Processes of creation and propagation of correlations in quantum many-particle systems

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We review some new approaches to the description of the evolution of states of many-particle quantum systems by means of the correlation operators.

Using the definition of marginal correlation operators within the framework of dynamics of correlations governed by the von Neumann hierarchy, we establish that a sequence of such operators is governed by the nonlinear quantum BBGKY hierarchy. The constructed nonperturbative solution of the Cauchy problem to this hierarchy of nonlinear evolution equations describes the processes of the creation and the propagation of correlations in many-particle quantum systems.

Furthermore, we consider the problem of the rigorous description of collective behavior of many-particle quantum systems by means of a one-particle (marginal) correlation operator that is a solution of the generalized quantum kinetic equation with initial correlations, in particular, correlations characterizing the condensed states of systems. In addition, we establish the mean field asymptotic behavior of the process of the propagation of initial correlations.