

Challenges of Laser Cooling at SIS100: UV Systems and Overlap in 5D

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Relativistic ion beams with a narrow momentum distribution are crucial for high-precision experiments at accelerator facilities. Laser cooling offers a promising approach to further reduce the momentum spread, thereby enhancing the ion beam quality. Previous experiments conducted at the Experimental Storage Ring (ESR) at GSI have demonstrated the efficiency of both continuous-wave (cw) and pulsed UV lasers in achieving this goal. By using three laser systems, the cooling efficiency can be further improved.

This work presents a continuous-wave laser system operating at a wavelength of 257.24 nm, enabled by two second-harmonic generation stages. Particularly, long-term operation with high UV output power is of great interest. By employing elliptical focusing in the second enhancement cavity, a long term stable UV output power up to 2 W is achieved, providing an efficient solution for ion beam cooling. The integration of this cw laser and two pulsed laser systems at the SIS100 of FAIR requires the optimization of the spatial, temporal, and energy overlap between the three laser beams and the ion beam.

Footnotes

Funding Agency

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Yes

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