Atomic And Molecular Spectroscopy 1st Edition

The latest in the 'Tutorial Chemistry Texts' series, 'Basic Atomic and Molecular Spectroscopy' contains chapters on quantization in polyelectronic atoms, molecular vibrations and electronic spectroscopy.
The study of electron spectrometry using synchrotron radiation is a growing field of research driven by the increasing availability of advanced synchrotron radiation light sources and improved theoretical methods for solving the many-electron problem in atoms. This balanced account, by a leading researcher in this field, will be of value to both theorists and experimentalists in atomic, molecular and chemical physicists.
Table of contents
This is the first volume of textbooks on atomic, molecular and optical physics, aiming at a comprehensive presentation of this highly productive branch of modern physics as an indispensable basis for many areas in physics and chemistry as well as in state of the art bio- and material-sciences. It primarily addresses advanced students (including PhD students), but in a number of selected subject areas the reader is lead up to the frontiers of present research. Thus even the active scientist is addressed. This volume 1 provides the canonical knowledge in atomic physics together with basics of modern spectroscopy. Starting from the fundamentals of quantum physics, the reader is familiarized in well structured chapters step by step with the most important phenomena, models and measuring techniques. The emphasis is always on the experiment and its interpretation, while the necessary theory is introduced from this perspective in a compact and occasionally somewhat heuristic manner, easy to follow even for beginners.
Fundamentals of Molecular Symmetry
Basic Atomic and Molecular Spectroscopy
Introduction to Molecular Spectroscopy
Atoms, Molecules and Optical Physics 1
Atomic, Molecular, and Optical Physics: Atoms and Molecules

Covers spectroscopic principles, methods and applications ranging from atomic to molecular spectroscopy. Many entries on instrumentations will help in trouble-shooting spectrometers.
Combined with the other two volumes, this text is a comprehensive treatment of the key experimental methods of atomic, molecular, and optical physics, as well as an excellent experimental handbook for the field. Thewide availability of tunable lasers in the past several years has revolutionized the field and lead to the introduction of many new experimental methods that are covered in these volumes. Traditional methods are also included to ensure that the volumes will be a complete reference source for the field.
Focusing on atom-light interactions and containing numerous exercises, this in-depth textbook prepares students for research in a fast-growing field.
This book describes both the theory of atomic spectroscopy and all the major atomic spectrometric techniques (AAS, Flame-AES, Plasma AES, AFS, and ICP-MS), including basic concepts, instrumentation and applications. Spectrochemical Analysis by Atomic Absorption and Emission is very wide in scope and will be extremely useful to both undergraduates and lecturers undertaking modern analytical chemistry courses. It contains many figures and tables which illuminate the text, covers various sample preparation methods and gives suggestions for further reading.
Spectra of Atoms and Molecules
Modern Spectroscopy
Basic Aspects and Practical Applications
MOLECULAR STRUCTURE AND SPECTROSCOPY
Molecular Spectroscopy and Quantum Dynamics

