Atomic Mass Compilations

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The "Atomic Mass Compilation 2012" has been prepared in close collaboration of the II. Phys. Inst., Universität Gießen, the GSI and the Sri Sathya Sai Institute of Higher Learning, India, and is now accessible at "Atomic Data and Nuclear Data Tables" [1].
Compilations of (elemental) atomic masses have been established ever since the beginning of the 19^{th} century [2]. One of the most recent ones has been published in the Landoldt-Börnstein New Series [3], but is rarely available in scientific libraries. Therefore we started a new compilation to be published in a peer-reviewed journal accessible in most scientific institutions.

German precursors

From 1921 to 1945, the "Deutsche Atomgewichts-Kommission" (see, e.g. [4]) published annual reviews on recent experiments on atomic masses and compilations of elemental and isotopic masses [5]. Since 1932, these reports were prepared by the "Kaiser-Wilhelm-Institut für Chemie" [6]. Gradually the preponderant experimental methods shifted from chemical to physical techniques. Mass spectroscopy was represented at the Kaiser-Wilhelm-Institut by the team of J. Mattauch. *[One of the post-docs was Heinz Ewald, later the first director of the II. Phys. Inst. in Gießen* [1]*. He was involved in the construction of instruments like LOHENGRIN and OSTIS in Grenoble and SHIP at GSI, installations which yielded many contributions to atomic mass determinations.]*
After WWII, the study of atomic masses was continued at the Max-Planck-Institut für Chemie. The mass compilation published in 1949 [7] included also the recent american results on nuclear properties, which were made available to Mattauch by G.T. Seaborg as preprint of the "Table of Isotopes" [8].
In 1960, the group of Mattauch in collaboration with A.H. Wapstra published the first edition of the "Atomic Mass Evaluation" [9]. After the retirement of Mattauch in 1965, the work was directed first by Wapstra and later on by G. Audi. The last edition [10] had been prepared by an international collaboration including the GSI and the II. Physik. Inst.

[1]Two of the authors, U.C.and B.P., were admitted to the institute by Prof. Ewald.

Follow-up work in preparation

The information contained in the mass tables can be displayed in plots of the binding energy (or mass) versus Z, N or A. Any plots of derivatives of the binding energies (meaning a specified difference between the binding energies of two nearby nuclides) show a smooth behaviour and have in addition the advantage of displaying much smaller variations. In [11], two representative examples for such graphs of double β-decay energies and two-neutron separation energies, respectively, are displayed, clearly showing the trends in the mass surface.
Thus, dependable estimates of unknown , poorly known or questionable masses can be obtained. It is foreseen to use such graphs for more dependable extrapolations of masses toward the drip lines and also to test theoretical models.

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