



# Quantum Groups

Benjamin Enriquez  
Editor



# A To Quantum Groups

**Leonid I. Korogodski, Yan S. Soibelman**

## A To Quantum Groups:

**Introduction to Quantum Groups** Masud Chaichian, Andrei Pavlovich Demichev, 1996 In the past decade there has been an extremely rapid growth in the interest and development of quantum group theory This book provides students and researchers with a practical introduction to the principal ideas of quantum groups theory and its applications to quantum mechanical and modern field theory problems It begins with a review of and introduction to the mathematical aspects of quantum deformation of classical groups Lie algebras and related objects algebras of functions on spaces differential and integral calculi In the subsequent chapters the richness of mathematical structure and power of the quantum deformation methods and non commutative geometry is illustrated on the different examples starting from the simplest quantum mechanical system harmonic oscillator and ending with actual problems of modern field theory such as the attempts to construct lattice like regularization consistent with space time Poincar symmetry and to incorporate Higgs fields in the general geometrical frame of gauge theories Graduate students and researchers studying the problems of quantum field theory particle physics and mathematical aspects of quantum symmetries will find the book of interest Quantum Groups and Their Representations Anatoli Klimyk, Konrad Schmüdgen, 2012-12-06 This book start with an introduction to quantum groups for the beginner and continues as a textbook for graduate students in physics and in mathematics It can also be used as a reference by more advanced readers The authors cover a large but well chosen variety of subjects from the theory of quantum groups quantized universal enveloping algebras quantized algebras of functions and  $q$  deformed algebras  $q$  oscillator algebras their representations and corepresentations and noncommutative differential calculus The book is written with potential applications in physics and mathematics in mind The basic quantum groups and quantum algebras and their representations are given in detail and accompanied by explicit formulas A number of topics and results from the more advanced general theory are developed and discussed *Quantum Groups and Lie Theory* Andrew Pressley, 2001 Leading researchers discuss quantum groups and integrable systems for graduates and researchers **An Invitation to Quantum Groups and Duality** Thomas Timmermann, 2008 This book provides an introduction to the theory of quantum groups with emphasis on their duality and on the setting of operator algebras Part I of the text presents the basic theory of Hopf algebras Van Daele s duality theory of algebraic quantum groups and Woronowicz s compact quantum groups staying in a purely algebraic setting Part II focuses on quantum groups in the setting of operator algebras Woronowicz s compact quantum groups are treated in the setting of  $C^*$  algebras and the fundamental multiplicative unitaries of Baaj and Skandalis are studied in detail An outline of Kustermans and Vaes comprehensive theory of locally compact quantum groups completes this part Part III leads to selected topics such as coactions Baaj Skandalis duality and approaches to quantum groupoids in the setting of operator algebras The book is addressed to graduate students and non experts from other fields Only basic knowledge of multi linear algebra is required for the first part while the second and third part assume some familiarity with Hilbert spaces

C algebras and von Neumann algebras      *Introduction to Quantum Groups* George Lusztig, 2010-10-27 The quantum groups discussed in this book are the quantized enveloping algebras introduced by Drinfeld and Jimbo in 1985 or variations thereof. The theory of quantum groups has led to a new extremely rigid structure in which the objects of the theory are provided with canonical basis with rather remarkable properties. This book will be of interest to mathematicians working in the representation theory of Lie groups and Lie algebras, knot theorists and to theoretical physicists and graduate students. Since large parts of the book are independent of the theory of perverse sheaves, the book could also be used as a text book.      *A Guide to Quantum Groups* Vyjayanthi Chari, Andrew N. Pressley, 1995-07-27 Since they first arose in the 1970s and early 1980s, quantum groups have proved to be of great interest to mathematicians and theoretical physicists. The theory of quantum groups is now well established as a fascinating chapter of representation theory and has thrown new light on many different topics, notably low dimensional topology and conformal field theory. The goal of this book is to give a comprehensive view of quantum groups and their applications. The authors build on a self contained account of the foundations of the subject and go on to treat the more advanced aspects concisely and with detailed references to the literature. Thus this book can serve both as an introduction for the newcomer and as a guide for the more experienced reader. All who have an interest in the subject will welcome this unique treatment of quantum groups.      *Introduction To Quantum Groups* Masud Chaichian, Andrei Demichev, 1996-11-22 In the past decade there has been an extremely rapid growth in the interest and development of quantum group theory. This book provides students and researchers with a practical introduction to the principal ideas of quantum groups theory and its applications to quantum mechanical and modern field theory problems. It begins with a review of and introduction to the mathematical aspects of quantum deformation of classical groups, Lie algebras and related objects, algebras of functions on spaces, differential and integral calculi. In the subsequent chapters the richness of mathematical structure and power of the quantum deformation methods and non commutative geometry is illustrated on the different examples starting from the simplest quantum mechanical system, harmonic oscillator and ending with actual problems of modern field theory such as the attempts to construct lattice like regularization consistent with space time Poincaré symmetry and to incorporate Higgs fields in the general geometrical frame of gauge theories. Graduate students and researchers studying the problems of quantum field theory, particle physics and mathematical aspects of quantum symmetries will find the book of interest.      **Quantum Groups and Noncommutative Geometry** Yuri I. Manin, 2018-10-11 This textbook presents the second edition of Manin's celebrated 1988 Montreal lectures which influenced a new generation of researchers in algebra to take up the study of Hopf algebras and quantum groups. In this expanded write up of those lectures, Manin systematically develops an approach to quantum groups as symmetry objects in noncommutative geometry in contrast to the more deformation oriented approach due to Faddeev, Drinfeld and others. This new edition contains an extra chapter by Theo Raedschelders and Michel Van den Bergh surveying recent work that focuses on the representation theory.

