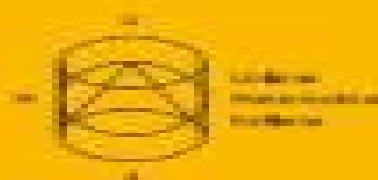


Lecture Notes of the Unione Matematica Italiana

Edoardo Ballico  
Alessandra Bernardi  
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# Quantum Physics and Geometry



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# Geometry And Quantum Physics

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**Classical and Quantum Physics** G. Marmo, David Martín de Diego, Miguel Muñoz Lecanda, 2019-10-26 This proceedings is based on the interdisciplinary workshop held in Madrid 5-9 March 2018 dedicated to Alberto Ibort on his 60th birthday Alberto has great and significantly contributed to many fields of mathematics and physics always with highly original and innovative ideas Most of Alberto's scientific activity has been motivated by geometric ideas concepts and tools that are deeply related to the framework of classical dynamics and quantum mechanics Let us mention some of the fields of expertise of Alberto Ibort Geometric Mechanics Constrained Systems Variational Principles Multisymplectic structures for field theories Super manifolds Inverse problem for Bosonic and Fermionic systems Quantum Groups Integrable systems BRST Symmetries Implicit differential equations Yang Mills Theories BiHamiltonian Systems Topology Change and Quantum Boundary Conditions Classical and Quantum Control Orthogonal Polynomials Quantum Field Theory and Noncommutative Spaces Classical and Quantum Tomography Quantum Mechanics on phase space Wigner Weyl formalism Lie Jordan Algebras Classical and Quantum Quantum to Classical transition Contraction of Associative Algebras contact geometry among many others In each contribution one may find not only technical novelties but also completely new way of looking at the considered problems Even an experienced reader reading Alberto's contributions on his field of expertise will find new perspectives on the considered topic His enthusiasm is happily contagious for this reason he has had and still has very bright students wishing to elaborate their PhD thesis under his guidance What is more impressive is the broad list of rather different topics on which he has contributed *Operators, Geometry and Quanta* Dmitri Fursaev, Dmitri

Vassilevich, 2011-06-25 This book gives a detailed and self contained introduction into the theory of spectral functions with an emphasis on their applications to quantum field theory All methods are illustrated with applications to specific physical problems from the forefront of current research such as finite temperature field theory D branes quantum solitons and noncommutativity In the first part of the book necessary background information on differential geometry and quantization including less standard material is collected The second part of the book contains a detailed description of main spectral functions and methods of their calculation In the third part the theory is applied to several examples D branes quantum

solitons anomalies noncommutativity This book addresses advanced graduate students and researchers in mathematical physics with basic knowledge of quantum field theory and differential geometry The aim is to prepare readers to use spectral functions in their own research in particular in relation to heat kernels and zeta functions **Geometry of Quantum**

**States** Ingemar Bengtsson, Karol Życzkowski, 2007-12-06 Quantum information theory is at the frontiers of physics mathematics and information science offering a variety of solutions that are impossible using classical theory This book provides an introduction to the key concepts used in processing quantum information and reveals that quantum mechanics is a generalisation of classical probability theory After a gentle introduction to the necessary mathematics the authors describe the geometry of quantum state spaces Focusing on finite dimensional Hilbert spaces they discuss the statistical distance measures and entropies used in quantum theory The final part of the book is devoted to quantum entanglement a non intuitive phenomenon discovered by Schrödinger which has become a key resource for quantum computation This richly illustrated book is useful to a broad audience of graduates and researchers interested in quantum information theory

Exercises follow each chapter with hints and answers supplied *Geometric and Algebraic Topological Methods in Quantum Mechanics* G. Giachetta, L. Mangiarotti, Gennadi Aleksandrovich Sardanashvili, 2005 The book collects all the advanced methods of quantization in the last decade It presents in a compact way all the necessary up to date mathematical tools to be used in studying quantum problems *Quantum Theories and Geometry* M. Cahen, M. Flato, 2012-12-06 This book presents

the text of most of the lectures which were delivered at the Meeting Quantum Theories and Geometry which was held at the Fondation Les Treilles from March 23 to March 27 1987 The general aim of this meeting was to bring together mathematicians and physicists who have worked in this growing field of contact between the two disciplines namely this region where geometry and physics interact creatively in both directions It is the strong belief of the organizers that these written contributions will be a useful document for research people working in geometry or physics Three lectures were devoted to the deformation approach to quantum mechanics which involves a modification of both the associative and the Lie structure of the algebra of functions on classical phase space A Lichnerowicz shows how one can view classical and quantum statistical mechanics in terms of a deformation with a parameter inversely proportional to temperature S Gutt reviews the physical background of star products and indicates their applications in Lie groups representation theory and in harmonic analysis D Arnal gives a rigorous theory VII viii PREFACE of the star exponential in the case of the Heisenberg group and shows how this can be extended to arbitrary nilpotent groups **Quantum Geometry** Jan Ambjørn, Bergfinnur Durhuus, Þórður

