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Abstract for an Invited Paper
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Trapped ion arrays for quantum simulation¹

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Trapped ions have been used to demonstrate a broad range of quantum information processes with high fidelity² and are an obvious choice for quantum simulations. Several quantum simulations have already been demonstrated with ions.^{3,4} The present goal is to simulate quantum systems that cannot be achieved with classical computation using more than 20 ions. It is challenging to assemble more than 20 ions in suitable arrays for quantum simulation of arbitrary model systems. Present ion trap based quantum simulations with up to 20 ions are now in progress. This talk describes ion trap micro-fabrication techniques and designs that have the potential to increase the number of coupled ions to the range between 50 and 100 ions. High precision ion traps are fabricated using silicon VLSI techniques on silicon wafers with aluminum electrodes.⁵ At the Georgia Tech Research Institute we are designing, fabricating and testing ion trap arrays that will contain and accurately control at least 50 ions in linear chains of equally spaced ions. Large numbers of equally spaced ions have recently been shown⁶ to be stable in anharmonic trap potentials that are easily obtained in the micro-fabricated traps. The limits on quantum simulation accuracy due to errors in the ion trap parameters will be discussed.

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