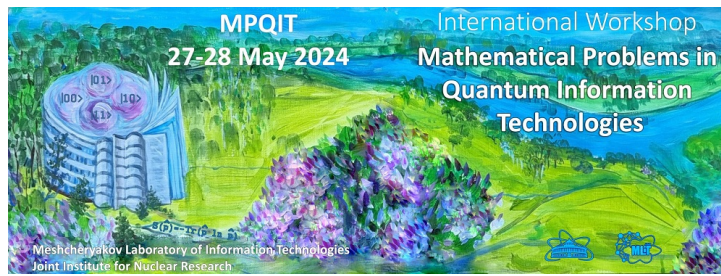


Mathematical Problems in Quantum Information Technologies



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Quantum computing with qudits

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Recent progress in a development of quantum computing platforms operating with qudits (d -dimensional quantum particles with $d > 2$) rises important questions of how such platforms can be used in the most efficient way for implementing known quantum algorithms. We are going to discuss possible approaches for implementing quBit-based circuits with quDit-based hardware. These approaches include (i) employing “higher” qudits’ levels for substituting ancillary qubits in decomposition of multiqubit gates, (ii) encapsulating computational space of several qubits in a single qudit, and (iii) combination of (i) and (ii). Special attention will be given to implementation of the approaches for trapped ion-based qudit systems with Mølmer–Sørensen gate as a native two-particle gate, and transmon-based superconducting qudrits. Recent experimental results will be also highlighted.

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