

The von Neumann Hierarchy for Bose and Fermi Particles

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We consider the microscopic origin of the rigorous description of non-equilibrium correlations of Bose and Fermi many-particle systems. We deduce the von Neumann hierarchy for correlation operators that give an alternative description of quantum state evolution.

Existence and uniqueness theorem of a strong and a weak solution of the Cauchy problem of the von Neumann hierarchy is proved in the spaces of sequences of trace class operators [1]. In case of absence of correlations at initial time it is established that the correlations generated by dynamics of systems are governed by cumulants of the groups of operators of the von Neumann equations.

The links of constructed solution of the von Neumann hierarchy both with the solution of the BBGKY hierarchy for marginal density operators and with the nonlinear BBGKY hierarchy for marginal correlation operators are discussed.

[1] V.I. Gerasimenko, D.O. Polishchuk, arXiv:1001.3893, 2010.