1. Introduction. 1.1. Waves, Particles, and Units. 1.2. The Electromagnetic Spectrum. 1.3. Interaction of Radiation with Matter. 1.3a. Blackbody Radiation. 1.3b. Einstein A and B Coefficients. 1.3c. Absorption and Emission of Radiation. 1.3d. Beer's Law. 1.3e. Lineshape Functions. 1.3f. Natural Lifetime Broadening. 1.3g. Pressure Broadening. 1.3h. Doppler Broadening. 1.3i. Transit-Time Broadening. 1.3j. Power Broadening. 2. Molecular Symmetry. 2.1. Symmetry Operations. 2.1a. Operator Algebra. 2.1b. Symmetry Operator Algebra. 2.2. Groups. 2.2a. Point Groups. 2.2b. Classes. 2.2c. Subgroups. 2.3.
Rather different problems can be lumped together under the general term 'laser control of atoms and molecules'. They include the laser selection of atomic and molecular velocities for the purpose of Doppler-free spectroscopy, laser control of the position and velocity of atoms (i.e. laser trapping and cooling of atoms), and laser control of atomic and molecular processes (ionization, dissociation) with a view of detecting single atoms and molecules and particularly separating isotopes and nuclear isomers. Over the last decades the principal problems posed have been successfully solved, and many of them have evolved remarkably in the subsequent investigations of the international research community. For example, the solution of the problem of laser cooling and trapping of atoms has given birth to the new field of the physics of ultracold matter, i.e. quantum atomic and molecular gases. The laser non-coherent control of uni-molecular processes has found an interesting extension in the field of laser coherent control of molecules. The concept of laser control of position has been successfully demonstrated with microparticles (optical tweezers), concurrently with investigations into atomic control. The laser photo-ionization of molecules on surfaces has led to the development of novel techniques of laser-assisted mass spectrometry of macromolecules, and so on. The aim of this book is to review these topics from a unified or 'coherent' point of view. It will be useful for many readers in various fields of laser science and its applications.
The Book Has 15 Chapters In All. The First Two Chapters Are Related To Atomic Structure And Atomic Spectra. The Next Chapter Is Devoted To Nature Of Chemical Bonds As Looked Upon Through Quantum Mechanics, Followed By All Types Of Spectroscopy. Every Aspect Is Explained With Some Typical Spectra. The Underlying Theory So Developed Will Help Students To Carry Out Spectral Analysis.Only Simple Quantum Mechanics Relevant To Simple Molecular Structure Has Been Given. Attempt Has Been Made To Relate The Characteristic Chemical Behavior Of These Molecules With Its Mo And Thus To Molecular Spectra. One Will Not Find Such Relationship In Any Book, But This Will Make Chemistry, As Such, Still More Interesting.Application Of Infrared And Ultra-Violet Spectroscopy, Nmr And Mass Spectra In Structure Determination Of Organic Molecules Are Very Elegantly Presented. In The Fourteenth Chapter, Lasers And Their Applications To Various Types Of Second, Third, And Fourth Order Scattering Spectroscopy Have Been Developed. The Book Has Minimum But Essential Mathematics With Very Easy Format In Its Text. Such An Approach Will Give A Clear Understanding Of The Subject And Provides Knowledge To Excel At Any Level University Examination, Competitive Examination, And Before Interview Boards.
The main aim of this unique book is to introduce the student to spectroscopy in a clear manner which avoids, as far as possible, the mathematical aspects of the subject. It is thus intended for first or second year undergraduates, particularly those with minimal mathematics qualifications. After explaining the theory behind spectroscopy, the book then goes on to look at the different techniques, such as rotational, vibrational and electronic spectroscopy. It encompasses both high resolution (structural) and low resolution (analytical) spectroscopy, demonstrating their close interrelationship. The many worked problems make this book particularly appealing for independent study.
Spectrochemical Analysis by Atomic Absorption and Emission
Molecular Spectroscopy: Modern Research
Dynamics, Spectroscopy, Clusters, and Nanostructures
Absolute Partial Cross Sections
Encyclopedia of Spectroscopy

