Abstract Submitted
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Engineering programmable spin interactions in a trapped ion quantum simulator with holographic single-ion addressing[1] CHUNG-YOU SHIH, FERESHTEH RAJABI, Institute for Quantum Computing and Department of Physics and Astronomy, University of Waterloo, ASHOK AJOY, Department of Chemistry, University of California, Berkeley, KALEB RUSCITTI, NIKHIL KOTIBHASKAR, SAINATH MOTLAKUNTA, NIKOLAY VIDENOV, ILANGO MARAN, RAJIBUL ISLAM, Institute for Quantum Computing and Department of Physics and Astronomy, University of Waterloo — Trapped ions are an ideal platform for quantum simulation of many-body spin Hamiltonians. To engineer arbitrary spin-spin interaction graphs, we need arbitrary addressing of individual spins. Here, we demonstrate holographic beam shaping using a digital micro-mirror device (DMD) for individually manipulating Yb+ ion spins and interactions between spin pairs. A precise optical intensity gradient will allow us to control individual spin phases, which can modify global Molmer-Sorensen interactions to realize the target interaction graph, in a hybrid analog-digital quantum simulation. This method of individual addressing is a scalable alternative for a long inhomogeneously spaced ion chain compared to other approaches that rely on scanning a tightly focused laser beam, or on devices that produce a fixed number of equally spaced laser beams.

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