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From thallium to calcium: Pushing the limits of CLS at COLLAPS in 2023

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On behalf of the COLLAPS collaboration

Collinear laser spectroscopy (CLS) has been a cornerstone of low energy nuclear physics since its conception in the 1970s, providing access to nuclear charge radii and moments of nuclear ground states and long-lived isomers. The COLLAPS setup at ISOLDE hosted the very first online CLS measurement in which the nuclear structure of barium isotopes, produced at yields of $10^{>7}$ ions/s, was investigated. In this talk, I will give an overview of the 2023 experimental campaign at COLLAPS and the efforts to improve the sensitivity of the setup down to 1 ion/s.

Neutron deficient thallium ($Z=81$) isotopes were studied at the beginning of the running period. Nuclear properties of more than 25 isotopes and 15 isomers were successfully measured. The physics output of this run, closely linked to a measurement campaign on lead isotopes in 2021, will be discussed. A novel detection scheme to push closer towards the drip-line in future runs will also be presented.

Following the thallium measurements, a feasibility study on thulium ($Z=69$) isotopes was carried out in cooperation with ISOLTRAP. The main goal was to check the production/contamination rates of the $^{>147}$ Tm proton emitter nuclei for a future exploration of its nuclear structure at COLLAPS. The efficiency of the setup for this specific case was also quantified to 1000 ions/s.

Finally, neutron-rich calcium isotopes were studied with a new implementation of the ROC technique (radioactive detection after optical pumping and state selective charge exchange). An enhanced sensitivity of 1 ion/s was expected and needed to reach the physics case which included the first laser spectroscopy measurement of $^{>53}$ Ca and $^{>54}$ Ca. The preliminary results will be shown and discussed.

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