MS 13: Accelerator Mass Spectrometry and Applications 3

Time: Thursday 17:00–18:30 Location: PH/HS2

Invited Talk MS 13.1 Thu 17:00 PH/HS2

From the Earth to the Stars: AMS a versatile technique in different fields of Science. — •Gunther Korschinek — Physik-Department Technische Universität München, 85748 Garching

Modern AMS (Accelerator Mass Spectrometry) has developed since around 35 years. It started with 14C but soon spread out to long-lived radioactive isotopes of different elements. Most of the AMS facilities at present are dedicated to specific isotopes and their applications. The unique sensitivity of AMS offers applications in rather different scientific fields; from chemistry, physics, and medical science, until geo-science, extra-terrestrial-physics, and astrophysics.

After a historical remark on AMS I will introduce the method with emphasis on AMS at the Munich Tandem facility. Examples that will be discussed:

i. Measurements of 232Th and 238U in ultra clean Cu for low background detectors.

ii. 53Mn (T1/2 = 3.7My) determined in deep ocean ferromanganese crusts reveal an almost constant interplanetary dust flow (originating from the Asteroid-belt and the Kuiper-belt) on Earth during about the last 10My.

iii. 60Fe (T1/2 = 2.62My) measured in ferromanganese crusts suggested a close supernova around 2 to 3My ago. This is now supported by 60Fe determinations in ocean sediments, and in lunar samples.

MS 13.2 Thu 17:30 PH/HS2

Supernova-Produced ^{26}Al and ^{60}Fe in Deep-Sea Sediments — •Jenny Feige[1], Anton Wallner[2], L. Keith Fifield[2], Silke Merchel[3], Georg Rugel[3], Peter Steier[1], Steve Tims[2], Stephan R. Winkler[1], and Robin Golser[1] — [1]University of Vienna, Austria — [2]ANU Canberra, Australia — [3]HZDR, Germany

Massive stars, which end their lives in a supernova (SN) explosion, eject freshly produced nuclides into the surrounding interstellar medium. Among them long-lived radionuclides, that can be deposited into terrestrial archives, if such an event occurs close to the Solar System.
About 100 samples of four deep-sea sediment cores originating from the Indian Ocean were analyzed for their content in the isotopes ^{26}Al and ^{60}Fe for the time range of 2-3 Myr. These nuclides are produced in SNe and the time range corresponds to an ^{60}Fe enhancement observed in a deep-ocean crust sample (Knie et al., 2004). The method used for analysis is accelerator mass spectrometry (AMS), a very sensitive technique for the detection of long-lived radionuclides.
A clear signal of ^{60}Fe throughout the whole measured time period was observed. This observation is in contrast to a narrow peak if originating from a direct input from a single SN. Further, no ^{60}Fe was detected in much older or younger sediment samples. A concurring SN-signal of ^{26}Al is, however, hidden underneath a dominant terrestrial background from continuous atmospheric and in-situ production. The resulting limits on the ratios of ^{60}Fe/^{26}Al were compared to nucleosynthesis models.

MS 13.3 Thu 17:45 PH/HS2

Search for supernova-^{60}Fe in Earth's microfossil record — •Peter Ludwig[1], Shawn Bishop[1], Ramon Egli[2], Valentyna Chernenko[1], Boyana Deneva[1], Thomas Faestermann[1], Nicolai Famulok[1], Leticia Fimiani[1], Jose Manuel Gomez Guzman[1], Karin Hain[1], Gunther Korschinek[1], Thomas Frederichs[3], Marianne Hanzlik[4], Georg Rugel[5], and Silke Merchel[5] — [1]Physik Department, TU München — [2]ZAMG, Wien — [3]Fachbereich Geowissenschaften, Univ. Bremen — [4]Fakultät für Chemie, TU München — [5]HZDR Dresden

