High Resolution Laser Spectroscopy of Actinide Elements within the LISA Network

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LISA
LASER IONISATION AND SPECTROSCOPY OF ACTINIDES

LISA

Laser Ionization and Spectroscopy of Actinides
The project aims to develop and push the limits of current knowledge in the actinide region by joining the expertise and capabilities coming from academic research institutions as well as industrial partners.

In-gas-cell laser ionization

- Gas Phase Chemistry [1]
- Development of a grating Ti:Sapphire Laser [2]
- Investigation of Ionization schemes

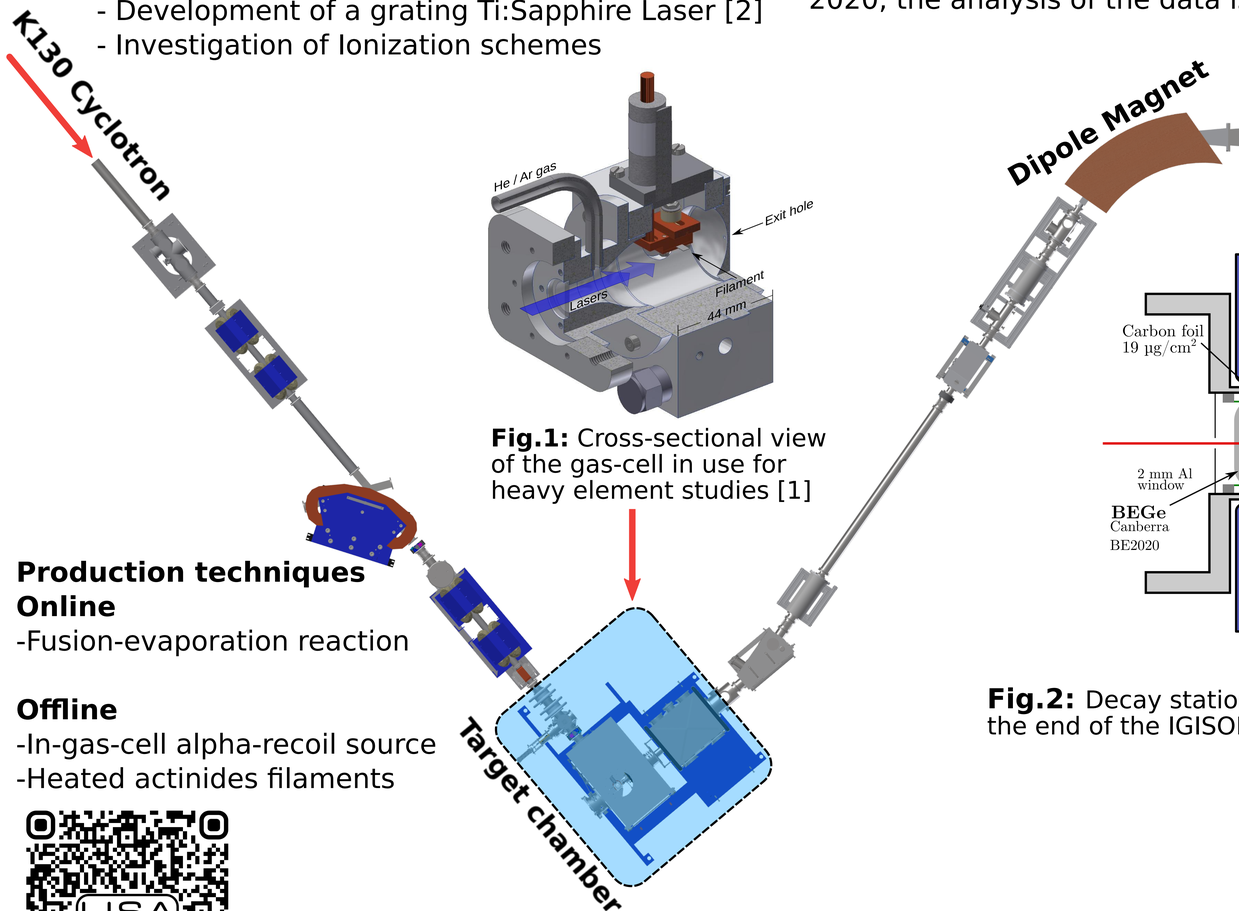

Fig.1: Cross-sectional view of the gas-cell in use for heavy element studies [1]

Production techniques
Online
-Fusion-evaporation reaction

Offline
-In-gas-cell alpha-recoil source
-Heated actinides filaments

IGISOL

Ion Guide Isotope Separation On Line
The IGISOL facility in the Accelerator Laboratory of the University of Jyväskylä is at the forefront in the application of laser spectroscopy techniques for the extraction of nuclear ground-state properties. In addition to optical spectroscopy, nuclear decay spectroscopy and precision mass measurements are implemented to further investigate the region of interest. The first decay spectroscopy experiment was performed using proton-induced fusion-evaporation on a ^{232}Th target in July 2020, the analysis of the data is underway.

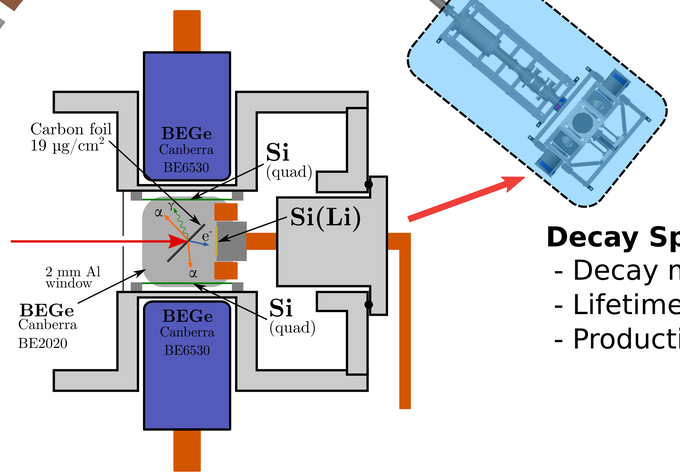

Fig.2: Decay station setup mounted at the end of the IGISOL spectroscopy line

Decay Spectroscopy
- Decay modes
- Lifetimes
- Production yields

High resolution collinear laser spectroscopy
Hyperfine structure and isotope shift
- Nuclear spins
- Electromagnetic moments
- Mean-square charge radii

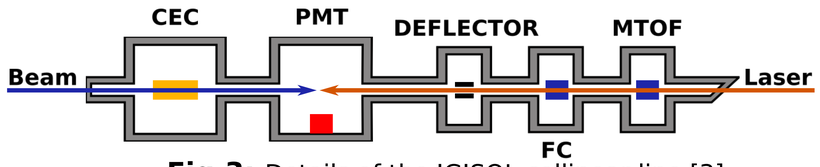

Fig.3: Details of the IGISOL collinear line [3]

JYFL Penning trap [4]
- High precision mass measurment
- Direct measurement of production yield of ^{229}Th

References

[1] Pohjalainen, I. et al., Nucl. Instr. Meth. Phys. Res. Sect. B, 376 (2016) 233-239.
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[3] De Groote, R. P. et al. Nucl. Instr. Meth. Phys. Res. Sect. B, 463 (2020) 437-440.
[4] Eronen, T. et al. Eur. Phys. Jour. A, 48 (4) (2004) 46

Physics Days 2021, March 24-26
Jyväskylä

This Marie Sklodowska-Curie Action (MSCA) Innovative Training Network (ITN) receives funding from the European Union H2020 Framework Programme under grant agreement no. 861198.