

OPTICAL SCIENCES

S. Trillo
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(Eds.)

Spatial Solitons



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Spatial Solitons

Mikhail I. Kolobov



Spatial Solitons:

Spatial Solitons Stefano Trillo, William Torruellas, 2013-06-05 Soliton based concepts open the road for newly designed laser sources new frequency converters and high intensity laser material interactions Optical solitons as stable spatial patterns of complex nonlinear systems allow for the control of the diffraction of optical beams Solitons also prevent unwanted chaotic behavior Thus solitary wave physics plays a significant role from modern optical physics to optical communication optical switching and optical storage The book gives an updated overview of optical solitons and can serve as a reference and guide for advanced students and scientists working in the field and related areas of science where solitons are observed

Optical Spatial Solitons in Photorefractive Materials Aavishkar Katti, R.A. Yadav, 2021-05-31 This book highlights recent advances of optical spatial solitons in photorefractive materials ranging broadly from the coupling modulation instability effect of pyroelectricity and the stability of photorefractive solitons among other topics Photorefractive solitons have been at the forefront of research because of their formation at low laser powers and unique saturable nonlinearity present in photorefractive materials which supports solitons in 2 1 D There has been a spurt in research on photorefractive solitons recently which has contributed to a greater understanding of the theoretical foundation of photorefractive solitons as also of their various interesting and practical applications The book elucidates the diversity of photorefractive solitons and provides a good resource for students researchers and professionals in the area of nonlinear optics

Optical Solitons: Theoretical Challenges and Industrial Perspectives Vladimir E. Zakharov, Stefan Wabnitz, 2013-04-17 1 2 V E Zakharov and S Wabnitz 1 L D Landau Institute for Theoretical Physics 2 Kosygin Str 117334 Moscow Russia 2 Laboratoire de Physique University of Bourgogne 9 avenue A Savary 21078 Dijon France After about a quarter of a century since the first theoretical predictions of optical solitons the industrial application of the optical soliton concept is near to reality in the booming field of modern telecommunications where the demand for high speed data transmission and routing is of ever growing This book contains a set of lectures that were presented at a Les Houches school on optical solitons in September 1998 The school was successful in gathering among the lecturers most of the well recognized world leaders in the field of optical solitons A variety of different aspects of research into optical solitons was exposed in the lectures ranging from the mathematical foundations of integrability theory to the rapidly evolving technological advances of fiber soliton based telecommunication systems The overall impression that the participants and the students received from the school is that this field of research is an excellent example of the rapid transfer that occurs nowadays from basic science to the technological implementations of the first principles The subjects that were covered by the lectures can be broadly grouped into four main categories optical soliton theory fiber soliton telecommunications optical soliton generation methods and all optical information processing via spatial solitons

Optical Solitons Yuri S. Kivshar, Govind P. Agrawal, 2003-06-12 The current research into solitons and their use in fiber optic communications is very important to the future of communications Since the advent of computer networking

and high speed data transmission technology people have been striving to develop faster and more reliable communications media Optical pulses tend to broaden over relatively short distances due to dispersion but solitons on the other hand are not as susceptible to the effects of dispersion and although they are subject to losses due to attenuation they can be amplified without being received and re transmitted This book is the first to provide a thorough overview of optical solitons The main purpose of this book is to present the rapidly developing field of Spatial Optical Solitons starting from the basic concepts of light self focusing and self trapping It will introduce the fundamental concepts of the theory of nonlinear waves and solitons in non integrated but physically realistic models of nonlinear optics including their stability and dynamics Also it will summarize a number of important experimental verification of the basic theoretical predictions and concepts covering the observation of self focusing in the earlier days of nonlinear optics and the most recent experimental results on spatial solitons vortex solitons and soliton interaction spiraling Introduces the fundamental concepts of the theory of nonlinear waves and solitons through realistic models Material is based on authors years of experience actively working in and researching the field Summarizes the most important experimental verification of the basic theories predictions and concepts of this ever evolving field from the earliest studies to the most recent *Progress in Optics* ,2009-06-20 In the forty eight years that have gone by since the first volume of Progress in Optics was published optics has become one of the most dynamic fields of science The volumes in this series which have appeared up to now contain more than 300 review articles by distinguished research workers which have become permanent records for many important developments 3D optical microscopy Transformation optics and geometry of light Photorefractive solitons Stimulated scattering effects Optical vortices and polarization singularities Quantum feedforward control of light **Optical Waveguides** María L. Calvo,Vasudevan Lakshminarayanan,2018-10-03 Although the theory and principles of optical waveguides have been established for more than a century the technologies have only been realized in recent decades Optical Waveguides From Theory to Applied Technologies combines the most relevant aspects of waveguide theory with the study of current detailed waveguiding technologies in particular photonic devices telecommunication applications and biomedical optics With self contained chapters written by well known specialists the book features both fundamentals and applications The first three chapters examine the theoretical foundations and bases of planar optical waveguides as well as critical optical properties such as birefringence and nonlinear optical phenomena The next several chapters focus on contemporary waveguiding technologies that include photonic devices and telecommunications The book concludes with discussions on additional technological applications including biomedical optical waveguides and the potential of neutron waveguides As optical waveguides play an increasing part in modern technology photonics will become to the 21st century what electronics were to the 20th century Offering both novel insights for experienced professionals and introductory material for novices this book facilitates a better understanding of the new information era the photonics century Soliton-driven Photonics A.D. Boardman,A.P.