of a number of bi and Hopf algebras that were first introduced in Manin's lectures and have since gained a lot of attention. Emphasis is placed on the Tannaka-Krein formalism which further strengthens Manin's approach to symmetry and moduli objects in noncommutative geometry.

**Algebras of Functions on Quantum Groups: Part I** Leonid I. Korogodski, Yan S. Soibelman, 1998. The text is devoted to the study of algebras of functions on quantum groups. The book includes the theory of Poisson-Lie algebras, quasi-classical version of algebras of functions on quantum groups, a description of representations of algebras of functions and the theory of quantum Weyl groups. It can serve as a text for an introduction to the theory of quantum groups and is intended for graduate students and research mathematicians working in algebra, representation theory and mathematical physics.

**Lectures on Quantum Groups** Pavel I. Etingof, Olivier Schiffmann, 2002. Based on lectures given at Harvard University in 1997, this book is an introduction to the theory of quantum groups and its development between 1982 and 1997. Topics covered include relevant quasiclassical objects, bialgebras, Hopf algebras and Lie associators.

**A Quantum Groups Primer** Shahn Majid, 2002-04-04. This book provides a self-contained introduction to quantum groups as algebraic objects. Based on the author's lecture notes for the Part III pure mathematics course at Cambridge University, it is suitable for use as a textbook for graduate courses in quantum groups or as a supplement to modern courses in advanced algebra. The book assumes a background knowledge of basic algebra and linear algebra. Some familiarity with semisimple Lie algebras would also be helpful. The book is aimed as a primer for mathematicians but will also be useful for mathematical physicists.

**Algebraic Combinatorics and Quantum Groups** Naihuan Jing, 2003. Algebraic combinatorics has evolved into one of the most active areas of mathematics. Its developments have become more interactive with not only its traditional field representation theory but also geometry, mathematical physics and harmonic analysis. This book presents articles from some of the key contributors in the area. It covers Hecke algebras, Hall algebras, the Macdonald polynomial and its deviations and their relations with other fields.

**Quantum Groups and Their Applications in Physics** Leonardo Castellani, Julius Wess, Società italiana di fisica, 1996. This book focuses on quantum groups, i.e. continuous deformations of Lie groups and their applications in physics. These algebraic structures have been studied in the last decade by a growing number of mathematicians and physicists and are found to underlie many physical systems of interest. They do provide in fact a sort of common algebraic ground for seemingly very different physical problems. As it has happened for supersymmetry, the  $q$  group symmetries are bound to play a vital role in physics even in fundamental theories like gauge theory or gravity. In fact,  $q$  symmetry can be considered itself as a generalization of supersymmetry evident in the  $q$  commutator formulation. The hope that field theories on  $q$  groups are naturally regularized begins to appear, founded and opens new perspectives for quantum gravity. The topics covered in this book include conformal field theories and quantum groups, gauge theories of quantum groups, anyons, differential calculus on quantum groups and non-commutative geometry, Poisson algebras, 2-dimensional statistical models, 2+1 quantum gravity, quantum groups and lattice physics, inhomogeneous  $q$  groups,  $q$ -Poincaré group and

deformed gravity and gauging of W algebras      **Quantum Groups and Their Primitive Ideals** Anthony Joseph, 2012-12-06  
 by a more general quadratic algebra possibly obtained by deformation and then to derive  $R_q \mathfrak{g}$  by requiring it to possess the latter as a comodule. A third principle is to focus attention on the tensor structure of the category of modules. This means of course just defining an algebra structure on  $R_q \mathfrak{g}$  but this is to be done in a very specific manner. Concretely the category is required to be braided and this forces the existence of an R matrix satisfying in particular the quantum Yang-Baxter equation and from which the algebra structure of  $R_q \mathfrak{g}$  can be written down. Finally there was a search for a perfectly self-dual model for  $R_q \mathfrak{g}$  which would then be isomorphic to  $U_q \mathfrak{g}$ . Apparently this failed but V.G. Drinfeld found that it could be essentially made to work for the Borel part of  $U_q \mathfrak{g}$  denoted  $U_q \mathfrak{b}$  and further found a general construction the Drinfeld double  $q$  mirroring a Lie bialgebra. This gives  $U_q \mathfrak{g}$  up to passage to a quotient. One of the most remarkable aspects of the above superficially different approaches is their extraordinary intercoherence. In particular they essentially all lead for  $\mathfrak{g}$  semisimple to the same and hence canonical objects  $R_q \mathfrak{g}$  and  $U_q \mathfrak{g}$  though this epithet may as yet be premature.

