

# Preface

Soon after the first edition of *Nonrelativistic Quantum Mechanics* appeared, I received numerous requests for solutions to the problems in that book. To remedy this situation I started by writing out solutions to the more difficult problems, but as I proceeded with the third edition of *Nonrelativistic Quantum Mechanics* I also revised some of the problems and added quite a few others. Since in constructing these new problems I had to solve them, in the first place, to be sure that they were indeed problems that students could solve, I finally went on to write out solutions to all the problems. However, I did not simply want a compendium of solutions of the Schrödinger equation since with programs such as Maple or Mathematica these solutions are accessible to every student. Instead I wanted to concentrate on problems that teach quantum mechanics. It is with this in mind that I began to collect and solve problems. My idea was to provide a means for students to learn quantum mechanics by “doing it”. This is why the book begins with extremely simple problems and progresses to more difficult ones.

Some of the problems extend results that are usually taught in a course on quantum mechanics. But, by having the students obtain the results themselves they are more likely to retain the ideas and at the same time gain confidence in their own abilities.

As usual, I tested most of these problems on my students. Sometimes they came up with very original ways of looking at old problems. I have learned a lot from my students. It is this learning process that led me to occasionally introduce more than one way of solving a problem since the solutions are intended to help students to obtain a better understanding of the techniques involved in tackling problems in quantum mechanics.

The notation and methods used are those explained in *Nonrelativistic Quantum Mechanics* and I frequently refer to chapters from that book. The chapter headings are also the same as in *Nonrelativistic Quantum Mechanics*. Nevertheless, the present book is independent and should serve as a companion to any of the numerous excellent books on quantum mechanics. Throughout the book I have used Gaussian units since these are the units most commonly used in atomic physics. I also tried to arrange the problems according to increasing degree of difficulty. This, was not always possible since it would have meant losing the possibility of arranging them according to topic.

It is a pleasure to thank Professor M. Razavy for his generous help in, not

only providing me with some wonderful problems and supplying me with numerous references, but also for his constant moral support.

Of course the students who suffered through the courses in which I subjected them to all sorts of quantum problems also deserve my heartfelt thanks. To their credit, the undergraduates seldom complained. On the other hand, there was many an evening, after I had assigned some more than usually difficult problems in the graduate course on quantum mechanics, that walking down the hall of the fourth floor of the physics building I heard my name muttered with less than flattering epithets. Nevertheless, the graduate students survived and many, after they completed their degree, even thanked me for what they had learned.

It is my hope that these problems and solutions will be of use to future generations of physics students. At any rate they should provide more entertainment than solving cross word puzzles.

A.Z.Capri  
Edmonton, Alberta  
July, 2002.