Positive maps in matrix algebras (more generally operator algebras) plays essential role both in mathematics (theory of operator algebras, functional analysis) and in mathematical physics (mathematical foundations of quantum information theory, theory of quantum entanglement, quantum dynamical systems). A subset of positive maps (so-called completely positive maps) represents a legitimate physical operations which can be applied to a quantum system. On the other hand positive maps which are not completely positive found important applications in the analysis of quantum entanglement which is one of the most fundamental *resource* of modern quantum technologies (quantum information, quantum communication, quantum computing). It shows that there is another fundamental connection of abstract mathematics and theoretical physisc and proves celebrated Wigner's statement "The Unreasonable Effectiveness of Mathematics in the Natural Sciences".

Main goals of the project:

- construction of new positive maps in matrix algebras. It should be stressed that there is no universal method to construct such maps. There is one special class of maps – so-called decomposable maps – which is fully characterized. However, decomposable maps are less important in quantum information. Interestingly, maps which are not decomposable are closely related to the celebrated 17th Hilbert problem. It shows that construction of such maps is a hard problem. There are several examples of non-decomposable maps in the literature (some of them were proposed by our team).

- systematic analysis and characterization of positive maps in operator algebras which possesses important properties for mathematical physics: optimality, extremality, exposednes. It should be stressed that each property is hard to control.

Clearly we expect to open new directions and pose new interesting questions and/or conjectures.