Quantum Mechanics

Eric Du Andrew Binder

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Preface

Welcome to our Quantum Mechanics book!

What is This?

This book contains a comprehensive catalog of the fundamentals of quantum mechanics (QM), to the extent that the authors have encountered the topics and the material. With this book, our objective is to provide an intuitive approach to learning quantum mechanics, and share with you the tips and tricks we learned while we were studying the field. Whether you're just getting started with QM or are already familiar with some of the content covered, we hope there is something here for you to learn!

Fundamental Structure

We have divided this book into three major parts, in an attempt to effectively compartmentalize the vast amount of material we aim to cover. The first part covers fundamental theory; specifically, it details the basic building blocks of quantum mechanics and helps us transition from the classical frame to the quantum one. The second part shifts focus to approximation methods. As we will learn, solving quantum systems exactly is nigh-impossible, which necessitates the need to approximate in order to effectively study physical systems. The final part will explore some more advanced special topics and extend beyond quantum mechanics into the relativistic frame.

How to Use This Book

The purpose of this book is to provide the reader with the foundations for a basic understanding of quantum mechanics. We will attempt to be as rigorous as possible when appropriate, but we stress intuitive understanding above anything else. With that said, this book is not an adequate substitute for any other reading materials or a university course. This, first and foremost, should be a springboard for further discovery. After reading a chapter, the hope is the reader has a general understanding of what was covered, to the extent that they can venture out on their own and supplement their knowledge with additional resources.

Some Notational Logistics

Before we get started with the content, let's go over some basic elements you will see throughout this book.

Definition 0.1 (A Thing)**.** Whenever we come across a new term, we will define it like so.

We will also occasionally highlight specific mathematical notation like so.

Lemma 0.1 (Auxiliary Trick)**.** *If there's a relevant fact that services a larger result, we will encode it as a lemma.*

Theorem 0.1 (Major Result)**.** *When we arrive at a major result, we will encode it as a theorem.*

Proof. We will take care to prove theorems as soon as possible. □

Corollary 0.1 (Consequence)**.** *If a theorem has an important consequence, we'll label it as a corollary.*

Remark. If there's an important side note we wish to highlight, we'll place those here.

Example 0.1 (What Just Happened)**.** Examples will help us illustrate what just happened.

Read these! These contain common mistakes and things to be careful.

We will try to keep such remarks and warnings to a minimum. We will also try our best to keep theorems and important results cross-referenceable; for instance, clicking Theorem 0.1 will take you to the corresponding theorem (or hovering over it will give you a summary). Finally, this book combines elements from various books that we've encountered over our own journey through quantum mechanics, a full list of which can be found in the references page.

One last thing: there is a lot of content in this book, and there are only two of us actively maintaining it. If you find that there are any errors, or you wish to make any suggestions, please reach out via email and let us know! We both want this book to be as approachable as it can be, and are always looking for ways to improve it. You can find our emails in the author list at the top of the page.

Happy reading!

Part I

I: Fundamental Theory

This chapter aims to…

1 Introduction

This is a book created from markdown and executable code.

See Knuth (1984) for additional discussion of literate programming.

Theorem 1.1. *testing the numbering*

2 Summary

In summary, this book has no content whatsoever.

Theorem 2.1. *testing*

References

Knuth, Donald E. 1984. "Literate Programming." *Comput. J.* 27 (2): 97–111. https://doi.org/10.1093/comjnl/27.2.97.