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Single atom counting with highest sensitivity via AMS

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Accelerator Mass Spectrometry (AMS) is the most sensitive technique for measuring longer-lived radionuclides in our environment with applications ranging e.g. from archaeology, geology, climate research, biomedical applications to nuclear astrophysics and nuclear physics. I will highlight here three examples where AMS has demonstrated an outstanding performance.

-) When and where are the heavy elements produced in nature? Nuclear astrophysics aims to study these nucleosynthesis processes. Some radionuclides are characteristic products of specific cosmic explosions and their detection gives insight into e.g. recent supernova-activity close to the solar system on timescales of millions of years. Actinides, such as ^{244}Pu or ^{247}Cm are products of the enigmatic r-process nucleosynthesis. AMS has recently been successful in identifying spurious traces of these interstellar radionuclides in terrestrial and lunar archives.

-) Man-made actinides and fission products have been spread globally. They mark a characteristic signature that has become an important tool e.g. in environmental science. In particular, isotopic fingerprints are important in nuclear forensics and they allow identifying their source of origin. The anthropogenic Pu signature was discussed as a most promising marker for the Anthropocene. Clearly, the unmatched abundance sensitivity of AMS is a key for many applications utilizing these radionuclides.

-) The abundance of radionuclides is the interplay between production and their radioactive decay. Changes in the environment affect their abundance level. The half-life of a nuclide defines the time window of its applicability. New dedicated AMS systems allow today to generate highly precise data that is important for dating million-year old archives and that is required for understanding the variations of radionuclide concentrations as a consequence of changing environmental conditions.

This presentation will focus on recent major advancements of AMS exemplifying detection sensitivity and background elimination.

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