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Engineering effective 2D Hamiltonians from 1D ion chains ASHOK AJOY, University of California Berkeley, CA, RAJIBUL ISLAM, Institute for Quantum Computing and Department of Physics and Astronomy, University of Waterloo, Ontario N2L 3G1, Canada — The lattice geometry in 2D systems affords one the ability to study a rich variety of physical phenomena – from quantum transport and localization, topological insulators and the Haldane model and in topological quantum computation. Ion traps have emerged as the preeminent platform for quantum simulation, where it would be desirable to simulate several of these 2D Hamiltonian models. The long-ranged Coulomb mediated spin-spin interactions in an ion trap make this possible in conventional radio-frequency ion traps where the ions are often arranged in a linear geometry. In this work, we describe a method for the Floquet engineering of 2D nearest neighbor Hamiltonian models from a linear chain of ions. Each cycle of the periodically driven dynamics consists of a calibrated evolution under a flip-flop type spin interaction and laser AC Stark shift assisted field gradient. We show that experimental implementations scale efficiently with system size, and discuss a range of 2D models that can be simulated.

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