Contribution ID: **28** Contribution code: **WEB2** Type: **Invited Oral Presentation**

Ion machine-gun experiment at Hiroshima University

Wednesday 29 October 2025 11:15 (30 minutes)

Low-intensity ion beams with transverse dimensions of the order of microns or submicrons have been employed for a variety of purposes. In some advanced applications, however, the beam size needs to be even much smaller. One such example is the creation of color centers in diamond, which requires us to transport ions of specific species one by one to a target with nanometer precision. A possible approach to this challenging goal is the use of the so-called "ion machine gun (IMG)". The IMG is a unique ion source based on a compact "linear Paul trap"with a Doppler laser cooler. The Doppler cooling technique is so powerful that we can reduce the temperature of a stored ion cloud close to absolute zero where the ultracold ions establish a spatially ordered configuration called "Coulomb crystal". The normalized root-mean-squared emittance of a Coulomb crystal can be on a femtometer order, which opens up the possibility of attaining an extremely narrow "nanobeam". At Hiroshima University, we have conducted a proof-of-principle study of this novel beam-source concept, using laser-coolable calcium ions and sympathetically cooled nitrogen ions in a prototype IMG. In this talk, an overview is given of recent results of numerical simulations and preliminary experiments.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: Mr MUROO, Kento (Hiroshima University)

Co-authors: ITO, Kiyokazu (Hiroshima University); OKAMOTO, Hiromi (Hiroshima University); YURI, Yosuke (National Institutes for Quantum Science and Technology); MIYAWAKI, Nobumasa (National Institutes for Quantum Science and Technology)

Presenter: Mr MUROO, Kento (Hiroshima University)

Session Classification: Advanced Cooling Applications

Track Classification: COOL'25