MS 5: Accelerator Mass Spectrometry 1

Time: Wednesday 14:00–15:45 Location: R 1.020

Invited Talk MS 5.1 Wed 14:00 R 1.020

Nachweis von Beryllium-10 aus exotischen Zerfällen mit Hilfe von Beschleunigermassenspektrometrie (AMS) — •Oliver Forstner[1,2], Silke Merchel[3], Johannes Lachner[4] und IS541 Kollaboration[5] — [1]FSU Jena — [2]HI Jena — [3]HZDR — [4]Universität Wien — [5]ISOLDE/CERN, Genf

Der Ein-Neutronen Halokern ^{11}Be geht über einen Beta-Minus-Zerfall in ^{11}B über ($t_{1/2} = 13,76$ s). In seltenen Fällen jedoch erfolgt über eine anschließende Emission eines Protons die Umwandlung zu ^{10}Be. Ziel dieser Studie ist es, das nach theoretischen Vorhersagen bei unter 10^{-7} liegende Verzweigungsverhältnis dieses raren Zerfallskanals zu messen. Mit Hilfe der Möglichkeiten der AMS zur Messung extrem niedriger Isotopenverhältnisse ist dies erstmalig experimentell gelungen und wurde zu $8,3(0,9) \times 10^{-6}$ bestimmt [1].

Zur Bestimmung dieser Rate wurde an ISOLDE / CERN ein Strahl radioaktiver ^{11}Be Ionen produziert und in Kupfer-Targets implantiert. Daraus wurde chemisch Beryllium extrahiert und mittels AMS das Verhältnis ^{10}Be/^{9}Be bestimmt sowie die Menge des implantierten ^{10}Be berechnet. Aufgrund des niedrigen Verzweigungsverhältnisses und der daraus resultierenden niedrigen Zahl von entstehenden ^{10}Be-Atomen ist eine möglichst hohe Effizienz und niedriger Untergrund im ^{9}Be-Trägermaterial [2] essentiell. Für die Datenanalyse wurde besonderes Augenmerk auf die Methodik der Produktion gelegt, um mögliche systematische Fehler ausschließen zu können.

[1] K. Riisager, et al., Phys. Lett. B 732 (2014) 305
[2] S. Merchel, et al., Nucl. Instr. and Meth. B 266 (2008) 4291

MS 5.2 Wed 14:30 R 1.020

Beryllium-7 at DREAMS — •Georg Rugel[1], Silke Merchel[1], Andreas Scharf[1], Rebecca Querfeld[2], Georg Steinhauser[2], and Collin Tiessen[1,3] — [1]HZDR, Dresden, Germany — [2]IRS Hannover, Germany — [3]AEL AMS Laboratory, Canada

Half-lives of routine AMS nuclides range from thousands to millions of years. We measured short-lived ^{7}Be ($T_{1/2} = 53.2$ d) at the DREsden AMS-facility (DREAMS) [2] as low as 90 mBq, which can be challenging for rapid γ-counting. Simultaneous determination of ^{7}Be and ^{10}Be ($T_{1/2} = 1.387$ Ma) via AMS is advantageous for improved understanding of production, transport, and deposition of atmospherically produced ^{7,9,10}Be [2].

Data was normalized to a ^{7}Be sample produced via ^{7}Li(p,n)^{7}Be, measured by γ-counting and chemically processed to BeO (^{7}Be/^{9}Be $\approx 10^{-12}$). The isobar ^{7}Li is completely eliminated by chemistry and the degrader foil technique (^{7}Be^{4+}, 10.2 MeV). The blank ratio of 5×10^{-16} ^{7}Be/^{9}Be (0.8 mBq) and simple and fast chemistry allows for the measurement of rainwater samples, collected in Germany, as small as 10 ml corresponding to a few times 10^{-14} ^{7}Be/^{9}Be [3,4].

Thanks to D. Bemmerer (HZDR) and G. György (ATOMKI, Hungary) for help with the ^{7}Be normalization material.

Ref.: [1] G. Rugel et al., *NIMB* 370 (2016) 94. [2] A.M. Smith et al., *NIMB* 294 (2013) 59. [3] R. Querfeld et al., *JRNC* 314 (2017)521. [4] C. Tiessen et al. *JRNC* (submitted).

MS 5.3 Wed 14:45 R 1.020

The Flux of Interplanetary Dust on Earth: Status. — •David Krieg[1], Christoph Busser[1], Thomas Faestermann[1], Leticia Fimiani[1], J. M. Gomez-Guzman[1], Angelina Kinast[1], Dominik Koll[1], Gunther Korschinek[1], Manuel Lebert[1], Silke Merchel[2], Jan Welch[3], and Sepp Kipfstuhl[4] — [1]Technische Universität München, Garching, Germany — [2]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [3]Atominstitut of the Technischen Universität Wien, Vienna, Austria — [4]Alfred-Wegener-Institut, Bremerhaven, Germany

Earth's accumulation rate of Interplanetary Dust Particles (IDPs) is a matter of discussion, ranging from 5 (middle atmosphere measurements) up to 300 (space borne dust detection) tons per day.
A new approach for a more precise measurement of this accumulation rate is made by extracting manganese from 500 kg of Antarctic snow collected near the Kohnen station, and measuring the concentration of ^{53}Mn with AMS at the MLL in Munich.
This ^{53}Mn ($t_{1/2} = 3,7\ Ma$) is mostly produced by nuclear reactions of cosmic rays on the iron of the IDPs. Relating the amount of ^{53}Mn to the precipitation rate, a meridional transport and deposition model based on ^{10}Be measurements, and to a chemical model of meteoritic ablation will help to reduce the uncertainty of the IDP input on Earth. The method of our measurement and the status of this study will be discussed.

