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Achieving Translationally Invariant Trapped Ion Rings[1] ERIK URBAN, HAO-KUN LI, CRYSTAL NOEL, BOERGE HEMMERLING, XIANG ZHANG, HARTMUT HAEFFNER, UC Berkeley — We present the design and implementation of a novel surface ion trap design in a ring configuration. By eliminating the need for wire bonds through the use of electrical vias and using a rotationally invariant electrode configuration, we have realized a trap that is able to trap up to 20 ions in a ring geometry 45um in diameter, 400um above the trap surface. This large trapping height to ring diameter ratio allows for global addressing of the ring with both lasers and electric fields in the chamber, thereby increasing our ability to control the ring as a whole. Applying compensating electric fields, we measure very low tangential trap frequencies (less than 20kHz) corresponding to rotational barriers down to 4mK. This measurement is currently limited by the temperature of the ions but extrapolation indicates the barrier can be reduced much further with more advanced cooling techniques. Finally, we show that we are able to reduce this energy barrier sufficiently such that the ions are able to overcome it either through thermal motion or rotational motion and delocalize over the full extent of the ring.

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Erik Urban
UC Berkeley

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