Sukhorukov,2012-12-06 It is ironic that the ideas of Newton which described a beam of light as a stream of particles made it difficult for him to explain things like thin film interference Yet these particles called photons have caused the adjective photonic to gain common usage when referring to optical phenomena The purist might argue that only when we are confronted by the particle nature of light should we use the word photonics Equally the argument goes on only when we are face to face with an integrable system i.e. one that possesses an infinite number of conserved quantities should we say soliton rather than solitary wave Scientists and engineers are pragmatic however and they are happy to use the word soliton to describe what appears to be an excitation that is humped multi humped or localised long enough for some use to be made of it The fact that such solitons may stick to each other fuse upon collision is often something to celebrate for an application rather than just evidence that after all these are not really solitons in the classic sense Soliton therefore is a widely used term with the qualification that we are constantly looking out for deviant behaviour that draws our attention to its solitary wave character In the same spirit photonics is a useful generic cover all noun even when electromagnetic theory or optics would suffice *Transverse-Pattern Formation in Photorefractive Optics* Cornelia Denz, Michael Schwab, Carsten

Weilnau,2003-09-22 Overview of current developments in nonlinear photorefractive optics The book discusses exciting discoveries with special emphasis on transverse effects such as spatial soliton formation and interaction spontaneous pattern formation and pattern competition in active feedback systems Different aspects of potential applications such as wave guiding in adaptive photorefractive solitons and techniques for pattern control for information processing are also described

Photorefractive Materials and Their Applications 1 Peter Günter, Jean Pierre Huignard,2006-04-09 This is the first volume of a set of three within the Springer Series in Optical Sciences and is devoted to photorefractive effects photorefractive materials and their applications Since the publication of our first two Springer books on Photorefractive Materials and Their Applications Topics in Applied Physics Vols 61 and 62 almost 20 years ago a lot of research has been done in this area New and often expected effects have been discovered theoretical models developed known effects finally explained and novel applications proposed We believe that the field has now reached a high level of maturity even if research continues in all areas mentioned above and with new discoveries arriving quite regularly We therefore have decided to invite some of the top experts in the field to put together the state of the art in their respective fields This after we had been encouraged to do so for more than ten years by the publisher due to the fact that the former volumes were long out of print *Advances in Integrated Optics* M. Bertolotti, Arthur N. Chester, S. Martellucci,2012-12-06 This volume contains the Proceedings of a two week summer conference titled Advances in Integrated Optics held June 1-9 1993 in Erice Sicily This was the 18th annual course organized by the International School of Quantum Electronics under the auspices of the Ettore Majorana Centre for Scientific Culture The term Integrated Optics signifies guided wave optical circuits consisting of two or more devices on a single substrate Since its inception in the late 1960 s Integrated Optics has evolved from a specialized research topic into a

broad field of work ranging from basic research through commercial applications Today many devices are available on market while a big effort is devolved to research on integrated nonlinear optical devices This conference was organized to provide a comprehensive survey of the frontiers of this technology including fundamental concepts nonlinear optical materials devices both in the linear and nonlinear regimes and selected applications These Proceedings update and augment the material contained in a previous ISQE volume Integrated Optics Physics and Applications S Martellucci and A N Chester Eds NATO ASI Series B Vol 91 Plenum 1983 For some closely related technology the reader may also wish to consult the ISQE volumes Optical Fiber Sensors A N Chester S Martellucci and A M Scheggi Eds NATO ASI Series E Vol 132 Nijhoff 1987 and Nonlinear Optics and Optical Computing S Martellucci and A N Chester Eds E Majorana Int Science Series Vol 49 plenum 1990