MS 5.4 Wed 15:00 R 1.020

Search for Recent ^{60}Fe Deposition in Antarctic Snow via AMS — •Dominik Koll[1], Christoph Busser[1], Thomas Faestermann[1], Leticia Fimiani[1], J. M. Gomez-Guzman[1], Angelina Kinast[1], Gunther Korschinek[1], David Krieg[1], Manuel Lebert[1], Silke Merchel[2], Johannes Sterba[3], Jan Welch[3], and Sepp Kipfstuhl[4] — [1]Physik Department, Technische Universität München, Germany — [2]Helmholtz-Zentrum Dresden-Rossendorf, Germany — [3]Atominstitut, Technische Universität Wien, Austria — [4]Alfred-Wegener-Institut, Germany

^{60}Fe with a half-life of 2.6 Myr [1] is produced in stellar environments and ejected into space mainly by core-collapse supernovae. Due to its long half-life, traces of ^{60}Fe were deposited and incorporated on Earth and on the Moon and have been detected there [2,3,4,5].

Here, a new possible reservoir will be presented: Antarctic snow. This time, in contrast to former investigations, any signal detected would be recent material which might origin from the local interstellar cloud. 500 kg of Antarctic snow were chemically processed and are going to be analyzed by AMS in Munich at the 14 MV tandem. First results for ^{60}Fe measurements will be presented as well as chemical extraction methods applied.

[1] Rugel et. al. ; Phys. Rev. Lett. 103, 072502 (2009)
[2] Knie et. al. ; Phys. Rev. Lett. 93, 171103 (2004)
[3] Ludwig et. al. ; PNAS 113 (33), 9232-9237 (2016)
[4] Wallner et. al. ; Nature 532, 69-72 (2016)
[5] Fimiani et. al. ; Phys. Rev. Lett. 116, 151104 (2016)

MS 5.5 Wed 15:15 R 1.020

The first (^{53}Mn/^{55}Mn) isotopic ratio measurements at the Cologne FN-Tandem Accelerator — •Markus Schiffer, Richard Altenkirch, Claus Müller-Gatermann, Susan Herb, Claus Feuerstein, Stefan Heinze, Alexander Stolz, and Alfred Dewald — Institute for Nuclear Physics, University of Cologne, Germany

The new AMS system at the Cologne 10 MV FN accelerator is finalized in its first stage. The system has been designed for the measurement of medium mass isotopes, especially for ^{53}Mn and ^{60}Fe. It provides the opportunity to use several detector systems in different combinations: degrader foils with an electrostatic analyzer, a 4m time-of-flight system, a 135° gas filled magnet and different gas ionization detectors.

The whole system was tested with measurements of stable ion beams and isotopic ratios. During the test measurements of (^{41}Ca/^{40}Ca) isotopic ratios without passive absorbers a detection limit lower 5.3×10^{-13} was reached. A high ^{53}Cr suppression in the (^{53}Mn/^{55}Mn) isotopic ratio measurement with the electrostatic analyzer was reached by using the optimal silicon nitride degrader foil thickness.

We will present the first (^{53}Mn/^{55}Mn) ratio measurements in a range from 10^{-9} to 10^{-10}, and background spectra measured with blank sample material. Transmission tests show an overall efficiency of 0.0033%, including sputter efficiency, charge state yield, transmissions and software gates.

MS 5.6 Wed 15:30 R 1.020

Ultra-trace analysis of Tc-99 with AMS in environmental samples — •Francesca Quinto[1], Christoph Busser[2], Thomas Faestermann[2], Horst Geckeis[1], José-Manuel Gomez-Guzman[2], Karin Hain[3], Dominik Koll[2], Gunther Korschinek[2], Peter Ludwig[2], Markus Plaschke[1], and Thorsten Schäfer[1] — [1]Institute for Nuclear Waste Disposal, Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]Physics Department, Technical University of Munich, Garching, Germany — [3]Isotope Research and Nuclear Physics, University of Vienna, Vienna, Austria

Tc-99 originating from global fallout, accidents and activities related to nuclear energy production shows environmental levels down to 1E+7 atoms/g (ca. 1.6 fg/g). The analytical capability of determining Tc-99 at such ultra-trace levels offers the possibility to investigate its behavior in a variety of environmental systems. The main limitation to the sen-

sitivity of the mass spectrometric analysis of Tc-99 is the background of its stable isobar Ru-99. For ultra-trace analysis, in addition to a chemical separation of Tc from Ru, the Gas-Filled Analyzing Magnet System (GAMS) at the 14 MV Tandem AMS facility of the Technical University of Munich is greatly effective in suppressing the interference from Ru-99. In the frame of studies on the safe management of nuclear waste, we present our recent results in the analysis of Tc-99 in natural samples and reference materials using AMS.