PAUL SCHERRER INSTITUT

NES Colloquium

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Laser Isotope Separation Revisited
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Radioisotope spectroscopy and purification by laser mass spectrometry at Mainz University

Prof. Klaus Wendt
Institute for Physics, Johannes Gutenberg University Mainz, D-55099 Mainz, Germany

Based on the universality and reliability of present days laser systems, as developed primarily for on-line laser ion sources and laser based ultra-trace analysis [1,2], resonance ionization mass spectrometry has recently demonstrated great versatility in the field of radioisotope separation and ion beam purification. This application primarily profits from the very high overall efficiency of the resonance ionization process in the order of 20 - 50 % and the unrivaled suppression of isobaric and other background in the finally collected sample. In the field of long-lived radioisotopes, as accessible at the laser-ion-source development and off-line radioactive ion beam facility RISIKO at Mainz University, fundamental and applied research applications complement exclusively laser spectroscopic oriented activities on rare radioisotopes. The latter also include preparations for ultrapure production of novel radiopharmaceuticals in the CERN-Medicis project [3]. We shall discuss prominent examples of specific radioisotope purification, concerning e.g. the isotope 163-Ho and its efficient implantation into the small magnetic metallic calorimeter chips of the ECHo collaboration for determination of the neutrino mass [4]. Purification of the isotope 53-Mn, delivered from beam dump recovery as part of the MeaNCoRN project of PSI, Switzerland, [5], is carried out for supporting lifetime measurements, while radiometrically pure collection of the isotope 226-Ra serves for production of radon emanation standards for the PTB in Germany. Further goals, advances and limitations of the technique will be discussed.

[1] V. Fedosseev et al., J. Phys. G: Nucl. Part. Phys. 44, 084006(2017)
[2] C. Gruening et al., Int. Journal of Mass Spectr. 235, 171–178(2004)
[3] R. M. dos Santos Augusto et al., Appl. Sci. 4, 265-281 (2014)
[4] L. Gastaldo et al., Eur. Phys. J. Special Topics 226, 1623–1694 (2017)
[5] R. Dressler, MeaNCoRN – Measurement of Neutron capture cross sections and determination of half-lives of short-lived Cosmogenic Radio-Nuclides, https://www.psi.ch/lrc/meancorn