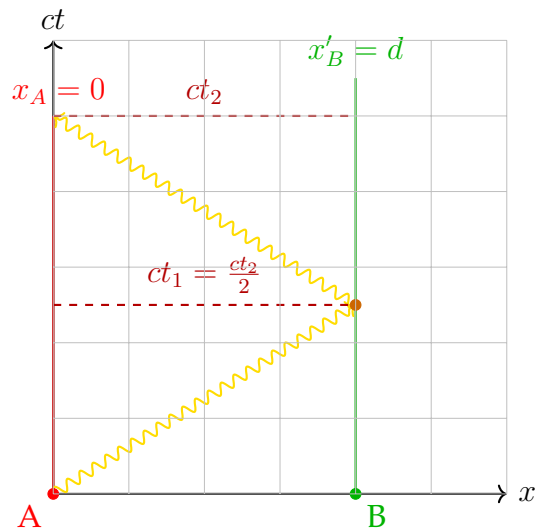


Figure 2.2: Spacetime diagram showing light signal exchange between two observers.

## 2.5 Using Citations

To cite sources, use the biblatex package:

```
\usepackage{biblatex}
\addbibresource{references.bib}
```

### 2.5.1 Inline Citation Example

Use `\cite` to refer to an author within the text:

According to `\cite{author2025book}`, books are important.

### 2.5.2 Parenthetical Citation Example

Use `\parencite` to place citations in parentheses:

Books are an important source of knowledge \parencite{author2025book}.

To list all references, add:

\printbibliography

This is an example of using color in your document Author1 Given et al. (2024, 2023).

## Chapter 3

### Conclusion

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# Bibliography

A. F. Author1 Given, A. F. Author2 Given, and A. F. Author3 Given. Title of the conference paper. In *Proceedings of Conference Name*, pages 50–60. Publisher Name, 2023.

A. F. Author1 Given, A. F. Author2 Given, and A. F. Author3 Given. Title of the article. *Journal Name*, 10(2):100–120, 2024. URL <https://www.example.com/article>.

A. F. Author1 Given, A. F. Author2 Given, and A. F. Author3 Given. *Title of the Book*. Publisher Name, 2025. URL <https://www.example.com/book>.