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Adrian Ankiewicz
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LECTURE NOTES IN PHYSICS 751

Dissipative Solitons: From Optics to Biology and Medicine

Dissipative Solitons From Optics To Biology And Medicine Lecture Notes In Physics

Akira Hasegawa



Dissipative Solitons From Optics To Biology And Medicine Lecture Notes In Physics:

Dissipative Solitons: From Optics to Biology and Medicine Nail Akhmediev, Adrian Ankiewicz, 2008-08-26 The dissipative soliton concept is a fundamental extension of the concept of solitons in conservative and integrable systems It includes ideas from three major sources namely standard soliton theory developed since the 1960s nonlinear dynamics theory and Prigogine's ideas of systems far from equilibrium These three sources also correspond to the three component parts of this novel paradigm This book explains the above principles in detail and gives the reader various examples **High Temperature Plasmas** Karl-Heinz Spatschek, 2013-11-12 Filling the gap for a treatment of the subject as an advanced course in theoretical physics with a huge potential for future applications this monograph discusses aspects of these applications and provides theoretical methods and tools for their investigation Throughout this coherent and up to date work the main emphasis is on classical plasmas at high temperatures drawing on the experienced author's specialist background As such it covers the key areas of magnetic fusion plasma laser plasma interaction and astrophysical plasmas while also including nonlinear waves and phenomena For master and PhD students as well as researchers interested in the theoretical foundations of plasma models *Optical Signal Processing in Highly Nonlinear Fibers* Mário Ferreira, 2020-05-18 This book provides an updated description of the most relevant types of highly nonlinear fibers It also describes some of their actual applications for nonlinear optical signal processing Multiple types of highly nonlinear fibers are considered such as silica based conventional highly nonlinear fibers tapered fibers photonic crystal fibers and fibers made of highly nonlinear materials namely lead silicate tellurite bismuth oxide and chalcogenide glasses Several nonlinear phenomena occurring on such highly nonlinear fibers are described and used to realize different functions in the area of all optical signal processing Describes several nonlinear phenomena occurring on optical fibers namely nonlinear phase modulation parametric and stimulated scattering processes optical solitons and supercontinuum generation Discusses different types of highly nonlinear fibers namely silica based conventional highly nonlinear fibers tapered fibers and photonic crystal fibers Examines fibers made of highly nonlinear materials namely lead silicate tellurite bismuth oxide and chalcogenide glasses Describes the application of several nonlinear phenomena occurring on highly nonlinear fibers to realize different functions in the area of all optical signal processing namely optical amplification multiwavelength sources pulse generation optical regeneration wavelength conversion and optical switching Mário Ferreira received his PhD degree in 1992 in physics from the University of Aveiro Portugal where he is now a professor in the Physics Department Between 1990 and 1991 he was at the University of Essex UK performing experimental work on external cavity semiconductor lasers and nonlinear optical fiber amplifiers His research interests have been concerned with the modeling and characterization of multisection semiconductor lasers quantum well lasers optical fiber amplifiers and lasers soliton propagation nanophotonics optical sensors polarization and nonlinear effects in optical fibers He has written more than 400 scientific journal and conference publications and

several books in the area of mathematical physics optics and photonics He has served as chair and committee member of multiple international conferences as well as guest editor and advisory board member of several international journals

Guided-Wave Optics Boris Malomed, 2018-03-23 This book is a printed edition of the Special Issue Guided Wave Optics that was published in Applied Sciences

Nonlinear Optical Cavity Dynamics Philippe Grelu, 2015-12-23 By recirculating light in a nonlinear propagation medium the nonlinear optical cavity allows for countless options of light transformation and manipulation In passive media optical bistability and frequency conversion are central figures In active media laser light can be generated with versatile underlying dynamics Emphasizing on ultrafast dynamics the vital arena for the information technology the soliton is a common conceptual keyword thriving into its modern developments with the closely related denominations of dissipative solitons and cavity solitons Recent technological breakthroughs in optical cavities from micro resonators to ultra long fiber cavities have entitled the exploration of nonlinear optical dynamics over unprecedented spatial and temporal orders of magnitude By gathering key contributions by renowned experts this book aims at bridging the gap between recent research topics with a view to foster cross fertilization between research areas and stimulating creative optical engineering design

