

2. 6. 2 Japanese Activity on Nuclear Structure Data Evaluation

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A brief review of evaluation works on nuclear structure data in Japanese through 1965 is given chronologically. Main activities in Japan are as follows: (1) contribution to ENSDF through 1979 by the JNDC-ENSDF working group, (2) evaluation of the decay data for estimation of decay heat of the shutdown nuclear reactor, and (3) Prediction of band-structure in excited state of non-rotational nuclei.

Introduction

Good and enough experimental data on nuclear structure bring good evaluation. Best compilation of experimental data is the Evaluated Nuclear Structure Data File (ENSDF)* at present. Unfortunately, experimental information on nuclei has its limit, because available accelerating particles, targets and detectors have some limitations. As the results, experimental data have many missing parts. On the other side, there are many users of evaluated data whose does request completeness for any data. Work as filling up missing parts of experimental results is based on extrapolation and/or interpolation on properties of nuclei. Of course, systematics on nuclear properties through several mass region also are used as means. But each nuclide is a considerably individual one and method of systematics is not success at any time. However, the method is correctly attractive one to study of nuclear properties.

* Evaluated Nuclear Structure Data File, a computer file of evaluated experimental nuclear structure data maintained by the National Nuclear Data Center, BNL, USA.

Data accumulation

The first edition of Table of Isotopes, a data book on decay properties of nuclides, was published on the Journal "Review of Modern Physics" in 1940, and it contained only 17 pages. Subsequent nuclear experiments have accumulated abundant and more accurate results for nuclear properties with advent of particle accelerators as well as NaI(Tl) and Germanium detectors. Then, its 7th edition published in 1978 occupies almost 1500 pages. The number of pages in the next edition of the book may be over 3000. K.Way and E.P. Wigner¹⁾ had calculated decay heat of the shutdown reactor and compared with experimental results in 1948. In later year, Way came to edit a journal devoted to compilations and evaluations of experimental and theoretical results in nuclear physics. It is sure that she had been quite

conscious of needs for data compilations through works on decay heat calculation. Way published the first issue of Nuclear Data A (former to Atomic and Nuclear Data Tables) in 1965 and Nuclear Data B (former to Nuclear Data Sheets) in 1966. We could find the name of R. Nakasima (Hosei Univ.) and M. Yamada (Waseda U.) in members of the board of editors of Nuclear Data B. H. Ikegami (Osaka Univ.) was also listed as one of those in Nuclear Data A. It connotes that our Japanese researchers have concerned with compilation and evaluation of nuclear data through the beginning the data work.

Decay data evaluation

In 1965, the Japan Atomic Energy Research Institute (JAERI) was established. Japanese Nuclear Data Committee (JNDC), operated jointly by JAERI and Atomic Energy Society of Japan, has started its activities in 1963. M. Yamada (Waseda Univ.) and his collaborators proposed the gross theory²⁾ of the beta decay in 1969 and calculated beta-strength function. They³⁾ also predicted the half-lives of beta emitted nuclides including those far from the beta stable line by the theory. It is obvious that the theory base on the compilation of decay data. In 1974, JNDC has organized a working group for evaluation of decay heat from the shutdown reactor. The group built up a first file of the decay data on fission products from ENSDF in 1981. This file, so called the JNDC FP decay file, included also beta-ray intensities⁴⁾ evaluated with the aid of the gross theory. Then, the group has proposed the recommended values of decay heat calculated using with the file in 1989. The final report of the group was published with some corrections and additions from direct measurements in 1990⁵⁾.

In 1976, IAEA Nuclear Data Section has established an international network supporting ENSDF and related works. This work is called mass chain evaluation. By the way, evaluation based on systematics is called horizontal one. The JNDC-ENSDF group has participated to the network through 1977 and done share of evaluation and entry of data in mass region $A=118-129$. The journal "Nuclear Data Sheets" had published the first evaluation work by our group on the issue of 1979⁶⁾.

A. Hashizume (RIKEN) published the first Japanese nuclear wall chart in 1970, and the first edition⁷⁾ of JAERI's wall chart compiled by Y. Yoshizawa, et al. (Univ. Hiroshima) was published in 1976. The later has been published for each four year. Its "sales point" is that nuclides are classified with half-life, and that calculated values for unmeasured half-lives of nuclides far from the beta stable line are given using with the Yamada's gross theory.

Horizontal evaluation

In a sense, the calculation of beta-decay half-lives by Yamada et. al. can be regarded as evaluation. A large accumulation of data does stimulate some bird-view of data, and enable to reveal common properties in nuclides in some mass region, i.e., systematics of properties. By

discover of systematics we can expect to light up some hidden nuclear properties. In 1967, M.Sakai (INS, Univ. Tokyo)⁸⁾ predicted the existing of rotational band-like structure (so called quasi-band) in vibrational nuclei as well as spherical nuclei. He said the idea of the quasi-band created in staying at BNL, USA. His works are clear to base on abundant accumulated data, i.e., ENSDF. M.Yamada⁹⁾, together with Gove, studied systematics on separation energy of neutron and proton in 1968.

Concluding remarks

Basic work on data evaluation is comprehensive collection of experimental data first of all. Recent works in experimental nuclear physics have shifted to in-beam spectroscopy with heavy ion, and studies for static nuclear decay are very few. This is undesirable situation for data compilation on nuclear structure. Data entered in ENSDF is still not sufficient. Precision of data, for example that of intensities for ground-state beta-radiations from the radioactive decay, is also not enough. We expect many young researchers to commit studying such problem, although these are not most topical and academic objects. Activity of our old evaluator comes gradually to decay. we welcome young generation to participate the work on evaluation and compilation of nuclear structure data.

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