The main aim of this unique book is to introduce the student to spectroscopy in a clear manner which avoids, as far as possible, the mathematical aspects of the subject. It is thus intended for first or second year undergraduates, particularly those with minimal mathematics qualifications.After explaining the theory behind spectroscopy, the book then goes on to look at the different techniques, such as rotational, vibrational and electronic spectroscopy. It encompasses both high resolution (structural) and low resolution (analytical) spectroscopy, demonstrating their close interrelationship. The many worked problems make this book particularly appealing for independent study. Visit www.rsc.org/books/6674 for further information. Ideal for the needs of undergraduate chemistry students, Tutorial Chemistry Texts is a major new series consisting of short, single topic or modular texts concentrating on the fundamental areas of chemistry taught in undergraduate science courses. Each book provides a concise account of the basic principles underlying a given subject, embodying an independent-learning philosophy and including worked examples.
Spectra of Atoms and Molecules, 2nd Edition is designed to introduce advanced undergraduates and new graduate students to the vast field of spectroscopy. Of interest to chemists, physicists, astronomers, atmospheric scientists, and engineers, it emphasizes the fundamental principles of spectroscopy with its primary goal being to teach students how to interpret spectra. The book includes a clear presentation of group theory needed for understanding the material and a large number of excellent problems are found at the end of each chapter. In keeping with the visual aspects of the course, the author provides a large number of diagrams and spectra specifically recorded for this book. Topics such as molecular symmetry, matrix representation of groups, quantum mechanics, and group theory are discussed. Analyses are made of atomic, rotational, vibrational, and electronic spectra. Spectra of Atoms and Molecules, 2nd Edition has been updated to include the 1998 revision of physical constants, and conforms more closely to the recommended practice for the use of symbols and units. This new edition has also added material pertaining to line intensities, which can be confusing due to the dozens of different units used to report line and band strengths. Another major change is in author Peter Bernath's discussion of the Raman effect and light scattering, where the standard theoretical treatment is now included. Aimed at new students of spectroscopy regardless of their background, Spectra of Atoms and Molecules will help demystify spectroscopy by showing the necessary steps in a derivation.
Designed to serve as a textbook for postgraduate students of physics and chemistry, this second edition improves the clarity of treatment, extends the range of topics, and includes more worked examples with a view to providing all the material needed for a course in molecular spectroscopy—from first principles to the very useful spectral data that comprise figures, charts and tables. To improve the conceptual appreciation and to help students develop more positive and realistic impressions of spectroscopy, there are two new chapters—one on the spectra of atoms and the other on laser spectroscopy. The chapter on the spectra of atoms is a detailed account of the basic principles involved in molecular spectroscopy. The chapter on laser spectroscopy covers some new experimental techniques for the investigation of the structure of atoms and molecules. Additional sections on interstellar molecules, inversion vibration of ammonia molecule, fibre-coupled Raman spectrometer, Raman microscope, supersonic beams and jet-cooling have also been included. Besides worked-out examples, an abundance of review questions, and end-of-chapter problems with answers are included to aid students in testing their knowledge of the material contained in each chapter. Solutions manual containing the complete worked-out solutions to chapter-end problems is available for instructors.
This is the second volume of textbooks on atomic, molecular and optical physics, aiming at a comprehensive presentation of this highly productive branch of modern physics as an indispensable basis for many areas in physics and chemistry as well as in state of the art bio- and material-sciences. It primarily addresses advanced students (including PhD students), but in a number of selected subject areas the reader is lead up to the frontiers of present research. Thus even the active scientist is addressed. This volume 2 introduces lasers and quantum optics, while the main focus is on the structure of molecules and their spectroscopy, as well as on collision physics as the continuum counterpart to bound molecular states. The emphasis is always on the experiment and its interpretation, while the necessary theory is introduced from this perspective in a compact and occasionally somewhat heuristic manner, easy to follow even for beginners.
Molecular Spectroscopy and Modern Electronic Structure Computations
The Fundamentals of Atomic and Molecular Physics
Atomic Spectra and Atomic Structure
Fundamentals of Molecular Spectroscopy
Atoms and Molecules Interacting with Light