Jónsson, 1997-06-19 Describes random geometry and applications to strings quantum gravity topological field theory and membrane physics *Geometry of Quantum States* Ingemar Bengtsson, Karol Życzkowski, 2017-08-18 Quantum information theory is a branch of science at the frontier of physics mathematics and information science and offers a variety of solutions that are impossible using classical theory This book provides a detailed introduction to the key concepts used in processing

quantum information and reveals that quantum mechanics is a generalisation of classical probability theory The second edition contains new sections and entirely new chapters the hot topic of multipartite entanglement in depth discussion of the discrete structures in finite dimensional Hilbert space including unitary operator bases mutually unbiased bases symmetric informationally complete generalized measurements discrete Wigner function and unitary designs the Gleason and Kochen Specker theorems the proof of the Lieb conjecture the measure concentration phenomenon and the Hastings non additivity theorem This richly illustrated book will be useful to a broad audience of graduates and researchers interested in quantum information theory Exercises follow each chapter with hints and answers supplied **Geometry and Quantum Physics** H. Gausterer, H. Grosse, L. Pittner, 2014-03-12 In modern mathematical physics classical together with quantum geometrical and functional analytic methods are used simultaneously Non commutative geometry in particular is becoming a useful tool in quantum field theories This book aimed at advanced students and researchers provides an introduction to these ideas Researchers will benefit particularly from the extensive survey articles on models relating to quantum gravity string theory and non commutative geometry as well as Connes approach to the standard model From Geometry to Quantum Mechanics Yoshiaki Maeda, Peter Michor, Takushiro Ochiai, Akira Yoshioka, 2007-04-22 Invited articles in differential geometry and mathematical physics in honor of Hideki Omori Focus on recent trends and future directions in symplectic and Poisson geometry global analysis Lie group theory quantizations and noncommutative geometry as well as applications of PDEs and variational methods to geometry Will appeal to graduate students in mathematics and quantum mechanics also a reference

**Noncommutative Geometry, Quantum Fields and Motives** Alain Connes, Matilde Marcolli, This book carries the unifying theme of the interaction among noncommutative geometry theoretical physics and number theory The detailed text co authored by Fields Medal winner Alain Connes stresses the relevance of noncommutative geometry in dealing with two spaces space time and the space of prime numbers The book includes significantly more detail than other monographs covering similar topics *Geometry Of Quantum Potential, The: Entropic Information Of The Vacuum* Davide Fisaletti, 2018-03-06 In virtue of its features Bohm s quantum potential introduces interesting and relevant perspectives towards a satisfactory geometrodynamical description of quantum processes This book makes a comprehensive state of the art review of some of the most significant elements and results about the geometrodynamical picture determined by the quantum potential in various contexts Above all the book explores the perspectives about the fundamental arena subtended by the quantum potential the link between the geometry associated to the quantum potential and a fundamental quantum vacuum After an analysis of the geometry subtended by the quantum potential in the different fields of quantum physics the non relativistic domain the relativistic domain the relativistic quantum field theory the quantum gravity domain and the canonical quantum cosmology in the second part of the book a recent interpretation of Bohm s quantum potential in terms of a more fundamental entity called quantum entropy the approach of the symmetryzed quantum potential and the link between

quantum potential and quantum vacuum are analysed also in the light of the results obtained by the author *Space-time Geometry and Quantum Events* Ignazio Licata, 2014 It is well known that the fundamental problem in contemporary theoretical physics is the pacific coexistence between General Relativity and Quantum Mechanics The scenarios of the explorable relationships between classical space time and quantum land are various the geometrodynamic one by a proper extension of geometry the stochastic fractal one defining a middle land mediated by QFT like hypotheses the emergent one from a physical viewpoint by the collective behaviours of discrete entities which mathematically means that the geometry derives from an algebraic structure of events This anthology includes some of the most significant voices on the problem of the possible relations between the space time dynamics and the quantum networks of events

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