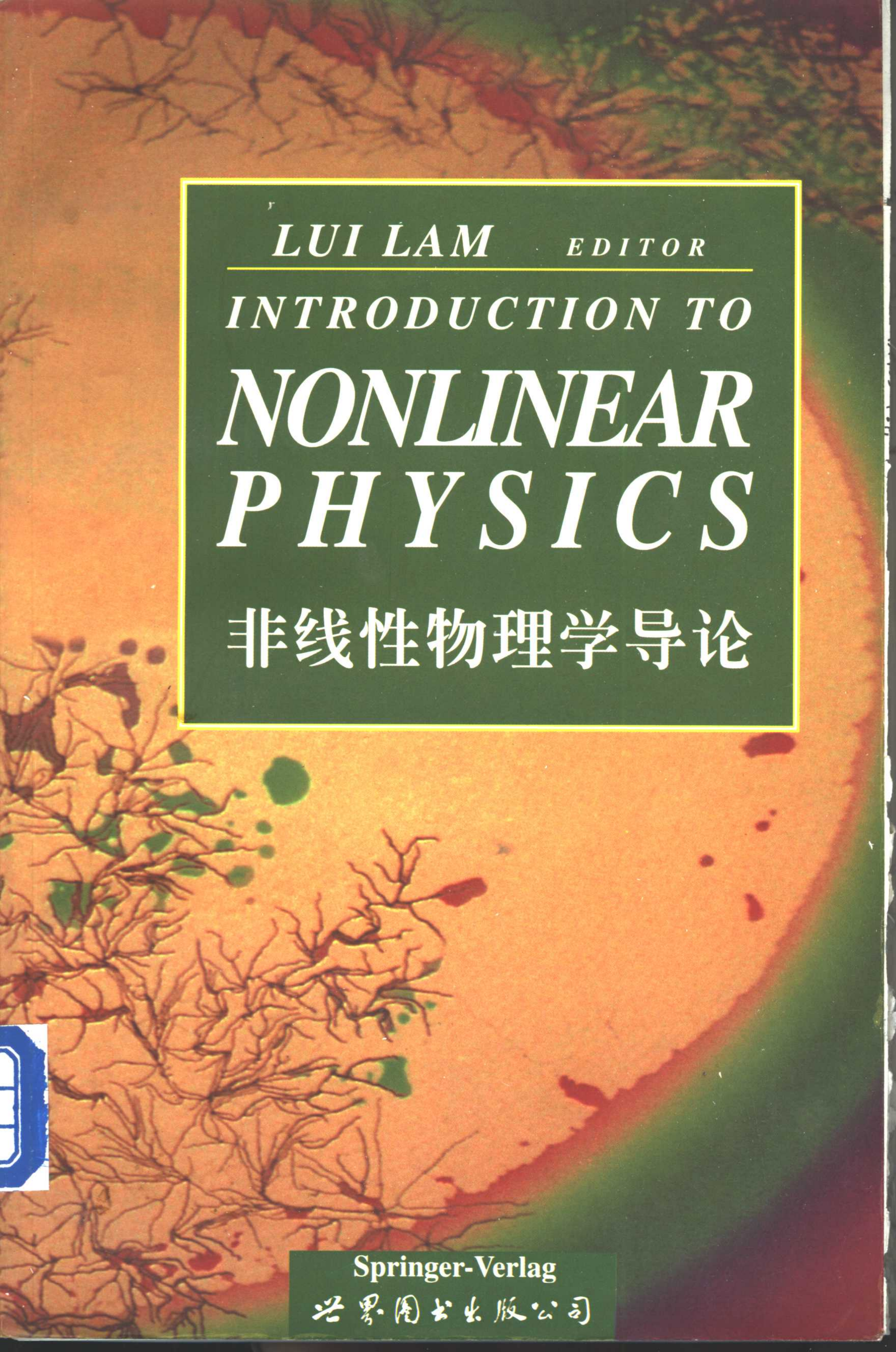


LUI LAM EDITOR

INTRODUCTION TO NONLINEAR PHYSICS

非线性物理学导论

Springer-Verlag
世界图书出版公司

Introduction to Nonlinear Physics

Springer
New York
Berlin
Heidelberg
Barcelona
Budapest
Hong Kong
London
Milan
Paris
Santa Clara
Singapore
Tokyo

