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A Hexagonal Lattice Ion Trap for Quantum Simulation of Spin Models ZILIANG LIN, ROBERT CLARK, YUFEI GE, ISAAC CHUANG, Massachusetts Institute of Technology, PLANAR LATTICE TRAP TEAM — Quantum simulations of one dimensional spin systems are being implemented by ions in linear Paul traps; however, a natural extension to two dimensional quantum spin simulations cannot be realized in the linear Paul trap geometry. Planar lattice traps not only offer the possibility for two dimensional simulations, but also hold two advantages over linear traps: first, neighboring ions in lattice traps have well defined and uniform spacings; second, quantum simulations with planar traps can be scaled up more easily than with linear traps. We develop a hexagonal lattice trap that allows vibrational coupling between ions due to their Coulomb repulsion, which is essential for effective spin-spin interaction. We present fabrication details, preliminary testing results, and a proposal for simulating geometrical spin frustration with three ions in a triangular configuration.

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