Unification of thermo field kinetic and hydrodynamics approaches in the theory of dense quantum field systems

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We generalized the nonequilibrium thermo field dynamics in the framework of Zubarev's nonequilibrium statistical operator method [1] within the framework of Renyi statistics. The non-Markov transport equations in the thermo field presentation in Renyi statistics are obtained, which can be used to describe the nonequilibrium processes in quantum Bose and Fermi systems. In the case of $q \rightarrow 1$, when Renyi statistics are transformed into non-extensive Tsallis statistics, we obtain the corresponding generalized transport equations with non-additive entropy for the system. Based on this approach and Gibbs statistics, the generalized equations of the consistent description of kinetics and hydrodynamics for dense quantum field systems with strongly-bound states were obtained [2]. Using this approach, one can investigate both strong and weak nonequilibrium processes of nuclear matter, when the interaction between particles of the latter is characterized by strongly-bound states of an internucleon nature.

1. D.N. Zubarev, M.V. Tokarchuk. *Theor. Math. Phys.*, **88**, (1991), 876–893.
2. M. Tokarchuk, P. Hlushak. *Particles*, **2**, (2019), 1–14.