Transverse Patterns in Nonlinear Optical Resonators Kestutis Staliunas, V.J. Sánchez-Morcillo, 2003-07-03 The growth of regularity from disorder the evolution from the simple towards the complex and the spontaneous formation of spatio temporal patterns in general are questions which intrigue everybody This has been one of the basic philosophical topics from ancient to modern times Is nature able to create something fundamentally new by itself If yes how does this creation occur Or does nature only reproduce something which was already encoded in it from the very beginning This remained a topic exclusively for philosophers until very recently and it was only a few decades ago that physicists started to convert this seemingly purely philosophical subject into a scientific discipline a scientific discipline like other scientific disciplines where one relies on formulas and equations on numerical simulations and on laboratory experiments This book is not about general questions related to pattern formation and self organization in nature It is about spontaneous patterns in just one part of nature in nonlinear optical systems and more precisely in nonlinear optical resonators Nonlinear optical systems represent a small part of nature but a very representative part one can observe here nearly all the known symmetries of patterns one can generate nearly all known types of localized structures and one can realize nearly all known spatial instabilities and spatial bifurcations

Quantum Imaging Mikhail I. Kolobov, 2007-11-03 Quantum Imaging is a newly born branch of quantum optics that investigates the ultimate performance limits of optical imaging allowed by the laws of quantum mechanics Using the methods and techniques from quantum optics quantum imaging addresses the questions of image formation processing and detection with sensitivity and resolution exceeding the limits of classical imaging This book contains the most important theoretical and experimental results achieved by the researchers of the Quantum Imaging network a research programme of the European Community

Self-focusing: Past and Present Robert W. Boyd, Svetlana G. Lukishova, Y. R. Shen, 2008-12-16 Self focusing has been an area of active scientific investigation for nearly 50 years This book presents a comprehensive treatment of this topic and reviews both theoretical and experimental investigations of self focusing This book should be of interest to scientists and engineers working with lasers and their applications From a practical point of view self focusing effects impose a limit on the power that can be transmitted through a material medium

Self focusing also can reduce the threshold for the occurrence of other nonlinear optical processes Self focusing often leads to damage in optical materials and is a limiting factor in the design of high power laser systems But it can be harnessed for the design of useful devices such as optical power limiters and switches At a formal level the equations for self focusing are equivalent to those describing Bose Einstein condensates and certain aspects of plasma physics and hydrodynamics There is thus a unifying theme between nonlinear optics and these other disciplines One of the goals of this book is to connect the extensive early literature on self focusing filamentation self trapping and collapse with more recent studies aimed at issues such as self focusing of fs pulses white light generation and the generation of filaments in air with lengths of more than 10 km It also describes some modern advances in self focusing theory including the influence of beam nonparaxiality on self focusing collapse This book consists of 24 chapters Among them are three reprinted key landmark articles published earlier It also contains the first publication of the 1964 paper that describes the first laboratory observation of self focusing phenomena with photographic evidence

Advances in FDTD Computational Electrodynamics Allen Taflov, Ardavan Oskooi, Steven G. Johnson, 2013 Advances in photonics and nanotechnology have the potential to revolutionize humanity's ability to communicate and compute This book helps readers understand the developments in computational modeling of nanoscale optical microscopy and microchip lithography as well as nanoscale plasmonics and biophotonics

Nonlinear Optics and Photonics Guangsheng He, 2015 This book provides a comprehensive presentation on most of the major topics in nonlinear optics and photonics with equal emphasis on principles experiments techniques and applications It covers many major new topics including optical solitons multi photon effects nonlinear photoelectric effects fast and slow light and Terahertz photonics Chapters 1-10 present the fundamentals of modern nonlinear optics and could be used as a textbook with problems provided at the end of each chapter Chapters 11-17 cover the more advanced topics of techniques and applications of nonlinear optics and photonics serving as a highly informative reference for researchers and experts working in related areas There are also 16 pages of color photographs to illustrate the visual appearances of some typical nonlinear optical effects and phenomena The book could be adopted as a textbook for both undergraduates and graduate students and serve as a useful reference work for researchers and experts in the fields of physics quantum electronics and laser technology To request a copy of the Solutions Manual visit global.oup.com/uk/academic/physics/admin/solutions

Anisotropic and Nonlinear Optical Waveguides C.G. Someda, G.I. Stegeman, 2012-12-02 Dielectric optical waveguides have been investigated for more than two decades In the last ten years they have had the unique position of being simultaneously the backbone of a very practical and fully developed technology as well as an extremely exciting area of basic forefront research Existing waveguides can be divided into two sets one consisting of waveguides which are already in practical use and the second of those which are still at the laboratory stage of their evolution This book is divided into two separate parts the first dealing with anisotropic waveguides and the second with nonlinear behaviour Nonlinear behaviour in

optical waveguides is a topic of current research interest an effect eagerly being sought in waveguides The relative importance of nonlinearity versus anisotropy in theoretical papers changes enormously from problem to problem Many theories can be quite useful and enlightening even though they neglect entirely one of the two aspects Scientists may find their research work leading them in the near future to deal simultaneously with anisotropy and nonlinearity in order to pursue their own investigations This book will be of interest to researchers who first need to understand the individual topics suitably chosen from the two parts of this work thus providing them with the necessary ingredients to pursue their explorations