Lui Lam
Department of Physics
San Jose State University
San Jose, CA 95192-0106
USA

Library of Congress Cataloging-in-Publication Data
Introduction to nonlinear physics / Lui Lam, editor.
p. cm.
Includes bibliographical references and index.
ISBN 0-387-94758-2 (alk. paper)
1. Nonlinear theories. 2. Mathematical physics. I. Lam, Lui.
QC20.7.N6I67 1996
530.1'55252—dc20 96-14764

Printed on acid-free paper.

© 1997 Springer-Verlag New York, Inc.
All rights reserved. This work may not be translated or copied in whole or in part without the written permission of the publisher (Springer-Verlag New York, Inc., 175 Fifth Avenue, New York, NY 10010, USA), except for brief excerpts in connection with reviews or scholarly analysis. Use in connection with any form of information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed is forbidden.
The use of general descriptive names, trade names, trademarks, etc., in this publication, even if the former are not especially identified, is not to be taken as a sign that such names, as understood by the Trade Marks and Merchandise Marks Act, may accordingly be used freely by anyone.

This reprint has been authorized by Springer-Verlag (Berlin/Heidelberg/New York) for sale in the People's Republic of China only and not for export therefrom.
Reprinted in China by Beijing World Publishing Corporation, 1999

ISBN 0-387-94758-2 Springer-Verlag New York Berlin Heidelberg SPIN 10536582

书　　名：Introduction to Nonlinear Physics

作　　者：L. Lam (ed.)

中 译 名：非线性物理学导论

出 版 者：世界图书出版公司北京公司

印 刷 者：北京中西印刷厂

发　　行：世界图书出版公司北京公司 (北京朝内大街 137 号　100010)

开　　本：1/24　711×1245　　印　张：18

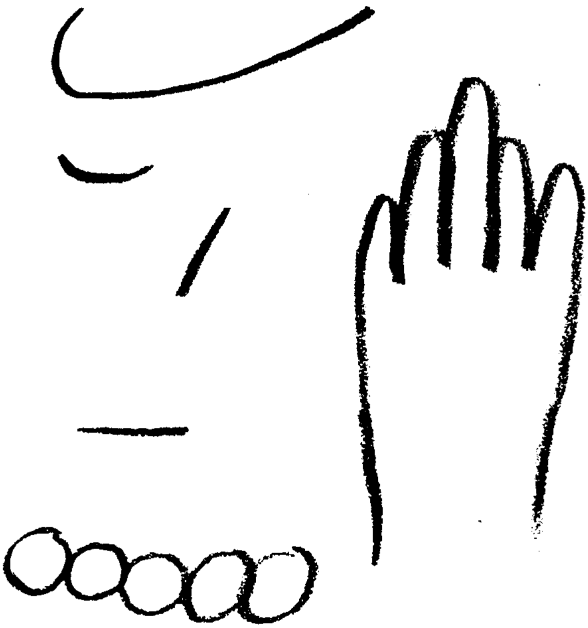
出版年代：1999 年 11 月

书　　号：ISBN 7-5062-1465-2/O・274

版权登记：图字 01-1999-1796

定　　价：67.00 元

世界图书出版公司北京公司已获得 Springer-Verlag 授权在中国大陆独家重印发行。



A complex system (Charlene Lam, 1987).

