<<相空间中的量子光学>>

图书基本信息

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前言

During the winter semester of 1992／93 I taught for the first time the course Quan.rum Optics I at the University of Ulm， which was followed by part II in the summer semester of 1993.When I offered the course a second time the University was kind enough to financially support two diplom students， Erwin Mayr and Daniel Krahmer， who had already taken this class in the previous year to transform my hand.written notes and sketches of drawings into a legible form.Erwin and Daniel have done atremendous job.Since then I have taught this course many times and collected more and more material which was included into this manuscript by other graduate stu-dents of the Abteilung.It has served many generations of students at the University of U1m as a first introduction to the field of quantum optics.During one of his many visits to Ulm， Michael Poulson， a close friend from the VCH-Wiley publishing house saw the manuscript on my desk. “ 1 want to pub.1ish these notes ” was his immediate reaction.Michael had complete faith that this manuscript would eventually be turned into a publishable book.He wanted the material to be expanded to include problems， experiments and an exhaustive list ofreferences.The goal was to convert the existing manuscript of about 150 pages into a book of about 250 pages.His trust in me was so great that he started advertising Quantum Optics in Phase Space before we had even signed a contract.I believe thepresent result satisfies the criteria Michael had put forward with one exception-thenumber of pages.At Christmas of 1996 we finally signed a contract and Michael was extremelyrelieved.I still remember his words “ now I have finally succeeded in signing you upfor the book ” .A week later his untimely death during Christmas vacation added anew meaning to this selltence and a purposeful dimension to his faith and expectation；1 was determined more than ever to deliver what I had promised.Eventually Erwin and Daniel graduated and their new professional life did notallow them to devote more time to continue the project.Since that fateful Christmasof 1996 ， many students have helped me transform my class notes into various sectionsof the book continuing the work that Erwin and Daniel had begun.Stephan Menegh.1nl took over and for several years he was instrumental in typing the manuscript.Butalso he graduated during the course of the project.In the final phase of the bookhis role was taken over by Florian Haug.I am enormously grateful to all of them fortheir assistance.What started out with 200 pages at Erwin and Daniel ’ s departureeventually expanded and reached its present 700 page size.Similarly ， the field of quantum optics has expanded enormously over the last 10years.

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内容概要

Niels Bohr 曾经说过，“ 如果量子力学没有让你感到困惑，那么你就没有真正理解量子力学 ”。这话同样适用于量子光学。

本书从相空间的角度，用基于半经典的方法来理解量子光学这一快速发展的领域。
它首先介绍令人惊奇的结果，然后给出清晰的解释。
本书非常详细地介绍了第一个光学实验，此项发现导致量子光学成为一个庞大的研究领域。
它试图用力学振子之于标准波，类似的方法解释物质和波的纠缠。
书中从量子光学的角度，对经典光学的一些实验予以新的诠释；对原子间的相互作用也进行了详细讨论。
为方便阅读，本书提供了上百页的相关数学背景知识。
每章结尾，给出一些具有挑战性的问题。

本书对于从事量子光学研究的研究者，具有很高的参考价值。

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书籍目录

章节摘录

插图：What iS quantum optics？
This is a rather personal question.A well-known scientistin this field once gave the following authoritative answer：“Whatever I do definesquantum optics”On a more objective basis one iS tempted to define this branch of physics by the pun：“Quantum optics is that branch of optics where the quantumfeatures of light matter.”Which discovery in physics marks the birthday of quantum optics？
Many phe-nomena come to our mind.Is it the discovery of the quantum，the development ofQED，or the maser／laser？
0r iS it none of the above？
In this chapter we answer this question in a back handed wav by summarizingsome path breaking experiments that define quantum optics.Admittedly this listiS not complete and chosen in a rather subjective way.The rapidly moving fieldof quantam optics demonstrares most clearly that even after 100 years of quantumphysics there iS still a lot to be learned from Ptanck’S original discovery1.1 On the Road to Quantum OpticsMore than hundred years ago M.Planck was struggling with the experimental data ofblack body radiation obtained at the Physikalisch.Technische Reichsanstalt in Berlinbv H.Rubens and F.Kurlbaum. From todays point of view these experimentslook rather academic. However.they were motivated bv industrial applications.Indeed，standards had to be developed in order to describe light bulbs.This needtriggered one of the most important problems in the physics of the 20th century：Classical electromagnetic theory cannot explain the measured black body spectrum.In a desperate but courageous attempt Planck postulated that the oscillators inthe Walls of the cavity can only absorb and emit radiation in discrete units.This revolutionary idea of discreteness rather than a continuum provided the celebrated radiation formula and Was the starting point of quantum mechanics.Nowadays we associate the quantization with the field rather than with the me-chanical oscillators in the wall.However.wave and matrix mechanics were first developed for massive particles and then，later，transferred to the electromagneticfield leading to quantized electrodynamics.The field of quantum electrodynamics.QED.which deals with the interaction of quantized matter with quantized electromagnetic fields started with P.A.M.Dirac.

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