

# Preface

World Scientific Publishing Company recently published my book entitled *Introduction to Modern Physics: Theoretical Foundations*. The book is aimed at the very best students, with a goal of exposing them to the foundations and frontiers of today's physics. Typically, students have to wade through several courses to see many of these topics, and I wanted them to have some idea of where they were going, and how things fit together, as they went along. Hopefully, they will then see more inter-relationships, and get more original insights, as they progress. The book assumes the reader has had a good one-year, calculus-based freshman physics course, along with a good one-year course in calculus. While it is assumed that mathematical skills will continue to develop, several appendices are included to bring the reader up to speed on any additional mathematics required at the outset. With very few exceptions, the reader should then find the material to be self-contained. Many problems are included, some for each chapter. Although the book is designed so that one can, in principle, read and follow the text without doing any of the problems, the reader is strongly urged to attempt as many of them as possible in order to obtain some confidence in his or her understanding of the basics of modern physics and to hone working skills.

After completing that book, it occurred to me that a second volume could be prepared that would significantly extend the coverage, while furthering the stated goals. The ground rules would be that anything covered in the text and appendices of the first volume would be fair game, while anything covered in the problems would first be re-summarized. Those few results quoted without proof in Vol. I would now be derived. The topics chosen would be those of wide applicability in all areas of physics. Again, an important goal would be to keep the entire coverage self-contained. The

present book is the outcome of those musings. All of the material in this book is taken from course lectures given over the years by the author at either Stanford University or the College of William and Mary.

Quantum mechanics is first reformulated in abstract Hilbert space, which allows one to focus on the general structure of the theory. The book then covers the following topics: angular momentum, scattering theory, lagrangian field theory, symmetries, Feynman rules, quantum electrodynamics, path integrals, and canonical transformations for quantum systems. Several appendices are included with important details. When finished, the reader should have an elementary working knowledge in the principal areas of theoretical physics of the twentieth century. With this overview in hand, development in depth and reach in these areas can then be obtained from more advanced physics courses.

I was again delighted when World Scientific Publishing Company, which had done an exceptional job with four of my previous books, showed enthusiasm for publishing this new one. I would like to thank Dr. K. K. Phua, Executive Chairman of World Scientific Publishing Company, and my editor Ms. Lakshmi Narayanan, for their help and support on this project. I am greatly indebted to my colleagues Paolo Amore and Alfredo Aranda for their reading of the manuscript.

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