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and Stability of Matter; 5. Hartree-Fock Theory; 6. Correlation Estimate Improving the Lieb-Oxford Inequality; 7. Accuracy of the Hartree-Fock Approximation for Large Neutral Atoms; 8. N-Representability; Acknowledgments; References; On the Dynamics of a Fermi Gas in a Random Medium with Dynamical Hartree-Fock Interactions Thomas Chen; 1. Introduction; Acknowledgment
ReferencesOn the Minimization of Hamiltonians over Pure Gaussian States Jan Derezinski, Marcin Napiorkowski, and Jan Philip Solovej; 1. Introduction; Acknowledgments; 2. Preliminaries; 2.1. 2nd quantization; 2.2. Wick quantization; 2.3. Bogoliubov transformations; 2.4. Pure Gaussian states; 3. Main Result; References; Variational Approach to Electronic Structure Calculations on Second-Order Reduced Density Matrices and the N-Representability Problem Maho Nakata, Mituhiro Fukuda, and Katsuki Fujisawa; 1. Introduction; 2. The Reduced-Density-Matrix Method; 2.1. Pure states and ensemble states 2.2. The first-order and second-order reduced density matrices

Sommario/riassunto

This volume is based on lectures given during the program Complex Quantum Systems held at the National University of Singapore's Institute for Mathematical Sciences from 17 February to 27 March 2010. It guides the reader through two introductory expositions on large Coulomb systems to five of the most important developments in the field: derivation of mean field equations, derivation of effective Hamiltonians, alternative high precision methods in quantum chemistry, modern many body methods originating from quantum information, and - the most complex - semirelativistic quantum electrodynamics.