

ACCELERATOR MASS SPECTROMETRY WITH THE 14 UD PELLETRON

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ABSTRACT

The 14UD Pelletron Accelerator is being utilized as an ultrasensitive mass spectrometer capable of measuring extremely low concentration (down to 10^{-16}) of rare radioisotope not measurable by the decay counting method. The Accelerator Mass Spectrometry (AMS) relies on acceleration the ions to high energies where single ions can be unambiguously identified by mass spectrometry and nuclear detection methods. Several applications of this novel method, have been pionnered over the recent years in our laboratory and include geophysics, geology, hydrology through atomic and nuclear physics. The profile of artificial ^{129}I , injected in the enviroment as a fission product is measured in an ice-core from Greenland. It is planned to measure also ^{36}Cl , ^{41}Ca . The discrimination power of an AMS system can be enhanced by combining the use of a laser with the accelerator. Background negative (e.g. isobars) can be neutralized by detaching their extra electron through interaction with a laser beam with properly chosen wavelength. We have recently studied the case of ^{59}Co , of interest for ^{59}Ni radioisotope detection : a strong suppression of ^{59}Co ions was observed while ^{59}Ni ions were not affected by the laser. By laser photodetachment in negative ions followed by an AMS analysis of residual ions, it is possible to measure electron affinities (EA) for specific negative atomic or molecular ions. Of particular interest is the measurement of the EA of $^{238}\text{U}^-$ and other actinides which have not yet been determined experimentally.