Spontaneous Symmetry Breaking, Self-Trapping, and Josephson Oscillations Boris A. Malomed, 2014-07-08 This volume collects a number of contributions on spontaneous symmetry breaking Current studies in this general field are going ahead at a full speed The book presents review chapters which give an overview on the major breakthroughs of recent years It covers a number of different physical settings which are introduced when a nonlinearity is added to the underlying symmetric problems and its strength exceeds a certain critical value The corresponding loss of symmetry called spontaneous symmetry breaking alias self trapping into asymmetric states is extensively discussed in this book The book presents both active theoretical studies of spontaneous symmetry breaking effects as well as experimental findings chiefly for Bose Einstein Condensates with the self repulsive nonlinearity and also for photorefractive media in optics

Quodons in Mica Juan F. R. Archilla, Noé Jiménez, Victor J. Sánchez-Morcillo, Luis M. García-Raffi, 2015-07-31 This book presents the current knowledge about nonlinear localized travelling excitations in crystals Excitations can be vibrational electronic magnetic or of many other types in many different types of crystals as silicates semiconductors and metals The book is dedicated to the British scientist FM Russell recently turned 80 He found 50 years ago that a mineral mica muscovite was able to record elementary charged particles and much later that also some kind of localized excitations he called them quodons was also recorded The tracks therefore provide a striking experimental evidence of quodons existence The first chapter by him presents the state of knowledge in this topic It is followed by about 18 chapters from world leaders in the field reviewing different aspects materials and methods including experiments molecular dynamics and theory and also presenting the latest results The last part includes a personal narration of FM Russell of the deciphering of the marks in mica It provides a unique way to present the science in an accessible way and also illustrates the process of

discovery in a scientist's mind **Dissipative Solitons: From Optics to Biology and Medicine** Nail Akhmediev, Adrian Ankiewicz, 2009-08-29 The dissipative soliton concept is a fundamental extension of the concept of solitons in conservative and integrable systems. It includes ideas from three major sources: namely, standard soliton theory developed since the 1960s, nonlinear dynamics theory, and Prigogine's ideas of systems far from equilibrium. These three sources also correspond to the three component parts of this novel paradigm. This book explains the above principles in detail and gives the reader various examples.

Dissipative Solitons Nail Akhmediev, Adrian Ankiewicz, 2005-04-25 This volume is devoted to the exciting topic of dissipative solitons, i.e. pulses or spatially localised waves in systems exhibiting gain and loss. Examples are laser systems, nonlinear resonators, and optical transmission lines. The physical principles and mathematical concepts are explained in a clear and concise way suitable for students and young researchers. The similarities and differences in the notion of a soliton between dissipative systems and Hamiltonian and integrable systems are discussed, and many examples are given. The contributions are written by the world's leading experts in the field, making it a unique exposition of this emerging topic.

Deutsche Nationalbibliographie und Bibliographie der im Ausland erschienenen deutschsprachigen Veröffentlichungen, 2009 **The Cumulative Book Index**, 1988 A world list of books in the English language

Dissipative Solitons Nail Akhmediev, Adrian Ankiewicz, 2009-09-02 This volume is devoted to the exciting topic of dissipative solitons, i.e. pulses or spatially localised waves in systems exhibiting gain and loss. Examples are laser systems, nonlinear resonators, and optical transmission lines. The physical principles and mathematical concepts are explained in a clear and concise way suitable for students and young researchers. The similarities and differences in the notion of a soliton between dissipative systems and Hamiltonian and integrable systems are discussed, and many examples are given. The contributions are written by the world's leading experts in the field, making it a unique exposition of this emerging topic.

Dissipative Solitons Natasha Natalia Devine, 2010 The notion of dissipative solitons is a useful concept that allows us to describe in general terms a variety of phenomena in physics, chemistry, biology, and medicine. Some specific features of these formations are common for all of them, independent of the problem that we are solving and the model we are using. Many problems in optics involving gain and loss can be formulated in terms of a single master equation that is in one or another form of the complex cubic quintic Ginzburg-Landau equation (CGLE) type.

