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## **Modular variable laser cooling for efficient entropy extraction**

*Tuesday, 26 September 2023 19:30 (2 hours)*

I will present work on laser cooling a trapped-ion oscillator based on sequences of spin-state dependent displacements followed by spin repumping. For a thermal state with mean occupation  $\bar{n} \gg 1$  the method attains a reduction of 0.632 of the initial thermal oscillator occupation for two repumps of the spin state. We demonstrate the motion using a single calcium ion, and illustrate its advantages and limitations. To increase robustness to imperfections, we have recently been working to implement the method spin-state dependent displacements with laser pulses of very different intensity, requiring integrating phase tracking into our FPGA hardware to work in real-time for flexible sequence generation and deployment. We will also present an overview of upgrades to the control system underlying all the experiments in the ETH Zurich group.

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