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Altri autori (Persone)	AccardiL <1947-> (Luigi) FagnolaFranco
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Nota di contenuto	Contents ; Preface ; Chapter 1 Lectures on Quantum Interacting Particle Systems ; 1.0 Introduction ; 1.1 Basic ideas of the stochastic limit ; ; 1.1.1 Quantum dynamics and flows ; 1.1.2 The stochastic golden rule: general scheme ; 1.1.3 Discrete spectrum systems 1.1.4 Quantum fields and white noises 1.1.5 Dipole interaction Hamiltonians ; 1.1.6 The stochastic golden rule ; 1.1.7 The Langevin equation ; 1.1.8 The quantum Feynman- Kac formula: master equation ; 1.1.9 Subalgebras invariant under the generator 1.1.10 Structure of the invariant states 1.1.11 The Langevin equation: generic systems ; 1.1.12 Appendix: Two-level system and Boltzmannian (or free) statistics ; 1.1.13 Appendix: Structure of discrete spectrum quantum dynamical systems 1.1.14 Appendix: Spectral theory for Heisenberg evolutions 1.1.15 The Langevin equation for the density matrix

; 1.1.16 The master equation for reduced density matrix  
 ; 1.1.17 Structure of the invariant states ;  
 1.1.18 Evolution of the diagonal and off-diagonal elements  
 1.1.19 Stationary states of the reduced evolution  
 1.1.20 Evolution of density matrix in the generic case  
 ; 1.1.21 Decoherence: vanishing of off-diagonal terms  
 ; 1.1.22 Discussion of decoherence ; 1.1.23  
 Classical detailed balance ; 1.1.24 A Lyapunov  
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 1.1.25 Non-detailed balance stationary state for a system driven by  
 master equation

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Sommario/riassunto

The problem of extending ideas and results on the dynamics of infinite classical lattice systems to the quantum domain naturally arises in different branches of physics (nonequilibrium statistical mechanics, quantum optics, solid state, ...) and new momentum from the development of quantum computer and quantum neural networks (which are in fact interacting arrays of binary systems) has been found. The stochastic limit of quantum theory allowed to deduce, as limits of the usual Hamiltonian systems, a new class of quantum stochastic flows which, when restricted to an appropriate Abelian subalgebra, produces precisely those interacting particle systems studied in classical statistical mechanics. Moreover, in many interesting cases, the underlying classical process "drives" the quantum one, at least as far as ergodicity or convergence to equilibrium are concerned. Thus many deep results concerning classical systems can be directly applied to carry information on the corresponding quantum system. The thermodynamic limit itself is obtained thanks to a technique (the four-semigroup method, new even in the classical case) which reduces the infinitesimal structure of a stochastic flow to that of four semigroups canonically associated to it (Chap. 1). Simple and effective methods to analyze qualitatively the ergodic behavior of quantum Markov semigroups are discussed in Chap. 2. Powerful estimates used to control the infinite volume limit, ergodic behavior and the spectral gap (Gaussian, exponential and hypercontractive bounds, classical and quantum logarithmic Sobolev inequalities, ...) are discussed in Chap. 3.

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