

## PREFACE

The lectures which constitute this book are given just as they were presented at the Massachusetts Institute of Technology from November 14, 1925, to January 22, 1926, without any amplification. They do not purport to be a text-book — for of these we have enough — but rather an exposition of the present status of research in those regions of physics in which I myself have made investigations, and of which I therefore believe that I can take a comprehensive view. In the short time that was at my disposal, I could neither seek for completeness nor consider minutiae. It was my purpose to present methods, objects of investigation, and the most important results. I have avoided references and have only occasionally named individual authors. I take this occasion to ask the pardon of all those colleagues whose names I have omitted to mention.

The lectures on the theory of lattices are essentially an abstract of certain sections of my book, *Atomtheorie des festen Zustandes*, and of subsequent works on this topic. In the same manner, the earlier lectures on the structure of the atom are closely related to my book *Atommechanik*, but I soon made the transition to a different point of view. At the time I began this course of lectures, Heisenberg's first paper on the new quantum theory had just appeared. Here his masterly treatment gave the quantum theory an entirely new turn. The paper of Jordan and myself, in which we recognized the matrix calculus as the proper formulation for Heisenberg's ideas, was in press, and the manuscript of a third paper by the three of us was almost completed. Though the results contained in this third paper left no doubt in my mind as to the superiority of the new methods to the old, I could not bring myself to plunge directly into the new quantum mechanics. To do this would not only be to deny to Bohr's great achievement its due need of credit, but even more to deprive the reader of the natural

and marvelous development of an idea. I have consequently begun by presenting the Bohr theory as an application of classical mechanics, but have emphasized more than is usual its weaknesses and conceptual difficulties. It is perhaps superfluous to state that this is only done to establish the necessity of a new conception, and is not intended as a hostile criticism of Bohr's immortal work. As the course proceeded, further achievements of the new method came to my notice. I was able to introduce some of these into the lectures. Pauli's theory of the hydrogen atom is a case in point. Of others, such as the treatment of the theory of aperiodic processes in terms of a general calculus of operators, developed by N. Wiener and myself, I was able to give a sketch. These sections are not so much a report on scientific results as an enumeration of the problems which seem of most interest to us theoretical physicists.

I wrote the original text in German. It was then translated into English by Dr. W. P. Allis and Mr. Hans Müller, and read through by me. Mr. F. W. Sears revised the second part; finally Dr. M. S. Vallarta went carefully through the complete text in order to verify the formulas and make the English idiomatic. I hereby express my sincere thanks to all these gentlemen, who have spent much labor on this work of revision, and have sacrificed much valuable time, as well as to Assistant Dean H. E. Lobbell, who has taken great pains in the supervision of the work of publication.

I feel it as a great honor that this book appears as a publication of the Massachusetts Institute of Technology. For this I wish to express my thanks to President S. W. Stratton and Professor C. L. Norton, the Head of the Department of Physics. To Professor Paul Heymans, who has not merely extended to my wife and myself the hospitality of his house, but also shared his office with me during the three months of my stay at the Institute, I wish to express my gratitude in visible form by the dedication of this little book.

MAX BORN

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