This work has been selected by scholars as being culturally important and is part of the knowledge base of civilization as we know it. This work is in the public domain in the United States of America, and possibly other nations. Within the United States, you may freely copy and distribute this work, as no entity (individual or corporate) has a copyright on the body of the work. Scholars believe, and we concur, that this work is important enough to be preserved, reproduced, and made generally available to the public. To ensure a quality reading experience, this work has been proofread and republished using a format that seamlessly blends the original graphical elements with text in an easy-to-read typeface. We appreciate your support of the preservation process, and thank you for being an important part of keeping this knowledge alive and relevant.
Introduce your students to the latest advances in spectroscopy with the text that has set the standard in the field for more than three decades: INTRODUCTION TO SPECTROSCOPY, 5e, by Donald L. Pavia, Gary M. Lampman, George A. Kriz, and James R. Vyvyan. Whether you use the book as a primary text in an upper-level spectroscopy course or as a companion book with an organic chemistry text, your students will receive an unmatched, systematic introduction to spectra and basic theoretical concepts in spectroscopic methods. This acclaimed resource features up-to-date spectra; a modern presentation of one-dimensional nuclear magnetic resonance (NMR) spectroscopy; an introduction to biological molecules in mass spectrometry; and coverage of modern techniques alongside DEPT, COSY, and HECTOR. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.
For beginners and specialists in other fields: the Nobel Laureate's introduction to atomic spectra and their relationship to atomic structures, stressing basics in a physical, rather than mathematical, treatment. 80 illustrations.
Molecular Spectroscopy: Modern Research, Volume III is a collection of papers presented at the 40th Annual Molecular Spectroscopy Symposium, held at the Ohio State University. The contributors of this seven-chapter text cover the significant advances in molecular spectroscopic research and their application in chemistry. Chapters 1 and 2 discuss first the higher-order vibration-rotation interactions in molecules and then present formulas and an insight into the direction being taken in theoretical pursuits. Chapter 3 provides an extensive compilation of published intensity and collision broadening parameters derived from infrared spectra. This chapter also contains a detailed discussion using consistent notation of some of the methods commonly applied to extract such information from laboratory spectra. Chapter 4 examines a variety of laser systems and their application in investigations involving triatomic free radicals and ions, while chapter 5 considers the developments in the microwave spectroscopic studies on nonpolar molecules when their symmetry is reduced by isotopic substitution. Chapter 6 emphasizes the quasi-linear molecular problem to develop an appreciation of the symptoms of quasi-linearity and theoretical treatments thereof. This chapter also examines the increasing role of highly resolved spectra in the interpretation of various large-amplitude motions in molecules. Lastly, Chapter 7 describes the electric multipolar moments of hydrogen and its isotopes. Spectroscopists, chemists, and researchers will find this work invaluable.
Rotational Spectroscopy of Diatomic Molecules
Atomic Physics for the Laser Era
Fundamentals of Molecular Spectroscopy.
Electron Spectrometry of Atoms Using Synchrotron Radiation
Advances in the Theory of Atomic and Molecular Systems

