

The fundamental objective of the theoretical research project entitled “*Quantum correlations in multi-component systems of several fermions*” is to better understand the non-classical properties of ultracold mixtures of interacting fermions. **Previous research** in this direction has focused mainly on **two-component** mixtures of several fermions, or multi-component mixtures but containing **a large** number of particles. The proposed research, therefore, is an attempt to find answers to scientific questions that lie on the edges of these two approaches but are beyond their range. Among the most intriguing questions that still await theoretical and experimental resolution is related to the phenomenon of the formation of so-called Cooper triples (and higher multiples) – strong correlations between quantum particles that have no counterpart in the classical world. These correlations are a broad generalization of the formation of Cooper pairs in two-component mixtures, *i.e.*, correlations that are the fundamental essence of the theory of superconductivity. Deep analysis of the possibility of forming analogous correlations in mixtures of a larger number of components can be of not only academic interest but also of great relevance to experiments aimed at harnessing quantum phenomena and using them in practical applications. For this reason, among others, research in this project will focus on systems containing a small number of particles. This will make it possible to investigate numerically in depth the full mathematical structure of the quantum state the mixture is prepared in, which is impossible in practice when the number of particles is very large and it is necessary to use approximate methods.