Beam Shaping and Control with Nonlinear Optics F. Kajzar, R. Reinisch, 2006-04-11 The field of nonlinear optics which has undergone a very rapid development since the discovery of lasers in the early sixties continues to be an active and rapidly developing search area The interest is mainly due to the potential applications of nonlinear optics rectly in telecommunications for high rate data transmission image processing and recognition or indirectly from the possibility of obtaining large wavelength range tuneable lasers for applications in industry medicine biology data storage and retrieval etc New phenomena and materials continue to appear regularly renewing the field This has proven to be especially true over the last five years New materials such as organics have been developed with very large second and third order nonlinear optical responses Imp tant developments in the areas of photorefractivity all optical phenomena frequency conv sion and electro optics have been observed In parallel a number of new phenomena have been reported some of them challenging the previously held concepts For example solitons based on second order nonlinearities have been observed in photorefractive materials and frequency doubling crystals destroying the perception that third order nonlinearities are quired for their generation and propagation New ways of creating and manipulating nonl ear optical materials have been developed An example is the creation of highly nonlinear second order active polymers by static electric field photo assisted or all optical poling Nonlinear optics involves by definition the product of electromagnetic fields As a con quence it leads to the beam control

Guided-Wave Optoelectronics Theodor Tamir, Giora Griffel, Henry L. Bertoni, 2013-06-29 In 1945 Dr Ernst Weber founded and was the first Director of the Microwave Research Institute MRI at Polytechnic University at that time named the Polytechnic Institute of Brooklyn MRI gained worldwide recognition in the 50s and 60s for its research in electromagnetic theory antennas and radiation network theory and microwave networks microwave components and devices It was also known through its series of 24 topical symposia and the widely distributed hardbound MRI Symposium Proceedings Rededicated as the Weber Research Institute WRI in 1986 the institute currently conducts research in such areas as electromagnetic propagation and antennas ultrabroadband electromagnetics pulse power acoustics gaseous electronics plasma physics solid state materials quantum electronics electromagnetic launchers and networks Following MRI tradition WRI has launched its own series of in depth topical conferences with published proceedings Previous conferences in this series were Directions in Electromagnetic Wave Modeling October 1990 Ultra Wideband Short Pulse Electromagnetics

October 1992 Ultra Wideband Short Pulse Electromagnetics II October 1994 The proceedings of these conferences were also published by Plenum Press This volume constitutes the proceedings of the fourth WRI International Conference dealing with Guided Wave Optoelectronics Device Characterization Analysis and Design The conference was held October 26 28 1994 at the Polytechnic University in Brooklyn New York in cooperation with the IEEE Lasers and Electro Optics Society and with the Optical Society of America Theodor Tamir Giora Griffel Henry L Bertoni v CONTENTS INTRODUCTORY Scanning the symposium 1 T Tamir and G Griffel Photonics in telecommunications 3 H

Metal Nanostructures for Photonics Luciana Reyes Pires Kassab, Cid Bartolomeu De Araujo, 2018-08-21 Metal Nanostructures for Photonics presents updates on the development of materials with enhanced optical properties and the demand for novel metal dielectric nanocomposites and nanostructured materials The book covers various aspects of metal dielectric nanocomposites and metallic nanostructures and illustrates techniques used to prepare and characterize materials and their physical properties It focuses on three main sections nanocomposites with enhanced luminescence properties due to contributions of metal nanoparticles hosted in photonic glasses near and far field optical phenomena and the optical response of single nanoparticles that reveal quantum phenomena in the nanoscale amongst other topics This book will serve as an important research reference for materials scientists who want to learn more on how a range of metallic nanostructured materials are used in photonics Sets out the properties of a range of metal dielectric nanostructures and nanocomposites along with the use cases for each in photonics Discusses the pros and cons of using different metallic nanostructures for different photonic applications Includes case studies that illustrate how metallic nanostructures have successfully been applied in photonics

Nonlinear Photonics Yili Guo, 2002 This book systematically discusses the nonlinearities in optics optoelectronics and fiber communications The theory of optical nonlinearity ties closely with the fiber communication technologies and the applied optoelectronics

Decoding **Spatial Solitons**: Revealing the Captivating Potential of Verbal Expression

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