The main theme of this book is the idea that quantum mechanics is valid not only for microscopic objects but also for the macroscopic apparatus used for quantum mechanical measurements. The author demonstrates the intimate relations between quantum mechanics and its interpretation that are induced by the quantum mechanical measurement process. Consequently, the book is concerned both with the philosophical, metatheoretical problems of interpretation and with the more formal problems of quantum object theory.

The consequences of this approach turn out to be partly very promising and partly rather disappointing. On the one hand, it is possible to give a rigorous justification of some important aspects of interpretation, such as probability, by means of object theory. On the other hand, the problem of the objectification of measurement results leads to inconsistencies that cannot be resolved in an obvious way. This open problem has far-reaching consequences for the possibility of recognising an objective reality in physics.

The book will be of interest to graduate students and researchers in physics, the philosophy of science, and philosophy.

THE INTERPRETATION OF QUANTUM MECHANICS AND THE MEASUREMENT PROCESS

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Preface

This book, on the interpretation of quantum mechanics and the measurement process, has evolved from lectures which I gave at the University of Turku (Finland) in 1991 and later in several improved and extended versions at the University of Cologne. In these lectures as well as in the present book I have aimed to show the intimate relations between quantum mechanics and its interpretation that are induced by the quantum mechanical measurement process. Consequently, the book is concerned both with the philosophical, metatheoretical problems of interpretation and with the more formal problems of quantum object theory.

The book is based on the idea that quantum mechanics is valid not only for microscopic objects but also for the macroscopic apparatus used for quantum mechanical measurements. We illustrate the consequences of this assumption, which turn out to be partly very promising and partly rather disappointing. On the one hand we can give a rigorous justification of some important parts of the interpretation, such as the probability interpretation, by means of object theory (chapter 3). On the other hand, the problem of the objectification of measurement results leads to inconsistencies that cannot be resolved in an obvious way (chapter 4). This open problem has far-reaching consequences for the possibility of recognising an objective reality in physics.

The manuscript of this book was carefully written in TEX by Dipl. Phys. Falko Spiller. In addition, he proposed numerous small corrections and improvements of the first version of the text. His helpful cooperation and his continued interest in the progress of this book are gratefully acknowledged.

Furthermore, I wish to express my gratitude to Dr. Julian Barbour for reading carefully the whole manuscript as a native English speaker and physicist. He proposed many changes and improvements of the language. Moreover, he made several interesting physical suggestions which are partly realized in the final version of the book.

Finally, I want to thank Dr Simon Capelin of Cambridge University Press for his encouragement to write this book and for his kind cooperation during the last two years.

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