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Using slow ions in accelerator mass spectrometry for experimental nuclear astrophysics

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Accelerator Mass Spectrometry (AMS) is the most sensitive technique for direct atom counting of many long-lived radionuclides. The addition of a buffer gas-filled ion cooler to the low-energy side of the AMS system opens up exciting new possibilities, especially in the mass range $60 - 200\,\mathrm{amu}$. The new ion cooler ILTIS, built at Helmholtz-Zentrum Dresden-Rossendorf in cooperation with the University of Vienna will be added to the new dedicated $1\,\mathrm{MV}$ AMS facility HAMSTER in Dresden. In the ion cooler, the near-thermal ion beam is collinearly overlapped with a laser beam to induce laser photodetachment ($A^- + \gamma \rightarrow A + e^-$). Using suitable molecules, this neutralizes any interfering atomic isobar while leaving the isotope of interest unaffected. Some radionuclides, whose detection has already been proven to benefit from this technique are e.g. $^{26}\mathrm{Al}$, $^{36}\mathrm{Cl}$, $^{90}\mathrm{Sr}$, $^{135}\mathrm{Cs}$ and $^{182}\mathrm{Hf}$. We will highlight the new measurement capabilities of ILTIS and give an outlook on AMS measurements of $^{90}\mathrm{Sr}$ and $^{135}\mathrm{Cs}$. AMS can provide direct assessments of the thermal and epithermal neutron capture cross sections on the radioactive target nuclei $^{134}\mathrm{Cs}$ and $^{89}\mathrm{Sr}$, leading to $^{135}\mathrm{Cs}$ ($T_{1/2} = 2.3\,\mathrm{Myr}$) and $^{90}\mathrm{Sr}$ ($28.91\,\mathrm{yr}$), respectively, which can serve as an anchor point for estimating the important cross sections in the astrophysical relevant keV-energy region.

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