Abstract Submitted
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Towards a large scale fully-programmable trapped-ion quantum spin simulator[1] SAINATH MOTLAKUNTA, CHUNG-YOU SHIH, NIKHIL KOTIBHASKAR, MANAS SAJJAN, YI-HONG TEOH, ZEWEN SUN, ROLAND HABLUTZEL, FERESHTEH RAJABI, RAJIBUL ISLAM, IQC and Dept. of Physics and Astronomy, University of Waterloo — A trapped-ion quantum simulator can simulate models of quantum many-particle systems that may be otherwise intractable, such as frustrated spin systems and fundamental forces in high energy physics. Our trapping architecture is based on a multi-segmented 'blade electrode' Paul trap, capable of producing anharmonic confining potentials to trap and control a long chain (>50) of Ytterbium ions with near-uniform spacing. A holographic optical addressing system is integrated for aberration-corrected optical engineering, providing the capability to exert programmable and dynamic control over non-trivial many-body Hamiltonians at the level of individual ion-spins and interactions between them. Leveraging powerful modern machine-learning tools [1], the quantum simulator can in principle be programmed to realize an arbitrarily connected spin network, allowing the simulation of dynamical spin systems on arbitrary lattice geometries in higher dimensions.
[1] Yi Hong Teoh , Marina Drygala, Roger G. Melko, and Rajibul Islam, *Quantum Science and Technology* **5**, 024001 (2020)

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