Winner of a 2005 CHOICE Outstanding Academic Book Award Molecular symmetry is an easily applied tool for understanding and predicting many of the properties of molecules. Traditionally, students are taught this subject using point groups derived from the equilibrium geometry of the molecule. Fundamentals of Molecular Symmetry shows how to set up symmetry groups for molecules using the more general idea of energy invariance. It is no more difficult than using molecular geometry and one obtains molecular symmetry groups. The book provides an introductory description of molecular spectroscopy and quantum mechanics as the foundation for understanding how molecular symmetry is defined and used. The approach taken gives a balanced account of using both point groups and molecular symmetry groups. Usually the point group is only useful for isolated, nonrotating molecules, executing small amplitude vibrations, with no tunneling, in isolated electronic states. However, for the chemical physicist or physical chemist who wishes to go beyond these limitations, the molecular symmetry group is almost always required.
Aimed primarily at an undergraduate audience, this book introduces the reader to a wide range of spectroscopies.
Bringing together scattered literature from a range of sources, Laser Spectroscopy and ItsApplications clearly elucidates the tools and concepts of this dynamic area, and providesextensive bibliographies for further study.Distinguished experts in their respective fields discuss resonance photoionization, laser absorption,laser-induced breakdown, photodissociation, Raman scattering, remote sensing,and laser-induced fluorescence. The book also incorporates an overview of the semiclassicaltheory of atomic and molecular spectra.Combining background at an intermediate level with an in-depth discussion of specifictechniques, Laser Spectroscopy and Its Applications is essential reading for laser and opticalscientists and engineers; analytical chemists; health physicists; researchers in optical,chemical, pharmaceutical, and metallurgical industries. It will also prove useful for upperlevelundergraduate and graduate students of laser spectroscopy and its applications, andin-house seminars and short courses offered by firms and professional societies.
"Authoritative and clearly written."—Applied Optics The direct observation of short-lived free radicals and the consequent study of their structure and reactions have led to important developments in almost every branch of chemistry as well as in other areas. This volume by a Nobel laureate offers an excellent introduction to the essentials of molecular spectroscopy. The introductory chapter discusses experimental methods and illustrates the observed spectra of various molecules and free radicals. Subsequent chapters explore rotational, vibrational, and electronic energy levels of diatomic molecules and ions; radiative transitions; linear and nonlinear polyatomic radicals and ions; continuous and diffuse spectra; predissociation and pre-ionization; and recombination. The well-illustrated text features more than 100 figures and spectra. A distilled version of the author's monumental three-volume study, Molecular Spectra and Molecular Structure, it constitutes a superb resource for anyone wishing a concise but complete treatment of the fundamentals of molecular spectroscopy.
The Spectra and Structures of Simple Free Radicals
Atomic and Molecular Processes
Atoms, Molecules and Optical Physics 2
Laser Spectroscopy and its Applications
Introduction to Spectroscopy

As quantum theory enters its second century, it is fitting to examine just how far it has come as a tool for the chemist. Beginning with Max Planck ' s agonizing conclusion in 1900 that linked energy emission in discreet bundles to the resultant black-body radiation curve, a body of knowledge has developed with profound consequences in our ability to understand nature. In the early years, quantum theory was the providence of physicists and certain breeds of physical chemists. While physicists honed and refined the theory and studied atoms and their component systems, physical chemists began the foray into the study of larger, molecular systems. Quantum theory predictions of these systems were first verified through experimental spectroscopic studies in the electromagnetic spectrum (microwave, infrared and ultraviolet/visible), and, later, by nuclear magnetic resonance (NMR) spectroscopy. Over two generations these studies were hampered by two major drawbacks: lack of resolution of spectroscopic data, and the complexity of calculations. This powerful theory that promised understanding of the fundamental nature of molecules faced formidable challenges. The following example may put things in perspective for today ' s chemistry faculty, college seniors or graduate students: As little as 40 years ago, force field calculations on a molecule as simple as ketene was a four to five year dissertation project.
A wide-ranging review of modern spectroscopic techniques such as X-ray, photoelectron, optical and laser spectroscopy, and related techniques. The book focuses on physical principles and the impact of spectroscopy on our understanding of the building blocks of matter, while examining applications to chemical analysis, photochemistry, surface characterization, environmental and medical diagnostics, remote sensing, and astrophysics. This Third Edition includes the most up-to-date developments.
A non-mathematical introduction to molecular spectroscopy. This revision includes: a chapter on the spectroscopy of surfaces and solids, new diagrams and problems, spectra that has been re-recorded on modern instruments, and enhanced applications of Fourier transform principles.
Engineering Chemistry-I
Introduction To Atomic And Molecular Spectroscopy
Fundamentals of Quantum Chemistry
High Resolution Spectroscopy
Atomic and Molecular Photoabsorption

Nonlinear Laser Spectroscopy

Molecular Spectroscopy and Quantum Dynamics, an exciting new work edited by Professors Martin Quack and Roberto Marquardt, contains comprehensive information on the current state-of-the-art experimental and theoretical methods and techniques used to unravel ultra-fast phenomena in atoms, molecules and condensed matter, along with future perspectives on the field. Contains new insights into the quantum dynamics and spectroscopy of electronic and nuclear motion Presents the most recent developments in the detection and interpretation of ultra-fast phenomena Includes a discussion of the importance of these phenomena for the understanding of chemical reaction dynamics and kinetics in relation to molecular spectra and structure

