MS 9: Accelerator Mass Spectrometry and Applications II

Time: Thursday 11:00–12:30 Location: F 442

Invited Talk MS 9.1 Thu 11:00 F 442

Extending the measuring capabilities of AMS — •Robin Golser, Oliver Forstner, Walter Kutschera, Martin Martschini, Alfred Priller, and Stephan Winkler — Universität Wien, Fakultät für Physik, Isotopenforschung, Währinger Str. 17, 1090 Wien

Accelerator Mass Spectrometry (AMS) is the most sensitive method to measure long-lived isotopic species. Although a certain level of maturity and routine has been reached since the beginnings in the 1980ies the strive for smaller sample size, for better sensitivity, for higher accuracy, for more isotopes in a larger mass range continues to be strong. I will focus on the technical side of four recent methodological developments to extend the limits of AMS pursued at the Vienna Environmental Research Accelerator (VERA): microgram samples for C-14 analysis, e.g. in [1], one liter ocean water samples for U-236 analysis, e.g. in [2], searching for super heavy nuclides around A=300, e.g. in [3], and separating isobars by laser interaction, e.g. in [4].

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[1] O. Bergmann et al. Neuron 74 (2012) 634.
[2] S. Winkler et al., EPSL 359-360 (2012) 124.
[3] F. Dellinger et al., Phys. Rev. C 83 (2011) 015801.
[4] M. Martschini et al., Int. J. Mass Spectr. 315 (2012) 55.

MS 9.2 Thu 11:30 F 442

Aktuelle Entwicklungen von CologneAMS — •Stefan Heinze[1], Claus Feuerstein[1], Alfred Dewald[1], Tibor Dunai[2], Steve Binnie[2], Hendrik Wiesel[2] und Janet Rethemeyer[2] — [1]Institut für Kernphysik, Universität zu Köln — [2]Institut für Geologie und Mineralogie, Universität zu Köln

CologneAMS, das Zentrum für Beschleunigermassenspektrometrie an der Universität zu Köln, ist seit Oktober 2011 in Betrieb. Das System wurde unter Berücksichtigung der Möglichkeit, auch schwere Isotope wie Uran und Putonium messen zu können, konstruiert. Bisher wurden hauptsächlich die kosmogenen Standardisotope ^{14}C und ^{10}Be gemessen. Diese Liste wurde um die Isotope ^{26}Al sowie ^{239,240,242}Pu erweitert. Wir präsentieren Messergebnisse aller im Routinebetrieb gemessenen Isotope. Ausserdem diskutieren wir den aktuellen Entwicklungsstand sowie die Möglichkeiten unseres neune Time-Of-Flight-Systems.

MS 9.3 Thu 11:45 F 442

Expanding the actinide capabilities of the compact (0.5 MV) ETH-Zurich AMS system Tandy — •Marcus Christl[1], Johannes Lachner[1], Xiongxin Dai[2], Xiaolin Hou[3], and Hans-Arno Synal[1] — [1]Laboratory of Ion Beam Physics, ETH-Zurich, Switzerland — [2]Atomic Energy of Canada Limited, Chalk River Laboratories, Canada — [3]Center for Nuclear Technologies, Technical University of Denmark

The installation of a second high energy magnet and the utilization of He as a stripper gas significantly improved the performance of the compact AMS system Tandy not only for the actinides. Meanwhile, U-236 and Pu-isotopes are routinely measured at very high sensitivities and at low background levels. Currently, we are expanding our capabilities to more non-traditional AMS nuclides. We intend to further improve the sensitivity of actinide measurements by optimizing chemical preparation methods and by developing robust and rapid detection methods for Np-, Am-, Cm-, and Cf-isotopes at ultra-trace levels. In this presentation, first, an overview over the existing AMS setup and the performance parameters for U- and Pu-isotopes will be given. Second, first sensitivity tests for Np, Am, and Cm will be presented. The first results show that detection limits in the attogram (10^{-18} g) range are achievable for these nuclides. However, a different and, more important, a temporally variable ionization yield for different actinide elements (e.g. Am vs. Cm) in the ion source is observed. This might hamper the application of, for example, a Am-spike to determine the amount of other actinides like Np or Cm in the same sample.

