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Towards large scale quantum computing –a many qubit ion trap at room temperature

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Extensive research is dedicated to large-scale quantum computing, still which one optimal platform is superior for general-purpose quantum computers is not yet clear. Trapped ions, serving as qubits, demonstrate superior gate fidelity and coherence times. However, current systems predominantly operate with a limited number of qubits. We are working to construct a new design that supports a linear chain comprising up to 50 ions, each individually addressable, thus offering a flexible platform with numerous qubits and precise control. The core of our system is a three-dimensional ion trap constructed from gold-coated laser-machined glass, operating in ultra-high vacuum conditions at room temperature. Individual addressing is facilitated through a waveguide array. Among its applications, our system contributes to research on large distance error correction, paving the way for fault-tolerant quantum computation. Its precise control proves advantageous for simulating complex Hamiltonians, enabling large-scale quantum simulations. Additionally, the trap's segmented electrodes permit the division of the ion chain into multiple segments, facilitating parallel quantum processing.

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