<<理论原子物理学>>

图书基本信息

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前言

The one and a half decades since the publication of the first edition of Theo-retical Atomic Physics have seen a continuation of remarkable and dramatic experimental breakthroughs. With the help of ultrashort laser pulses, special states of atoms and molecules can now be prepared and their time-evolution studied on time scales shorter than femtoseconds. Trapped atoms and mole-cules can be cooled to temperatures on the order of a few nano-Kelvin and light fields can be used to guide and manipulate atoms, for example in optical lattices formed as standing waves by counterpropagating laser beams. After the first production of Bose-Einstein condensates of ultracold atomic gases in 1995, degenerate quantum gases of ultracold atoms and molecules are now prepared and studied routinely in many laboratories around the world. Such progress in atomic physics has been well received and appreciated in the gen-eral academic community and was rewarded with two recent Nobel Prizes for physics. The 1997 prize was given to Steven Chu, Claude Cohen-Tannoudji and William Phillips for their work on cooling atoms, and only four years later Eric Cornell, Wolfgang Ketterle and Carl Wieman received the 2001 prize for the realization of the Bose-Einstein condensates mentioned above.The prominence of modern experimental atomic physics establishes fur-ther need for a deeper understanding of the underlying theory. The continuing growth in quality and quantity of available computer power has substantially increased the effectivity of large-scale numerical studies in all fields, including atomic physics. This makes it possible to obtain some standard results such as the properties of low-lying states in many-electron atoms with good accuracy using generally applicable programme packages. However, largely due to the dominant influence of long-ranged Coulomb forces, atomic systems are rather special. They can reveal a wide range of interesting phenomena in very differ-ent regimes——from near-classical states of highly excited atoms, where effects of nonlinearity and chaos are important, to the extreme quantum regime of ultracold atoms, where counterintuitive nonclassical effects can be observed. The theoretical solution of typical problems in modern atomic physics requires proficiency in the practical application of quantum mechanics at an advanced level, and a good understanding of the links to classical mechanics is almost always helpful. The aim of Theoretical Atomic Physics remains to provide the reader with a solid foundation of this sort of advanced quantum mechanics.In preparing the third edition I have again tried to do justice to the rapid development of the field. I have included references to important new work whenever this seemed appropriate and easy to do. Chapter I now includes a section on processes involving （wave packets of） continuum states and also an expanded treatment of the semiclassical approximation. Chapter 3 begins with a section illuminating the characteristic differences in the near-threshold properties of long-ranged and shorter-ranged potentials, and the first section of Chap. 4 contains a more elaborate discussion of scattering lengths. As a further "special topic" in Chap. 5 there is a section describing some aspects of atom optics, including discusions of the interactions of atoms with material surfaces and with light fields. The appendix on special mathematical functions has been slightly expanded to accommodate a few results that I repeatedly found to be useful.

内容概要

《理论原子物理学（第3版）》主要讲解量子力学基本原理在现代原子物理学中的应用。
在新版中，作者增添了理论原子物理领域的最新进展，介绍了目前大家非常感兴趣的议题，包括半经典周期轨道理论、外场中原子的标度性质、双电子原子的经典和量子动力学以及原子气体的玻色－爱因斯坦凝聚等。
《理论原子物理学（第3版）》还简明介绍了原子光学中若干前沿研究，这是目前和未来超冷原子实验必不可少的知识。
作者强调基本理论的解释，使读者能够理解标准理论结构里蕴藏的丰富物理思想，从而可以独立进行科学研究工作。
此外，形式各异的习题及其完整的解答过程为《理论原子物理学（第3版）》添色不少。
《理论原子物理学（第3版）》被选为德国Springer出版社的“高等物理学教材”，这是一套非常优秀的教材。
目次：量子力学概要；原子和离子；原子光谱；简单反应；专题；附录：特殊数学函数；习题答案；索引。
原子物理是物理学中最具有活力的前沿领域之一，它在推动人们对自然界的认知方面发挥了重要作用。
在过去几年里，该领域及相关领域因原子激光冷却（1997年）、玻色-爱因斯坦凝聚的实现（2001年）以及光的量子相干性与精密光谱学的发展（2005年）三次摘取诺贝尔物理学奖桂冠。
读者对象：理论物理、原子分子物理和物理化学等专业的高年级本科生、研究生和相关领域的科研人员。

书籍目录

章节摘录

插图：

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