MS 9.4 Thu 12:00 F 442

Ion source memory in ^{36}Cl accelerator mass spectrometry — •Stefan Pavetich[1], Shavkat Akhmadaliev[1], Maurice Arnold[2], Georges Aumaître[2], Didier Bourlès[2], Josef Buchriegler[3], Robin Golser[3], Karim Keddadouche[3], Martin Martschini[2], Silke Merchel[1], Georg Rugel[1], and Peter Steier[3] — [1]HZDR, Dresden, Germany — [2]ASTER, Aix-en-Provence, France — [3]VERA,Vienna, Austria

Since the DREAMS (Dresden Accelerator Mass Spectrometry) facility went operational in 2011, constant effort was put into enabling routine measurements of long-lived radionuclides as ^{10}Be, ^{26}Al and ^{41}Ca. For precise AMS-measurements of the volatile element Cl the key issue is the minimization of the long term memory effect [1]. For this purpose one of the two original HVE sources was mechanically modified, allowing the usage of bigger cathodes with individual target apertures. Additionally a more open geometry was used to improve the vacuum level. To evaluate this improvement in comparison to other up-to-date ion sources, a small interlaboratory comparison had been initiated. The long-term memory effect in the Cs sputter ion sources of the AMS facilities VERA, ASTER and DREAMS had been investigated by running samples of natural ^{35}Cl/^{37}Cl-ratio and samples containing highly enriched ^{35}Cl (^{35}Cl/^{37}Cl > 500). Primary goals of the research are the time constants of the recovery from the contaminated sample ratio to the initial ratio of the sample and the level of the long-term memory effect in the sources.

[1] R. Finkel et al., NIMB 294 (2013) 121.

MS 9.5 Thu 12:15 F 442

Messung von Plutoniumisotopenverhältnissen von CologneAMS; Entwicklung und erste Ergebnisse — •Claus Feuerstein[1], Stefan Heinze[1], Alfred Dewald[1], Tibor Dunai[2], Hendrik Wiesel[2], Keith Fifield[3] und Gregor Zitzer[1] — [1]CologneAMS/Institute of Nuclear Physics, University of Cologne, Germany — [2]Institute of Geology and Mineralogie, University of Cologne, Germany — [3]Department of Nuclear Physics, Research School of Physics and Engineering, Australian National University, Canberra, Australia

CologneAMS, das Zentrum für Beschleunigermassenspektrometrie (AMS) an der Universität zu Köln, ist seit Oktober 2011 in Betrieb; bisher wurden hauptsächlich die kosmogenen Standardisotope ^{14}C und ^{10}Be gemessen. Das System wurde unter Berücksichtigung der Möglichkeit, auch schwere Ionen wie Uran und Plutonium messen zu können, konstruiert. Der Hochenergiemagnet hat ein Massen-Energie-Produkt von 351 AMU MeV und erlaubt so die Detektion von ^{244}Pu^{5+} bis zur maximalen Terminalspannung von 6 MV.

Unser Ziel ist es nun die Plutoniumisotope ^{239}Pu, ^{240}Pu, ^{242}Pu und ^{244}Pu routinemäßig messen zu können. In diesem Report werden wir die Messmethode vorstellen und die Ergebnisse erster Messungen der Isotope ^{239}Pu, ^{240}Pu und ^{242}Pu - vor allem im Hinblick auf Qualität und Reproduzierbarkeit - präsentieren. Um sowohl die Probenaufbereitung als auch die Messung zu überprüfen, wurde das entsprechende Probenmaterial ebenfalls in ANU, Canberra aufbereitet und analysiert. Die Ergebnisse beider Labore werden verglichen.