

Soliton Spectrum of Integrable Models with Local Symmetries ¹

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ABSTRACT

The soliton spectrum (massive and massless) of a family of integrable models with local $U(1)$ and $U(1) \otimes U(1)$ symmetries is studied. These models represent relevant integrable deformations of $SL(2, R) \otimes U(1)^{n-1}$ - WZW and $SL(2, R) \otimes SL(2, R) \otimes U(1)^{n-2}$ - WZW models. Their massless solitons appear as specific topological solutions of the $U(1)$ (or $U(1) \otimes U(1)$) - CFTs. The nonconformal analog of the GKO-coset formula is derived and used in the construction of the composite massive solitons of the ungauged integrable models.

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New Symmetries And Integrable Models

Percy Deift, Peter Forrester



New Symmetries And Integrable Models:

Proceedings of XIV Max Born Symposium, New Symmetries and Integrable Models Andrzej Frydryszak, Jerzy Lukierski, Z. Popowicz, 2000 The Max Born Symposia started in 1991 and have been held once or twice a year in different places in Lower Silesia The scientific topics of the Symposia are closely related with front line research subjects in theoretical physics This volume deals with new concepts of symmetries in the theory of fundamental interactions as well as integrable dynamical systems **New Symmetry Principles in Quantum Field Theory** J. Frölich, Gerard 't Hooft, Arthur Jaffe, Gerhard Mack, Pronob K. Mitter, Raymond Stora, 2012-12-06 Soon after the discovery of quantum mechanics group theoretical methods were used extensively in order to exploit rotational symmetry and classify atomic spectra And until recently it was thought that symmetries in quantum mechanics should be groups But it is not so There are more general algebras equipped with suitable structure which admit a perfectly conventional interpretation as a symmetry of a quantum mechanical system In any case a trivial representation of the algebra is defined and a tensor product of representations But in contrast with groups this tensor product needs to be neither commutative nor associative Quantum groups are special cases in which associativity is preserved The exploitation of such Quantum Symmetries was a central theme at the Advanced Study Institute Introductory lectures were presented to familiarize the participants with the algebras which can appear as symmetries and with their properties Some models of local field theories were discussed in detail which have some such symmetries in particular conformal field theories and their perturbations Lattice models provide many examples of quantum theories with quantum symmetries They were also covered at the school Finally the symmetries which are the cause of the solubility of integrable models are also quantum symmetries of this kind Some such models and their nonlocal conserved currents were discussed **Nonlinear Systems and Their Remarkable Mathematical Structures** Norbert Euler, Da-jun Zhang, 2021-09-07 The third volume in this sequence of books consists of a collection of contributions that aims to describe the recent progress in nonlinear differential equations and nonlinear dynamical systems both continuous and discrete **Nonlinear Systems and Their Remarkable Mathematical Structures Volume 3 Contributions from China** just like the first two volumes consists of contributions by world leading experts in the subject of nonlinear systems but in this instance only featuring contributions by leading Chinese scientists who also work in China in some cases in collaboration with western scientists Features Clearly illustrate the mathematical theories of nonlinear systems and its progress to both the non expert and active researchers in this area Suitable for graduate students in Mathematics Applied Mathematics and some of the Engineering sciences Written in a careful pedagogical manner by those experts who have been involved in the research themselves and each contribution is reasonably self contained ***Models Of Agglomeration And Glass Transition*** Richard Kerner, 2006-12-06 This book is for any physicist interested in new vistas in the domain of non crystalline condensed matter aperiodic and quasi crystalline networks and especially glass physics and chemistry Students with an elementary background

in thermodynamics and statistical physics will find the book accessible The physics of glasses is extensively covered focusing on their thermal and mechanical properties as well as various models leading to the formation of the glassy states of matter from overcooled liquids The models of agglomeration and growth are also applied to describe the formation of quasicrystals fullerenes and in biology to describe virus assembly pathways a **Differential Equations - Geometry, Symmetries and Integrability** Boris Kruglikov,Valentin Lychagin,Eldar Straume,2009-07-24 The Abel Symposium 2008 focused on the modern theory of differential equations and their applications in geometry mechanics and mathematical physics Following the tradition of Monge Abel and Lie the scientific program emphasized the role of algebro geometric methods which nowadays permeate all mathematical models in natural and engineering sciences The ideas of invariance and symmetry are of fundamental importance in the geometric approach to differential equations with a serious impact coming from the area of integrable systems and field theories This volume consists of original contributions and broad overview lectures of the participants of the Symposium The papers in this volume present the modern approach to this classical subject

