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A scalable monolithic ion trap in three-dimensional geometry[1]

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— We developed a three-dimensional monolithic radio frequency (RF) trap that has a deep confining potential and can be extended to contain multiple zones similar to two-dimensional surface traps. The trap is fabricated by gold coating on a laser-machined alumina plate which has been successfully used for trapping ions. The basic structure of the trap is analogous to the combination of the structure of three-layer trap [1] and the symmetric trap [2], but the post-processing assembly of multi-layers is not required in the fabrication. On a single layer of alumina plate, we implement RF electrode and twenty DC electrodes. We successfully load ions in the trap. We report the basic properties of the trap such as axial and radial trap frequencies, heating rates and compare them to the theoretical expectations. The monolithic trap is able to produce a uniformly spaced ion chain and the technology can be extended to implement a junction structure on the trap to transport ions for connecting different trap zones.

[1] W. K. Hensinger, et al., Appl. Phys. Lett. 88, 034101 (2006).
[2] F. Shaikh, et al., arXiv:1105.4909.

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