Atomic and Molecular Photoabsorption: Partial Cross Sections is a companion work to Joseph Berkowitz's earlier work, Atomic and Molecular Photoabsorption: Absolute Total Cross Sections, published with Academic Press in 2002. In this work Joseph Berkowitz selected the "best" absolute partial cross sections for the same species as included in the companion work. A contrast, however, is that photoabsorption measurements, being of order I/Io, do not require the most intense light sources, whereas acquiring data on the products of light interactions with gaseous matter (ions, electrons, various coincidence measurements) has benefited significantly with the arrival of second- and third-generation synchrotrons. The newer devices have also extended the energy range of the light sources to include the K-shells of the species discussed here. The newer light sources encouraged experimentalists to develop improved instrumentation. Thus, the determination of partial cross sections continues to be an active field, with more recent results in some cases superseding earlier ones. Where the accuracy of the absolute partial cross sections is deemed sufficient (less than five percent), numerical tables are included in this new work. In other cases, the available data are presented graphically. Includes data on atoms, diatomic molecules, triatomic molecules, and polyatomic molecules Written by world-leading pioneer in the field of photoionization mass spectrometry Very clear presentation of the useful, quantitative information in both tables and graphs

This volume continues the tradition of the Advances series. It contains contributions from experts in the field of atomic, molecular, and optical (AMO) physics. The articles contain some review material, but are intended to provide a comprehensive picture of recent important developments in AMO physics. Both theoretical and experimental articles are included in the volume. • International experts • Comprehensive articles • New developments

The laser as a source of coherent optical radiation has made it possible to investigate nonlinear interaction of optical radiation with atoms and mole cules. Its availability has given rise to new research fields, such as non linear optics, laser spectroscopy, laser photochemistry, that lie at the boundary between quantum electronics and physical optics, optical spectros copy and photochemistry, respectively. The use of coherent optical radiation in each of these fields has led to the discovery of qualitatively ne\~ effects and possibilities; in particular, some rather subtle effects of interaction between highly monochromatic light and atoms and molecules, in optical spec troscopy, have formed the bases for certain methods of so-called nonlinear, laser Doppler-free spectroscopy. These methods have made it possible to in 5 6 crease the resolution of spectroscopic studies from between 10 and 10 , lim 11 ited by Doppl er 1 i ne broadeni ng up, to about 10 ; at present some 1 abor atories are developing new techniques that have even higher resolution. The discovery and elaboration of the methods of nonlinear laser spectroscopy have resulted largely from contributions by scientists from many countries, in particular from the USA (Massachusetts Institute of Technology, Stanford Uni versity, National Bureau of Standards in Boulder, Harvard University, etc.), the USSR (P. N. Levedev Institute of Physics, Institute of Semiconductor Phys ics in Novosibirsk, Institute of Spectroscopy, etc.

Molecules and Photons - Spectroscopy and Collisions

Atoms and Spectroscopy

Laser Control of Atoms and Molecules

Advances in Atomic, Molecular, and Optical Physics

Engineering Chemistry-I (For 1st Semester of Anna University)

Advances in the Theory of Atomic and Molecular Systems, is a collection of contributions presenting recent theoretical and computational developments that provide new insights into the structure, properties, and behavior of a variety of atomic and molecular systems. This volume (subtitled “Dynamics, Spectroscopy, Clusters, and Nanostructures”) deals with the topics of “Quantum Dynamics and Spectroscopy”, “Complexes and Clusters”, and “Nanostructures and Complex Systems”. This volume is an invaluable resource for faculty, graduate students, and researchers interested in theoretical and computational chemistry and physics, physical chemistry and chemical physics, molecular spectroscopy, and related areas of science and engineering.

