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On Semigroups of Operators Describing Processes of Creation and Propagation of Quantum Correlations

The subject of the talk is the analysis of processes of the creation and the propagation of correlations in large particle quantum systems.

We establish properties of cumulants (semi-invariants) of semigroups of operators of finitely many quantum particles that are the generating operators of solution expansions for hierarchies of evolution equations, describing the evolution of quantum correlations, in particular the von Neumann hierarchy for correlation operators [1] and the nonlinear quantum BBGKY (Bogolyubov–Born–Green–Kirkwood–Yvon) hierarchy for marginal correlation operators [3].

Moreover, we consider a mean field scaling behavior of processes of the creation of correlations and the propagation of initial correlations in large particle quantum systems. We establish that such processes are governed by the Vlasov-type quantum kinetic equation with initial correlations [2].

References

- [1] V.I. Gerasimenko, *Hierarchies of quantum evolution equations and dynamics of many-particle correlations*, in: *Statistical mechanics and random walks: Principles, processes and applications*, Nova Science Publ., Inc., N.Y., 2013.
- [2] ———, *New approach to derivation of quantum kinetic equations with initial correlations*, Carpathian Math. Publ. **7** (2015), no. 1, 38–48.
- [3] ———, *The evolution of correlation operators of large particle quantum systems*, Methods Funct. Anal. Topology **23** (2017), no. 2, 123–132.