Symmetries and Singularity Structures Muthuswamy Lakshmanan,Muthiah Daniel,2012-12-06 Proceedings of the Workshop Bharathidasan University Tiruchirapalli India November 29 December 2 1989 **Geometric and Topological Methods for Quantum Field Theory** Sylvie Paycha,Bernardo Uribe,2007 This volume based on lectures and short communications at a summer school in Villa de Leyva Colombia July 2005 offers an introduction to some recent developments in several active topics at the interface between geometry topology and quantum field theory It is aimed at graduate students in physics or mathematics who might want insight in the following topics covered in five survey lectures Anomalies and noncommutative geometry Deformation quantisation and Poisson algebras Topological quantum field theory and orbifolds These lectures are followed by nine articles on various topics at the borderline of mathematics and physics ranging from quasicrystals to invariant instantons through black holes and involving a number of mathematical tools borrowed from geometry algebra and analysis **Integrable Systems: From Classical to Quantum** John P. Harnad,Gert Sabidussi,Pavel Winternitz,2000 This volume presents the papers based upon lectures given at the 1999 S minaire de Math mathiques Sup rieurs held in Montreal It includes contributions from many of the most active researchers in the field This subject has been in a remarkably active state of development throughout the past three decades resulting in new motivation for study in r s3risingly different directions Beyond the intrinsic interest in the study of integrable models of many particle systems spin chains lattice and field theory models at both the classical and the quantum level and completely solvable models in statistical mechanics there have been new applications in relation to a number of other fields of current interest These fields include theoretical physics and pure mathematics for example the Seiberg Witten approach to supersymmetric Yang Mills theory the spectral theory of random matrices topological models of quantum gravity conformal field theory mirror symmetry quantum cohomology etc This collection gives a nice cross section of the current state of the work in the area of integrable

systems which is presented by some of the leading active researchers in this field The scope and quality of the articles in this volume make this a valuable resource for those interested in an up to date introduction and an overview of many of the main areas of study in the theory of integral systems

Symmetries Unveiled Oliver Vella, 2025-02-27 Exploring the Mysteries of Representation Theory Dive into the fascinating universe of symmetries and representations where mathematics unravels the secrets of the universe Symmetries Unveiled A Journey Through Representation Theory invites readers on a thrilling expedition through the intricate landscape of mathematical theory and its profound impact on science As you embark on this mathematical voyage you ll uncover foundational concepts and historical development behind representation theory From the elegant symmetries of groups to the groundbreaking applications of linear representations this book is your gateway to a deeper understanding of the subject Through chapters dedicated to Lie algebras root systems and quantum groups the narrative weaves a tapestry of knowledge that connects abstract theory with real world applications Imagine navigating the compelling world of Kac Moody algebras discovering the role of crystal bases and unlocking the mysteries of non linear realisations Each chapter promises to ignite curiosity with insights into symmetries in quantum mechanics and their implications in modern physics Whether you re captivated by symmetry breaking or intrigued by the concept of duality this book offers a profound exploration of these topics and more Symmetries Unveiled is not just a book for mathematicians it s a treasure trove for anyone passionate about the interplay between theory and application in theoretical physics With chapters on computational approaches educational techniques and interdisciplinary impacts it also serves as a comprehensive guide for educators and researchers alike The culmination of the journey is an exploration of open problems and philosophical insights paving the way for future exploration and discovery Join this intellectual adventure and let Symmetries Unveiled transform your understanding of the mathematical principles that underpin the very fabric of reality

Continuous Symmetries and Integrability of Discrete Equations Decio Levi, Pavel Winternitz, Ravil I. Yamilov, 2023-01-23 This book on integrable systems and symmetries presents new results on applications of symmetries and integrability techniques to the case of equations defined on the lattice This relatively new field has many applications for example in describing the evolution of crystals and molecular systems defined on lattices and in finding numerical approximations for differential equations preserving their symmetries The book contains three chapters and five appendices The first chapter is an introduction to the general ideas about symmetries lattices differential difference and partial difference equations and Lie point symmetries defined on them Chapter 2 deals with integrable and linearizable systems in two dimensions The authors start from the prototype of integrable and linearizable partial differential equations the Korteweg de Vries and the Burgers equations Then they consider the best known integrable differential difference and partial difference equations Chapter 3 considers generalized symmetries and conserved densities as integrability criteria The appendices provide details which may help the readers understanding of the subjects presented in Chapters 2 and 3 This book is written for PhD students and early

researchers both in theoretical physics and in applied mathematics who are interested in the study of symmetries and integrability of difference equations

Introduction to Conformal Invariance and Its Applications to Critical Phenomena Philippe Christe, Malte Henkel, 2008-09-11 The history of critical phenomena goes back to the year 1869 when Andrews discovered the critical point of carbon dioxide located at about 31 C and 73 atmospheres pressure In the neighborhood of this point the carbon dioxide was observed to become opalescent that is light is strongly scattered This is nowadays interpreted as coming from the strong fluctuations of the system close to the critical point Subsequently a wide variety of physical systems were realized to display critical points as well Of particular importance was the observation of a critical point in ferromagnetic iron by Curie Further examples include multicomponent fluids and alloys superfluids superconductors polymers and may even extend to the quark gluon plasma and the early universe as a whole Early theoretical investigation tried to reduce the problem to a very small number of degrees of freedom such as the van der Waals equation and mean field approximations and culminating in Landau's general theory of critical phenomena In a dramatic development Onsager's exact solution of the two dimensional Ising model made clear the important role of the critical fluctuations Their role was taken into account in the subsequent developments leading to the scaling theories of critical phenomena and the renormalization group These developments have achieved a precise description of the close neighborhood of the critical point and results are often in good agreement with experiments In contrast to the general understanding a century ago the presence of fluctuations on all length scales at a critical point is today emphasized

