SYAM 1 Atomare Präzisionsmassenspektrometrie

Zeit: Montag 10:00–12:00 Raum: HU Senatssaal

Hauptvortrag SYAM 1.1 Mo 10:00 HU Senatssaal

The history of mass spectrometry and the Atomic-Mass Evaluation — •Georges Audi — CSNSM, IN2P3-CNRS, et UPS, Bâtiment 108, F-91405 Orsay Campus, France

After giving the large lines of the history of mass spectrometry, I will develop some general ideas about evaluations in nuclear physics and describe the most prominent features of the Atomic Mass Evaluation (Ame), the reasons for its complexity, how they are faced and solved. I will explain why it was found essential to create the Nubase evaluation and how we finally succeeded in having Ame and Nubase co-ordinated and published for the first time together in December 2003.

Hauptvortrag SYAM 1.2 Mo 10:30 HU Senatssaal

High-Precision Mass Measurements on Radionuclides in Storage Rings and Ion Traps — •H.-Jürgen Kluge — GSI, Darmstadt and Universität Heidelberg

Mass spectrometry is a very well established technique in many disciplines of pure and applied science. In nuclear physics, high-precision mass determinations are important to directly observe nuclear structure effects such as shell closures, pairing, onset of deformation or the limits of nuclear binding. In nuclear astrophysics, the mass of radionuclides is a crucial parameter for reliable calculations of nucleosynthesis processes. Furthermore, highly precise measurements of beta-decay energies are mandatory for nuclear-physics tests of the Standard Model as, for example, the verification of the conserved-vector-current hypothesis or the check of the unitarity of the quark mixing Cabibbo-Kobayashi-Maskawa matrix. In the last decade, new ideas have been realized for high-precision mass measurements of short-lived radionuclides which both use the principle of trapping and cooling. These were pioneered on the small scale of ion traps by setting up the triple-trap mass spectrometer ISOLTRAP at ISOLDE/CERN and on the large scale of storage rings by developing the Schottky and isochronous mass spectrometry for the experimental storage ring ESR at GSI/Darmstadt. In the mean time, a large fraction of all known masses in the chart of nuclei have been determined by both devices, and throughout the world many other Penning trap facilities at accelerators are operational, in the building-up stage, or planned.

Hauptvortrag SYAM 1.3 Mo 11:00 HU Senatssaal

Precision Mass Spectrometry of Rare Isotopes in America — •Georg Bollen — Michigan State University, National Superconducting Cyclotron Laboratory and Department of Physics and Astronomy, East Lansing, MI, USA

Precise masses of nuclides far away from the valley of beta-stability are important for a better understanding of the nuclear many-body system, as input for the modelling of the synthesis of the elements in the universe, and for testing of fundamental symmetries. Penning trap mass spectrometry offers unprecedented accuracy and a very high sensitivity. In America, several Penning trap mass spectrometer projects make use of unique rare isotope production facilities and contribute to the worldwide effort to enhance our knowledge of nuclear binding energies. This talk will give an overview of on-going activities and discuss the perspectives of reaching even more exotic isotopes.

Hauptvortrag SYAM 1.4 Mo 11:30 HU Senatssaal

Theory and predictability of nuclear masses — •Piet Van Isacker — GANIL, BP 55027, F-14076 Caen cedex, France

The status of modern nuclear mass formulas is reviewed. This includes the elementary Weizsaecker liquid drop formula and its up-to-date refinements, such as the finite-range droplet model, as well as more microscopically founded attempts based on Hartree-Fock theory and the shell model. Special attention is paid to the recent suggestion that there might be a limit to the accuracy with which nuclear masses can be calculated in a mean-field approach and that chaotic motion inside the atomic nucleus is responsible for this lack of predictability. In view of the important implications of this claim (e.g., for nuclear astrophysics), its meaning is clarified with an empirical study of more than 2000 nuclear masses. With use of Garvey-Kelson relations, correlations among neighbouring masses are established that are satisfied with an rms deviation of less than 100 keV. This can be considered as a upper limit for the current predictability of nuclear masses.