7th European Conference on Trapped Ions

Contribution ID: **164** Type: **Poster**

Laser cooling and shuttling of trapped ions in strongly inhomogeneous magnetic fields

Monday, 25 September 2023 19:30 (2 hours)

We demonstrate that $^{40}Ca^{+}$ ions confined in a segmented linear Paul trap can be laser cooled in the presence of a strongly inhomogeneous magnetic field created by two permanent ring magnets. The magnetic field gradients of 800 to 1600 G/mm give rise to a highly position-dependent Zeeman shift on the energy levels of the trapped ions. Efficient laser cooling is demonstrated using two 397 nm cooling lasers with appropriate wavelengths and polarisations and one 866 nm repump laser. The obtained Coulomb crystals are found to exhibit similar secular temperatures compared to those trapped in absence of the magnetic field. The position dependency of the Zeeman effect can be used to create a map of the magnetic field and to estimate the mismatch between the eletric and magnetic field centres.

This work forms the basis for developing a hybrid trapping system that consists of an RF ion trap and a magnetic trap to study cold collisions with longer interaction times between particles compared to beam experiments. Such a system is currently under development in our lab. It will incorporate a cryogenic shield which increases the trap lifetime of the moelcules. Efficient shuttling of the ions to the magnetic trap centre by synchronously varying the electric potentials of the ion trap has alraedy been implemented, even in the presence of the strongly inhomogeneous magnetic fields. These findings could open new possibilities for quantum science experiments that employ trapped ions in inhomogeneous magnetic fields.

Primary author: MANGENG, Christian

Co-authors: YIN, Yanning; KARL, Richard; Prof. WILLITSCH, Stefan

Presenter: MANGENG, Christian

Session Classification: Monday Poster