Dissipative Optical Solitons Mário F. S. Ferreira, 2022-09-23 This book introduces the basic concept of a dissipative soliton before going to explore recent theoretical and experimental results for various classes of dissipative optical solitons: high energy dissipative solitons and their applications, and mode-locked fiber lasers. A soliton is a concept which describes various physical phenomena ranging from solitary waves forming on water to ultrashort optical pulses propagating in an optical fiber. While solitons are usually attributed to integrability, in recent years the notion of a soliton has been extended to various systems which are not necessarily integrable. Until now the main emphasis has been given to well-known conservative soliton systems, but new avenues of inquiry were opened when physicists realized that

solitary waves did indeed exist in a wide range of non integrable and non conservative systems leading to the concept of so called dissipative optical solitons Dissipative optical solitons have many unique properties which differ from those of their conservative counterparts For example except for very few cases they form zero parameter families and their properties are completely determined by the external parameters of the optical system They can exist indefinitely in time as long as these parameters stay constant These features of dissipative solitons are highly desirable for several applications such as in line regeneration of optical data streams and generation of stable trains of laser pulses by mode locked cavities

Optical Solitons Kuppuswamy Porsezian, Valakkattil Chako Kuriakose, 2003-01-22 Optical Solitons represent one of the most exciting and fascinating concepts in modern communications arousing special interest due to their potential applications in optical fibre communication This volume focuses on the explicit integration of analytical and experimental methods in nonlinear fibre optics and integrated optics It covers all important recent technical issues in optical soliton communication For example individual chapters are devoted to topics such as dispersion management and fibre Bragg grating All authors are leading authorities in their fields

Solitons in Physics, Mathematics, and Nonlinear Optics Peter J. Olver, David H. Sattinger, 2011-11-06 This IMA Volume in Mathematics and its Applications SOLITONS IN PHYSICS MATHEMATICS AND NONLINEAR OPTICS is based on the proceedings of two workshops which were an integral part of the 1988 89 IMA program on NONLINEAR WAVES The workshops focussed on the main parts of the theory of solitons and on the applications of solitons in physics biology and engineering with a special concentration on nonlinear optics We thank the Coordinating Committee James Glimm Daniel Joseph Barbara Keyfitz An Majda Alan Newell Peter Olver David Sattinger and David Schaeffer for drew planning and implementing the stimulating year long program We especially thank the Workshop Organizers for Solitons in Physics and Mathematics Alan Newell Peter Olver and David Sattinger and for Nonlinear Optics and Plasma Physics David Kaup and Yuji Kodama for their efforts in bringing together many of the major figures in those research fields in which solitons in physics mathematics and nonlinear optics theories are used

A vner Friedman Willard Miller Jr PREFACE This volume includes some of the lectures given at two workshops Solitons in Physics and Mathematics and Solitons in Nonlinear Optics and Plasma Physics held during the 1988 89 LM A year on Nonlinear Waves Since their discovery by Kruskal and Zabusky in the early 1960 s solitons have had a profound impact on many fields ranging from engineering and physics to algebraic geometry

Optical Solitons in Fibers Akira Hasegawa, 2014-03-12 Latest developments associated with two currently active and very important theoretical and practical topics in nonlinear optics namely solitons and fibers are considered in this volume Solitons as analytical solutions of nonlinear partial differential equations were established in 1967 and only five years later Hasegawa and Tappert predicted for the first time theoretically that solitons could be generated in a dielectric fiber In practical terms this work pursued mainly at the AT T Bell Laboratories points to technological advances allowing for an economic and undistorted propagation of signals which will revolutionize

telecommunications Starting from an elementary level readily accessible to undergraduates the author a pioneer in the field provides a clear and up to date exposition of both the theoretical background and the most recent experimental results in this new and rapidly evolving field This well written book is well suited for undergraduate or graduate lecture courses and makes easy reading not only for the researcher but also for the interested physicist mathematician and engineer *Spatial Solitons* Stefano Trillo, William Torruellas, 2012-11-23 Solitary wave physics plays a significant role from modern optical physics to optical communication optical switching and optical storage This book gives an updated overview of optical solitons as a reference and guide for advanced students and scientists working in the field **Nontopological Solitons** Lawrence Wilets, 1989 Ch 1 Introduction ch 2 The models ch 3 The mean field approximation classical and quantal ch 4 Projection and boost ch 10 Many bag problem ch 11 Retrospect and prospects *Optical Solitons* K. Porsezian, V. C. Kuriakose, 2001

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