

Seminar

Institute for Plasma Research

Title: End-Cap Type Paul Trap for Precision Spectroscopy and Ion-crystal Experiments

Speaker: Mr. Anand Prakash
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Date: 28th June 2024 (Friday)

Time: 09.30 AM

Venue: Board Room, IPR

Abstract

An end-cap type trap is a geometrical variation of the ideal Paul trap. It offers excellent optical access for interrogating ions with lasers and imaging their fluorescence. It is one of the promising trap geometries for optical clock experiments with a single trapped ion. We have indigenously developed the ion trap, drive circuit, and the atom source to load ions into the trap. I will present the trap's design, fabrication, assembly details, and initial characterization. The working species in our setup is Ca⁺. This trap is also designed to operate as a state-of-the-art ion clock at IUCAA(Yb⁺) and IIT Tirupati(Ca⁺). On the front of initial science experiments, we observe exotic ion crystal morphologies predicted by Ursekar et al. for four ions. For crystals of five and six ions, we observe new morphologies of ion crystals that match our molecular dynamics simulations. This type of trap is also suitable for studying the thermodynamics of small systems.

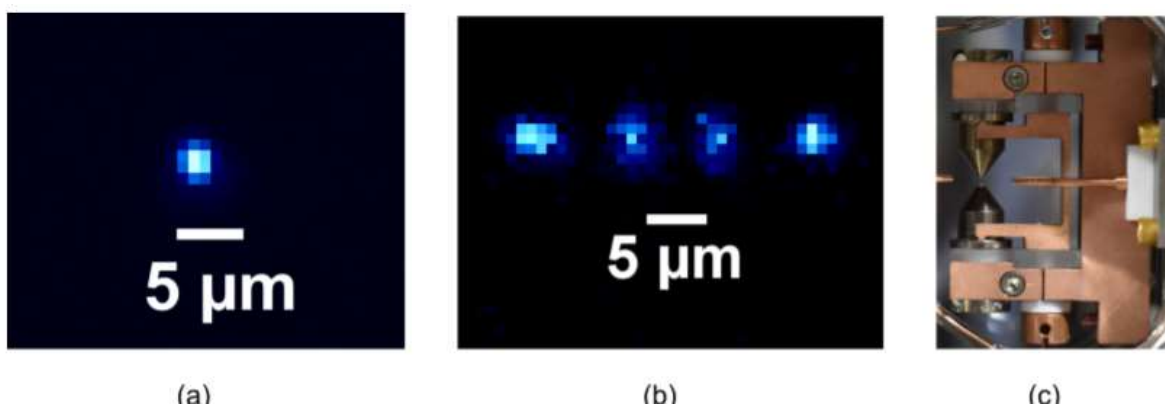


Figure 1: (a) Image of trapped and cooled single ion (b) 4 ion Coulomb crystal (c) Trap assembly mounted inside the chamber

References

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 4. Ursekar, V., Silvester, J.M., Nam, Y.S. et al. Prediction of exotic ion-crystal structures in a Paul trap. *Eur. Phys. J. D* 72, 165 (2018)
 5. Abdel-Hafiz, Moustafa et al. “Guidelines for developing optical clocks with 10–18 fractional frequency uncertainty.” *arXiv: Atomic Physics* (2019)
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