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High-precision mass measurements of exotic nuclides: The 2006 harvest of ISOLTRAP

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In 2006 the mass measurements at the tandem Penning trap spectrometer ISOLTRAP investigated short-lived nuclides relevant for superallowed beta decays, nuclear structure, and nucleosynthesis. After the installation of a new detector [1] and a temperature stabilization system, which improved respectively the precision and the accuracy of the experiment, a new excitation scheme has been successfully applied. Furthermore, for the first time mass selected iron nuclides have been directly studied at ISOLDE.

To contribute to the test of the unitarity of the CKM quark mixing matrix, a mass uncertainty below 1 keV is required. For the 38Ca and 26Al nuclides a new excitation scheme has been applied in order to reach a better precision within the given beam time period. Instead of the quadrupolar radiofrequency (rf) excitation, time separated oscillating fields, known as Ramsey technique, have been used resulting in a reduction of the uncertainty in the cyclotron frequency measurement by a factor of 3 compared to the standard technique within identical experimental conditions and beam time.

For the first time, refractory neutron-rich iron nuclides 61-63Fe were produced in the preparation Penning trap of ISOLTRAP by use of the in-trap decay technique [2]. Mass-selected manganese nuclides 61-63Mn from the ISOLDE target were stored in the preparation trap, waiting for the beta decay towards their iron daughter nuclide. After additional cooling the neutron-rich iron ions were transferred to the precision trap for precise mass determination dm/m in the order of 10-8.

The new techniques developed for high-precision mass experiments and the associated results will be presented together with outcomes from beam times dedicated to the investigation of neutron-rich Cd and Ag nuclides.

[1] C. Yazidjian et al., accepted in Hyp. Int.
[2] A. Herlert et al., New J. Phys. 7, 44 (2005)

Author: Dr YAZIDJIAN, Chabouh (GSI, Atomic Physics Group, Darmstadt, Germany)

Co-authors: Dr KELLERBAUER, Alban (MPI for Nuclear Physics, Heidelberg, Germany); Dr HERLERT, Alexander (CERN, Geneva, Switzerland); Dr GUÉNAUT, Céline (NSCL at Michigan State University, East Lansing, Michigan, USA); Dr LUNNEY, Dave (CSNSM, Orsay, France); Dr BECK, Dietrich (GSI, Atomic Physics Group, Darmstadt, Germany); Dr HERFURTH, Frank (GSI, Atomic Physics Group, Darmstadt, Germany); Prof. KLUGE, H-Juergen (GSI, Atomic Physics Group, Darmstadt, Germany); Dr BLAUM, Klaus (University of Mainz, Institute of Physics, Mainz, Germany); Prof. SCHWEIKHARD, Lutz (University of Greifswald, Institute of Physics, Greifswald, Germany); Mr BREITENFELDT, Martin (University of Greifswald, Institute of Physics, Greifswald, Germany); Mr SAVREUX, Romain (GSI, Atomic Physics Group, Darmstadt, Germany); Mr GEORGE, Sebastian (University of Mainz, Institute of Physics, Mainz, Germany); Dr SCHWARZ, Stefan (NSCL at Michigan State University, East Lansing, Michigan, USA); Mrs HAGER, Ulrike (University of Jyväskylä, Department of Physics, Jyväskylä, Finland)

Presenter: Dr YAZIDJIAN, Chabouh (GSI, Atomic Physics Group, Darmstadt, Germany)

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