

# Preface

This book has evolved from lectures of authors devoted to applications of the WKB (or quasi-classical) approximation and of the method of  $1/N$ —expansion for solving of various problems in atomic and nuclear physics. The intent of this book is to help students and investigators in this field to extend and to make contemporary their knowledge of these important calculational methods of quantum mechanics. It is envisioned that both advanced students and active researchers in this field will find it useful. Much material is contained herein that is not to be found elsewhere. WKB approximation, while constituting a fundamental area in atomic physics, has not been the focus of many books.

A novel method has been adopted for the presentation of the subject matter. The material is presented as a succession of problems. These problems are stated succinctly, solved using basic principles of quantum mechanics, and then the results are discussed in detail. It has been our experience that a possible initial discomfort with this unfamiliar structure gives way to an appreciation of its important advantages: First, different aspects of a single topic are treated in separate problems, which makes possible a progressive deepening of the understanding of the subject. Second, by considering limited cases of a general topic, it is possible to simplify the underlying mathematics so as to highlight the fundamental concepts. Third, although some of these problems build progressively on the results of those that precede it, there is also the possibility to enter into the subject matter at any point. Fourth, a very important feature is that the problem/solution format reinforces in the reader the ability to analyze the content of a physical problem and to apply the suitable mathematical and physical tools to solve it. Finally, the qualitative discussion of the outcome of the solution aids in the development of physical intuition.

It is presumed that the reader is already acquainted with the basics and mathematical apparatus of quantum mechanics in the frames of standard university courses described, for example, in the well-known book of Landau and Lifshitz [1].

Detailed investigation of the chapter “Quasi-Classical Approximation” in this book is desirable.

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