*Foundations of Quantum Group Theory* Shahn Majid, 2000. A graduate level text which systematically lays out the foundations of Quantum Groups      **Lectures on Quantum Groups** Jens Carsten Jantzen, 1996. The material is very well motivated. Of the various monographs available on quantum groups this one seems the most suitable for most mathematicians new to the subject will also be appreciated by a lot of those with considerably more experience. Bulletin of the London Mathematical Society. Since its origin the theory of quantum groups has become one of the most fascinating topics of modern mathematics with numerous applications to several sometimes rather disparate areas including low dimensional topology and mathematical physics. This book is one of the first expositions that is specifically directed to students who have no previous knowledge of the subject. The only prerequisite in addition to standard linear algebra is some acquaintance with the classical theory of complex semisimple Lie algebras. Starting with the quantum analog of  $\mathfrak{sl}_2$  the author carefully leads the reader through all the details necessary for full understanding of the subject particularly emphasizing similarities and differences with the classical theory. The final chapters of the book describe the Kashiwara-Lusztig theory of so-called crystal or canonical bases in representations of complex semisimple Lie algebras. The choice of the topics and the style of exposition make Jantzen's book an excellent textbook for a one semester course on quantum groups      **Finite Dimensional Algebras and Quantum Groups** Bangming Deng, 2008. The interplay between finite dimensional algebras and Lie theory dates back many years. In more recent times these interrelations have become even more strikingly apparent. This text combines for the first time in book form the theories of finite dimensional algebras and quantum groups. More precisely it investigates the Ringel-Hall algebra realization for the positive part of a quantum enveloping algebra associated with a symmetrizable Cartan matrix and it looks closely at the Beilinson-Lusztig-MacPherson realization for the entire quantum  $\mathfrak{gl}_n$ . The book begins with the two realizations of generalized Cartan matrices namely the graph realization and the root datum realization.

From there it develops the representation theory of quivers with automorphisms and the theory of quantum enveloping algebras associated with Kac Moody Lie algebras These two independent theories eventually meet in Part 4 under the umbrella of Ringel Hall algebras Cartan matrices can also be used to define an important class of groups Coxeter groups and their associated Hecke algebras Hecke algebras associated with symmetric groups give rise to an interesting class of quasi hereditary algebras the quantum Schur algebras The structure of these finite dimensional algebras is used in Part 5 to build the entire quantum  $\mathfrak{gl}_n$  through a completion process of a limit algebra the Beilinson Lusztig MacPherson algebra The book is suitable for advanced graduate students Each chapter concludes with a series of exercises ranging from the routine to sketches of proofs of recent results from the current literature Publisher s website *Quantum Groups* Steven Shnider, Shlomo Sternberg, 1993 An introduction to the field of quantum groups including topology and statistical mechanics based on lectures given at the Sackler Institute for Advanced Studies at Tel Aviv University Detailed proofs of the main results are presented and the bibliography contains more than 1260 references **Quantum Groups** Christian Kassel, 2012-12-06 Here is an introduction to the theory of quantum groups with emphasis on the spectacular connections with knot theory and Drinfeld s recent fundamental contributions It presents the quantum groups attached to  $SL_2$  as well as the basic concepts of the theory of Hopf algebras Coverage also focuses on Hopf algebras that produce solutions of the Yang Baxter equation and provides an account of Drinfeld s elegant treatment of the monodromy of the Knizhnik Zamolodchikov equations [Introduction to Quantum Groups and Crystal Bases](#) Jin Hong, Seok-Jin Kang, 2025-02-06 The notion of a quantum group was introduced by V G Drinfeld and M Jimbo independently in their study of the quantum Yang Baxter equation arising from 2 dimensional solvable lattice models Quantum groups are certain families of Hopf algebras that are deformations of universal enveloping algebras of Kac Moody algebras And over the past 20 years they have turned out to be the fundamental algebraic structure behind many branches of mathematics and mathematical physics such as solvable lattice models in statistical mechanics topological invariant theory of links and knots representation theory of Kac Moody algebras representation theory of algebraic structures topological quantum field theory geometric representation theory and C algebras In particular the theory of crystal bases or canonical bases developed independently by M Kashiwara and G Lusztig provides a powerful combinatorial and geometric tool to study the representations of quantum groups The purpose of this book is to provide an elementary introduction to the theory of quantum groups and crystal bases focusing on the combinatorial aspects of the theory

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