

ACCELERATOR SEMINAR

Sebastian Klammes

GSI

Thursday, 30. March 2023 at 4 pm

Seminarraum Theorie (SB3 3.170a)

Participation is also possible via Zoom: ID: 621 5735 7591/ PW: 078207

Laser cooling of bunched relativistic ion beams at GSI and FAIR

Ion beam cooling techniques are indispensable for generating high-quality ion beams with lowest longitudinal momentum spreads ($\Delta p/p$) and small emittances (ϵ) and are, therefore, of great importance for accelerator research and fundamental physics experiments. For these reasons ion beam cooling plays a major role at the GSI and FAIR accelerators.

In the future, the heavy-ion synchrotron SIS100 will store, accelerate and deliver ion beams at highest energies and highest intensities to the rest of the FAIR facility. Furthermore, after acceleration to the final energy, it is planned to cool the stored relativistic heavy-ion beams using bunched beam laser cooling. We have developed a novel cooling scheme using three complementary laser systems (cw and pulsed), which will be overlapped in time, space and frequency, to simultaneously interact with a very broad ion velocity range. This scheme should provide for fast cooling and suppress heating by intrabeam scattering. By combining the SIS100 bunch compression technique with bunched beam laser cooling, very cold and very short (below 50 ns) highly relativistic ion bunches could be created, extracted and delivered to experiments.

This seminar will give an overview of the principle and status of bunched beam laser cooling at GSI and FAIR. Results from a recent laser cooling experiment (May 2021) at the ESR will be presented, where broadband laser cooling of bunched relativistic C³⁺ ion beams was successfully demonstrated for the first time using a pulsed UV laser system with a very high repetition rate (\sim MHz), variable pulse durations (166 - 735 ps) and high UV power.



Coordinator: Claude Krantz, Janet Schmidt

Secretary: Larissa Birli

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