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Providing Element Selectivity in AMS measurements

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Accelerator Mass Spectrometry (AMS) is the technique of choice for the detection of long-lived radionuclides with typical isotopic abundances of 10^{-12} to 10^{-16} (or 10^{7} atoms per sample) in the environment. Interferences from stable isobars, however, usually restricted the applicability of this method to selected nuclides. The novel Ion-Laser InterAction Mass Spectrometry (ILIAMS) technique at the Vienna Environmental Research Accelerator VERA can overcome this limitation in many cases by highly-efficient isobar removal at eV-energies. In this way, nuclides can be measured for the first time with AMS while others become accessible also on low-energy AMS-systems. This opens up exciting possibilities e.g. in environmental radioactivity research (^{90}Sr, ^{99}Tc, ^{135}Cs) or Earth sciences (^{26}Al, ^{36}Cl, ^{41}Ca).
ILIAMS exploits differences in detachment energies (DE) within isobaric systems by neutralizing anions with DEs smaller than the photon energy via laser photodetachment. In addition, molecular interactions with the buffer gas can further enhance isobar suppression. Thereby, the VERA-facility has recently achieved the most sensitive detection of ^{90}Sr at the 3 attogram level in mg of stable Sr from 300 mL of seawater and 1 g of coral aragonite. Furthermore, the laser-induced suppression of ^{236}U during measurements of ^{236}Np will considerably improve the characterisation of a spike material for the analysis of environmental ^{237}Np. During the last 4.5 years we have intensively studied possibilities of analyzing environmental concentrations of ^{99}Tc with AMS. Complementary to ILIAMS, high-energy AMS was applied using the 14 MV tandem accelerator at the Australian National University (ANU, Canberra). With this method, we determined the ^{99}Tc concentration in selected samples from different environmental reservoirs, including 1 g peat bog samples and 10 L water samples from the Pacific Ocean and European rivers.

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Workshop Themes

Instrument capabilities

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