此为试读，需要完整PDF请访问：www.ertongbook.com

Lui Lam
Editor

Introduction to Nonlinear Physics

With 264 Figures

Springer

Preface

A revolution occurred quietly in the development of physics—or, more accurately, of science—in the last three decades. The revolution touches upon *every* discipline in both the natural and social sciences. We are referring to the birth of a new science—nonlinear science—which, for the sake of presentation, may be divided into six parts: fractals, chaos, pattern formation, solitons, cellular automata, and complex systems.

Yet, in spite of all the excitement about this new science, there is not a single textbook covering all these topics. To remedy this situation and in view of the diversity of the subject, a number of pioneers and experts were invited to write about their own fields of research. The result is a textbook intended for advanced undergraduates and graduate students, which is also suitable for self-study. The materials contained in this book have been test taught in classrooms in universities, and in summer and winter schools. Examples and homework problems are included in most chapters.

Emphasis is placed on fractals, chaos, pattern formation, and solitons, which form Parts I to IV in the book. Special topics, including cellular automata, turbulence, and complex systems, are grouped in Part V. Part I to Part IV can be studied independently of each other, whereas Part V can be ignored in a first reading, except that Chapter 15 is a useful supplement to Part III.

Although most of the applications in this book are taken from examples in the physical sciences, the general principles and theories expounded are definitely applicable to other branches of science. The book is thus of use to students and researchers not just in physics but also in, for example, chemistry, biology, astronomy, meteorology, geology, mathematics, computer science, engineering, medicine, economics, and ecology. The multidisciplinary nature of nonlinear science makes it the ideal course for broadening the perspective and education of students.

I am grateful to the contributors and the publisher for their professional skills and patience in making this book possible. For discussion and encouragement I want to thank numerous colleagues, in particular, Armin Bunde, David Campbell, Patricia Cladis, James Crutchfield, Herman Cummins, John Holland, Alfred Hübler, Stuart Kauffman, Yuji Kodama, Mitsugu Matsushita, Michael Nauenberg, Ru-Pin Pan, Gene Stanley, Harry Swinney, and Wing-Yim Tam. I am indebted to Marilyn Lam and Charlene Lam for contributing to the artwork and providing the sketch on page ii, and for a lot of other things.

San Jose — Lui Lam

Contents

此为试读，需要完整PDF请访问： www.ertongbook.com

Part III Pattern Formation and Disorderly Growth

1

Introduction

Lui Lam

1.1 A Quiet Revolution

Quantum mechanics and relativity, the two important discoveries in physics developed at the beginning of this century, are well recognized as revolutions. These two revolutions present unexpected concepts and insights by going beyond the classical domains (Fig. 1.1). New results are obtained in quantum mechanics when one goes to the microscopic level ($<10^{-8}$ cm) and, in the case of relativity, the speed of the object has to be close to that of light ($\sim 10^{10}$ cm/s).

Here comes a new branch of science—nonlinear science—which, like quantum mechanics and relativity, delivers a whole set of fundamentally new ideas and surprising results. Yet, unlike quantum mechanics and relativity, nonlinear science covers systems of *every* scale, and objects moving with *any* speed; that is, the whole area displayed in Fig. 1.1. Then, by the same standard, nonlinear science is more than qualified to be called a revolution. The fact that nonlinear science delivers within the conventional system sizes and speed limits should not be counted as negative toward its novelty but, on the contrary, in view of its wide applicability, makes nonlinear science more important and powerful as a true revolution. In particular, nonlinear science can be studied with daily macroscopic systems with ordinary tools, such as a camera or a copying machine, making it accessible to almost everybody.

If nonlinear science appears to be a somewhat quiet revolution, it is perhaps due to its wide scope of coverage. The important works were done by so many researchers and accumulated over such a long period of time that it was hard for a single person or a group to call a press conference. Or, following a long scientific tradition, no one bothered to call a press conference.

For pedagogical purposes, nonlinear science may be divided into six areas of study, namely, fractals, chaos, pattern formation, solitons, cellular automata, and complex systems. The common theme underlying this diversity of subjects is the nonlinearity of the systems under study.

此为试读，需要完整PDF请访问： www.ertongbook.com