Supernova (SN) explosions eject copious amounts of material into the interstellar medium. It is possible that supernova ejecta are incorporated into solar system reservoirs. ^{60}Fe is an ideal isotope to search for such a signature, since it is produced in massive stars and can be ejected in their subsequent SN explosions, and has almost no terrestrial background. For this study, the ratio of ^{60}Fe/Fe was determined with AMS using the GAMS setup in Garching, Germany, in a set of samples extracted from two Pacific Ocean sediment cores of 0 to 7 Ma of age. The Fe samples were obtained using a novel chemical extraction technique targeting specifically magnetofossils, chains of magnetite crystals produced by magnetotactic bacteria, and other small-grained Fe-bearing minerals, to prevent signal dilution. Our findings reveal a ^{60}Fe signature in the age range of 1.8-2.5 Ma, which is attributed to input of SN ejecta.

MS 13.4 Thu 18:00 PH/HS2

Interstellar radionuclides in lunar samples — •Leticia Fimiani[1], David Cook[2], Thomas Faestermann[1], Jose Manuel Gomez Guzman[1], Karin Hain[1], Gregory Herzog[3], Klaus Knie[1,4], Gunther Korschinek[1], Bret Ligon[3], Peter Ludwig[1], Jisun Park[3], Robert Reedy[5], and Georg Rugel[1,6] — [1]Technische Universität München, Garching, Germany — [2]Institut für Geochemie und Petrologie ETH, Zurich, Switzerland — [3]Dept. Chem. & Chem. Biol, Rutgers U., Piscataway NJ, United States of America — [4]GSI, Darmstadt, Germany — [5]Planetary Science Institute,Los Alamos NM, United States of America — [6]Forschungszentrum Dresden-Rosendorf, Dresden, Germany

The enhanced activity of ^{60}Fe found in several lunar samples is a confirmation of the deposition of supernova debris in the solar system. The concentrations of ^{53}Mn and ^{60}Fe were determined in samples originating from three different Apollo missions, by means of accelerator mass spectrometry (AMS).

A local interstellar fluence of ^{60}Fe between 2x10^{7}-4x10^{8} at/cm^{2} is consistent with the findings in a ferromanganese crust from the Pacific Ocean reported by Knie et al [PRL 93, 171103, 2004]. In this talk the results of this work will be summarized, with emphasis on the possible background sources and details on how these were estimated.

MS 13.5 Thu 18:15 PH/HS2

Determination of the Maxwellian averaged cross-section of the reaction ^{35}Cl(n,γ)^{36}Cl — •Stefan Pavetich[1], Shavkat Akhmadaliev[1], Iris Dillmann[2], Shlomi Halfon[3], Tanja Heftrich[4], Franz Käppeler[5], Claudia Lederer[6], Martin Martschini[7], Silke Merchel[1], Michael Paul[8], Rene Reifarth[4], Georg Rugel[1], Peter Steier[7], Moshe Tessler[8], Anton Wallner[9], Mario Weigand[4], and Leo Weissman[3] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Germany — [2]TRIUMF, Canada — [3]Soreq Nuclear Research Center, Israel — [4]Goethe Universität Frankfurt am Main, Germany — [5]Karlsruhe Institut of Technology, Germany — [6]University of Edinburgh, Scotland — [7]Vienna Environmental Research Accelerator (VERA), Austria — [8]Hebrew University of Jerusalem, Israel — [9]Australian National University, Australia

Routine measurements of ^{36}Cl at the Dresden Accelerator Mass Spectrometry (DREAMS) facility have resulted in an astrophysical application: the determination of the Maxwellian averaged cross-section (MACS) of the reaction ^{35}Cl(n,γ)^{36}Cl. As ^{35}Cl acts as a neutron poison in the nucleosynthesis processes during later burning phases of stars, the reaction is important for astrophysical calculations of elemental abundances. The neutron irradiations with a quasi Maxwell Boltzmann spectrum for the production of ^{36}Cl were performed at the Karlsruhe Institute of Technology and the Soreq Applied Research Accelerator Facility. AMS measurements were performed at VERA and DREAMS and are planned at the Australian National University in 2015. Acknowledgement: Alberto Mengoni, CERN.