Pt Symmetry: In Quantum And Classical Physics Carl M Bender, 2018-11-22 The text is easy to read because the matter is clearly explained Symmetries are a central component of physical laws and the PT symmetry proves to be very interesting and fruitful The discussion of the matter is up to date and self contained The book is recommended to students of higher courses PhD and researchers It is also a basic read to those who wish to have an insight into this field Contemporary Physics Originated by the author in 1998 the field of PT parity time symmetry has become an extremely active and exciting area of research PT symmetric quantum and classical systems have theoretical experimental and commercial applications and have been the subject of many journal articles PhD theses conferences and symposia Carl Bender's work has influenced major advances in physics and generations of students This book is an accessible entry point to PT symmetry ideal for students and scientists looking to begin their own research projects in this field

Advances in Nonlinear Dynamics Walter Lacarbonara, Balakumar Balachandran, Michael J. Leamy, Jun Ma, J. A. Tenreiro Machado, Gabor Stepan, 2022-03-18 This first of three volumes includes papers from the second series of NODYCON which was held virtually in February of 2021 The conference papers reflect a broad coverage of topics in nonlinear dynamics ranging from traditional topics from established streams of research to those from relatively unexplored and emerging venues of research These include Fluid structure interactions Mechanical systems and structures Computational nonlinear dynamics Analytical techniques Bifurcation and dynamic instability Rotating systems Modal

interactions and energy transfer Nonsmooth systems **MathPhys Odyssey 2001** Masaki Kashiwara,Tetsuji Miwa,2012-12-06 MathPhys Odyssey 2001 will serve as an excellent reference text for mathematical physicists and graduate students in a number of areas Kashiwara Miwa have a good track record with both SV and Birkhauser **Integrability, Supersymmetry and Coherent States** Şengül Kuru,Javier Negro,Luis M. Nieto,2019-07-12 This volume shares and makes accessible new research lines and recent results in several branches of theoretical and mathematical physics among them Quantum Optics Coherent States Integrable Systems SUSY Quantum Mechanics and Mathematical Methods in Physics In addition to a selection of the contributions presented at the 6th International Workshop on New Challenges in Quantum Mechanics Integrability and Supersymmetry held in Valladolid Spain 27 30 June 2017 several high quality contributions from other authors are also included The conference gathered 60 participants from many countries working in different fields of Theoretical Physics and was dedicated to Prof V ronique Hussin an internationally recognized expert in many branches of Mathematical Physics who has been making remarkable contributions to this field since the 1980s The reader will find interesting reviews on the main topics from internationally recognized experts in each field as well as other original contributions all of which deal with recent applications or discoveries in the aforementioned areas **Aspects of Integrability of Differential Systems and Fields** Costas J. Papachristou,2020-01-01 This book serves as an introduction to the concept of integrability as it applies to systems of differential equations as well as to vector valued fields The author focuses on specific aspects of integrability that are often encountered in a variety of problems in applied mathematics physics and engineering The following general cases of integrability are examined a path independence of line integrals of vector fields on the plane and in space b integration of a system of ordinary differential equations by using first integrals and c integrable systems of partial differential equations Special topics include the integration of analytic functions and some elements from the geometric theory of differential systems Certain more advanced subjects such as Lax pairs and B cklund transformations are also discussed The book is written at an intermediate level for educational purposes The presentation is as simple as the topics allow often sacrificing mathematical rigor in favor of pedagogical efficiency **GROUP 24** J.P Gazeau,R Kerner,J.P Antoine,S Metens,J.Y Thibon,2003-11-30 One of the most enduring elements in theoretical physics has been group theory **GROUP 24** Physical and Mathematical Aspects of Symmetries provides an important selection of informative articles describing recent advances in the field The applications of group theory presented in this book deal not only with the traditional fields of physics but also include such disciplines as chemistry and biology Awarded the Wigner Medal and the Weyl Prize respectively H J Lipkin and E Frenkel begin the volume with their contributions Plenary session contributions are represented by 18 longer articles followed by nearly 200 shorter articles The book also presents coherent states wavelets and applications and quantum group theory and integrable systems in two separate sections As a record of an international meeting devoted to the physical and mathematical aspects of group theory **GROUP 24** Physical and

Mathematical Aspects of Symmetries constitutes an essential reference for all researchers interested in various current developments related to the important concept of symmetry **Symmetries and Overdetermined Systems of Partial Differential Equations** Michael Eastwood, Willard Miller, 2009-04-23 This three week summer program considered the symmetries preserving various natural geometric structures There are two parts to the proceedings The articles in the first part are expository but all contain significant new material The articles in the second part are concerned with original research All articles were thoroughly refereed and the range of interrelated work ensures that this will be an extremely useful collection **Metamorphoses of Hamiltonian Systems with Symmetries** Konstantinos Efsthathiou, 2005

Random Matrix Theory, Interacting Particle Systems and Integrable Systems Percy Deift, Peter Forrester, 2014-12-15 This volume includes review articles and research contributions on long standing questions on universalities of Wigner matrices and beta ensembles

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