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A Cryogenic System for Rapid Ion Trap Characterization

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Trapped ions are promising qubit systems for quantum information processing due to their long coherence times and high gate fidelities. Current scalable trap design efforts rely on 2D surface traps, which are challenged by shallow trap depths and sensitivity to electric field noise. We built a cryogenic system aimed at efficient, iterative prototyping of scalable 3D-printed ion traps. These traps will be fabricated with sub-micron precision using a method based on two-photon polymerization. We have first used a 2D surface trap to calibrate our system. We demonstrated resolved sideband cooling to the motional ground state and measured axial motional heating rates for a single $^{88}Sr^{+}$ ion. We will replicate these measurements and test single and multi-qubit operations using 3D-printed traps, which can be rapidly installed and characterized in our system.

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