# Progress Report on Argonne Nuclear Data Activities

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## I. Nuclear Data Compilation and Evaluation

### I.1 Nuclear Structure and Decay Data

Argonne's Nuclear Data Program is actively involved with evaluations of nuclear structure and decay data for the International Nuclear Structure and Decay Data (INSDD) network. At the last USNDP meeting ANL was assigned evaluation responsibilities for the A=199-209 mass chains. The up-to-date status of these evaluations is presented in Fig. 1. Our ultimate goal is to make these mass chains current in the next 3-4 years. A full evaluation of the A=177 mass chain has been completed, reviewed and published in *Nuclear Data Sheets*. Mass A=205 evaluation has been completed and submitted to NNDC for review. From the middle of September, we have started working on the A=203 mass chain evaluation with the intention to complete it in the first half of next year.

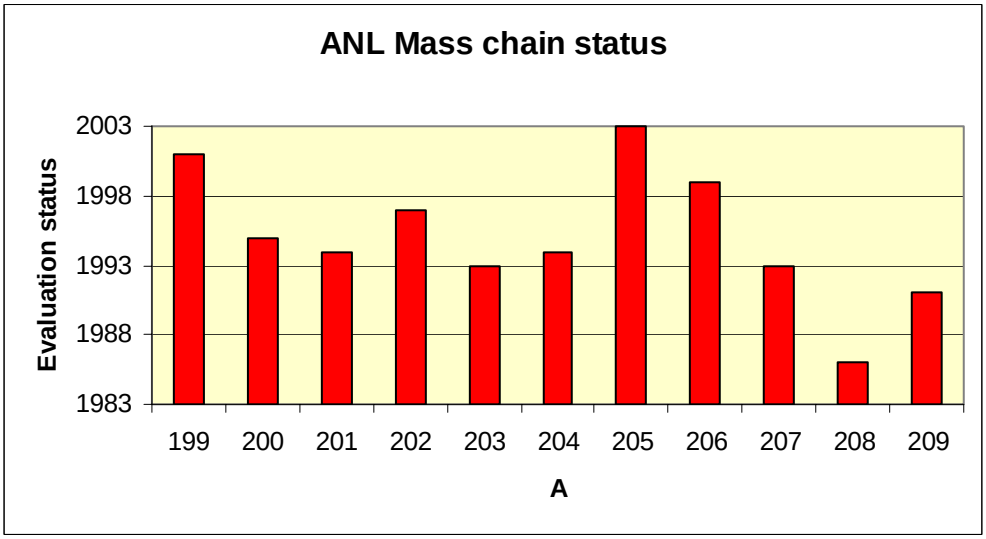


Figure 1. Status of the ANL mass chain evaluations. A=208 is currently being evaluated by M. Martin (ORNL).

Argonne is also involved in reviews of selected evaluations submitted by members of the INSDD network for publication in ENSDF and *Nuclear Data Sheets*. Reviews of "*Table of Superdeformed Bands and Fission Isomers"* and A=179 mass chain were completed during FY02 and FY03. ANL is also contributing to the activities of the Decay Data Evaluation Project (DDEP). An evaluated decay dataset for $^{177}$Lu, a nuclide that is important to medical applications, was submitted to the Chairman of the Decay Data Evaluation Project, reviewed and published. Evaluation of decay properties of the $K^{\pi}=16^{+}$, $T_{1/2}$=32y isomer in $^{178}$Hf is nearly completion. The review of the DDEP evaluation of $^{204}$Tl has been completed and that for $^{240}$Pu is currently ongoing. Argonne continued to contribute to the special (horizontal) evaluation of properties of nuclear isomeric states in deformed nuclei in the A = 180 mass region. Evaluations for all Hf (Z=72) isotopes are nearing completion. Our program is also involved in limited experimental nuclear structure and decay activities that are conducted mainly at the ATLAS facility, ANL. Some of the results from this effort have already been published in scientific journals and submitted to the appropriate data centers for inclusion in the ENSDF, and XUNDL databases. Some unpublished data were also made available to members of the INSDD network for inclusion in ENSDF and XUNDL. We are also developing a method that can be used to determine the half-life of very long lived nuclides with a high accuracy. Data on $^{239}$Pu, $^{245}$Cm and $^{246}$Cm are currently being analyzed. This work is performed in collaboration with a scientist (I. Ahmad) from the Physics Division, ANL.

**I.2 Nuclear Reaction Data**

The ongoing project of compiling and evaluating (p,$\alpha$) and (p,$\gamma$) data for $^{31}$P (in collaboration with Hiram College) neared completion. The only task remaining is to finalize the evaluation of the resonance parameters and to use them in calculating the resonance reaction rate component. An ANL/NDM report on this work has been prepared and needs only a few additional components in order to be complete.

A paper dealing with methods for representing and propagating large errors in nuclear data was completed and published in *Nuclear Instruments and Methods in Physics Research **A***. The main conclusion from this work was that deterministic procedures have to be abandoned in the calculation of derived quantities when uncertainties are large. Instead Monte Carlo simulation methods have to be employed, and the random variables involved (inherently positive) should be represented by lognormal distributions. We have developed a rigorous method for specifying confidence intervals. This work has shown that for very large uncertainties, one must abandoned the concept of specific values and error bars. Instead, a completely probabilistic approach must be taken – consistent with earlier findings – and results must be specified in terms of confidence intervals. A manuscript has been submitted to *Nuclear Instruments and Methods in Physics Research **A*** and an extended ANL/NDM report on this work has been published.

Argonne continued to participate in the IRMM, Geel collaboration on neutron activation cross sections, under the auspices of the Nuclear Energy Agency WPEC Subgroup 19 project. Argonne's principal contribution during this period was to prepare several

EXFOR files for nuclear activation cross sections measured at Geel and Juelich. Since these results were generated in Europe, the compiled data files were transmitted to the NEA Data Bank for checking and entering into the archives.

### I.3 USNDP Organization activities

Argonne organized and chaired the Measurement and Basic Physics Committee meeting at CSEWG meeting in November 2002. Argonne organized and hosted the annual OECD/Nuclear Energy Agency Working Party for International Evaluation Cooperation (WPEC) meeting in Coronado, California. Argonne served on the "Conventional Explosive and Weapon Detection" working group at the DOE/NP Workshop on the Role of the Nuclear Physics Research Community in Combating Terrorism. Argonne is currently serving on the organization committee of the 2004 International Conference on "Nuclei at the Limits" and on the program committee of the 2004 International Conference on "Nuclear Data for Science and Technology".

## II. Data Dissemination

Argonne continues to develop, update, and maintain the ANL Nuclear Data Measurement Report Series, ANL Nuclear Data Information, and Experimental Resources for Nuclear Data Web sites.

## III. Publications (FY2002-present)

25 articles were published in scientific journals; 52 contributed papers and abstracts were published in conference and technical meeting proceedings; 6 invited presentations were given at national and international conferences and technical meetings, and at university seminars.