Atomic and Molecular Processes describes radiative and collisional processes involving atoms or molecules. Organized into 21 chapters, this book emphasizes the developments in these processes stimulated by the growth of interest in space science, astrophysics, and plasma physics. The book initially discusses the general theory of magnetic dipole and electric quadrupole radiation and the calculations and observations on individual atoms, as well as the forbidden transitions. The text then explores general topics on forbidden and allowed lines and bands; photoionization; photodetachment; recombination and attachment; elastic and inelastic scattering of electron; and energy loss by slow electrons. Discussions on collision broadening of spectral features and encounters between atomic systems including range, energy loss, excitation, ionization, detachment, charge transfer, elastic scattering, mobility, diffusion, relaxation in gases, and chemical reactions are provided in other chapters. A chapter is devoted to the use of high-temperature shock waves, and accounts of other main experimental methods are given.

Encompassing a wide range of techniques, spectroscopy is used to analyze chemicals, biological and pharmaceutical compounds, food and beverages, and high-tech materials. Covering the whole range of spectroscopic techniques, this book provides a thorough overview of underlying principles, techniques and applications. Dr. Hollas is a well-known author and authority in the field, and this book is an expanded version of his well-received lower-level book, Modern Spectroscopy, now in its third edition (0-471-96523-5). "The first edition of High Resolution Spectroscopy (the big book version of Modern Spectroscopy) was undoubtedly the best textbook on spectroscopy written at an undergraduate / beginning graduate level, and the second edition is an improvement... ...The coverage is broad, deep and even. The first chapters give a concise and clear introduction to spectroscopy, covering much that is accessible elsewhere only in more complicated discussions... ...The production values of High Resolution Spectroscopy are high, diagrams are well reproduced and the whole text is lavishly illustrated with many spectra and diagrams of apparatus.... ... it contains a great deal of material and is beautifully written; every library should contain a copy; every student of spectroscopy (no-matter what age!) should have a copy on their shelves." Extracts from a Review in Spectroscopy Europe, 11/3 (1999)

With contributions by numerous experts

Basic Concepts and Applications

Atomic and Molecular Spectroscopy

An Introduction to Molecular Spectroscopy

Laser Spectroscopy of Atoms and Molecules

The Fundamentals of Atomic and Molecular Physics is intended as an introduction to the field for advanced undergraduates who have taken quantum mechanics. Each chapter builds upon the previous, using the same tools and methods throughout. As the students progress through the book, their ability to use these tools will steadily increase, along with their confidence in their efficacy. The book treats the two-electron atom as the simplest example of the many-electron atom—as opposed to using techniques that are not applicable to many-electron atoms—so that it is unnecessary to develop additional equations when turning to multielectron atoms, such as carbon. External fields are treated using both perturbation theory and direct diagonalization and spontaneous emission is developed from first principles. Only diatomic molecules are considered with the hydrogen molecular ion and neutral molecule treated in some detail. This comprehensive coverage of the quantum mechanics of complex atoms and simple diatomic molecules, developed from the very basic components, is extremely useful for students considering graduate studies in any area of physics.

Spectroscopy is the study of electromagnetic radiation and its interaction with solid, liquid, gas and plasma. It is one of the widely used analytical techniques to study the structure of atoms and molecules. The technique is also employed to obtain information about atoms and molecules as a result of their distinctive spectra. The fast-spreading field of spectroscopic applications has made a noteworthy influence on many disciplines, including energy research, chemical processing, environmental protection and medicine. This book aims to introduce students to the topic of spectroscopy. The author has avoided the mathematical aspects of the subject as far as possible; they appear in the text only when inevitable. Including topics such as time-dependent perturbation theory, laser action and applications of Group Theory in interpretation of spectra, the book offers a detailed coverage of the basic concepts and applications of spectroscopy.