



NUCLEAR DATA PROJECT EVALUATION ACTIVITY REPORT *

October 1998 -October 2000

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This report summarizes the activities of the ORNL Nuclear Data Project since the IAEA Advisory Group meeting in December 1998. The group's future plans are also included.

The ORNL Nuclear Data Project's responsibility includes the compilation/evaluation of astrophysics data, as well as the evaluation and compilation of nuclear structure data. The Nuclear Data Project, therefore, is composed of two groups. The Nuclear Data Project staff through September 2000 is listed below. Accomplishments for the period of October 1998 through September 2000 of the nuclear structure data group and the nuclear astrophysics group are submitted in this Nuclear Data Project report.

October 1998 October 2000 Nuclear Structure Group Nuclear Astrophysics Group



Professional Staff:

- Yurdanur Akovali (50%)
- Jeff Blackmon (20%)
- David Radford (10%)
- Michael Smith (20%)

Technical Support:

- Mary Ruth Lay (50%)#

Nuclear Structure Data Evaluations

Completed Work

Evaluations of nuclear structure data pertaining to all nuclei with mass numbers 248, 252, 256, 260, 264, 224, and 249 - 265 odd-mass nuclei have been completed, and adopted data, levels, spin, parity and configuration assignments are presented in the following publications:

- Nuclear Data Sheets for A=248, 252, 256, 260 and 264, Nucl. Data Sheets 87, 249 (1999).

Through May 2000. Effective June 2000, it is reduced to 0%.

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- Nuclear Data Sheets for $A=249 - 265$ (odd), Nucl. Data Sheets 88, 155 (1999).

Evaluations of nuclei with mass numbers 254, 258, 262, and 266 have been completed and submitted to the Brookhaven National Laboratory National Nuclear Data Center for publication. These evaluations have not been reviewed.

About 80% of the evaluations of $A=250$ nuclei are completed.

The evaluation of $A>267$ nuclei were reviewed.

Work in Progress

It is estimated that evaluations of $A=250$ nuclei will be finalized before December 2000.

Nuclei with odd-mass numbers 215, 219, 223 and 227 are being reviewed.

Future Plans for Nuclear Structure Evaluations

The nuclear structure and decay data for $A=242$ nuclei are planned to be evaluated in 2001.

As an integral part of ORNL's forefront research program in nuclear structure physics, the nuclear structure data evaluations will be extended to horizontal evaluation of nuclear states with the purpose of providing a guide to researchers and evaluators and as a means of gaining new insight into nuclear structure.

Nuclear-structure information for nuclei important to current research programs, in particular for nuclei in the far-from-beta-stability regions on both the neutron- and the proton-rich sides, will be evaluated.

Database and Web Interface Development and Experimental Nuclear Structure Data Compilation (XUNDL)

Our programs for nuclear structure database development and dissemination provide a modern and efficient user access to the nuclear data, and for semi-automatic conversion of journal articles and other data sources into ENSDF-format data bases.

Accomplishments

A FTP/WWW server site on the ORNL Physics Division local area-network was set up for compilation and distribution of nuclear-structure data. The data on this site are in the "Graphical Level Scheme" format. Members of experimental nuclear structure community are encouraged to contribute their own data by anonymous FTP. Contributed data use the same format, accompanied by additional information describing the experiment(s) that generated the level scheme, the names and institutions of the researchers involved, and references to any publications of the data. Contributed data are checked for internal consistency.

Software for semi-automatic extraction of tabular level-scheme data contained in PDF manuscripts into ENSDF-format data sets has been developed, and is now in extensive use as a production tool for data to be included in XUNDL, at ORNL and McMaster. Documentation has been written, and is available at <http://radware.phy.ornl.gov/t2e.html>.

A selection of RadWare-format level schemes created from ENSDF files, by means of a conversion program, have also been placed on the site with the intent of generating a displayed level scheme. The response of RadWare users (nuclear structure experimentalists) has been very encouraging, with an average of about three file retrievals per day.

On-line conversion of selected data sets from ENSDF-format to RadWare format was developed to replace the present archive of ENSDF-converted schemes.

Future Plans

We will continue to participate in the NNDC Common Web Interface working group. This initiative aims to improve the consistency of the data dissemination web interface at different NNDC sites, to provide more modern, efficient and consistent user access to the nuclear structure data.

Some further development of the software for semi-automatic extraction and conversion of tabular level-scheme data contained in PDF manuscripts into ENSDF-format data sets, will be done to extend its applicability, and to make it more robust and easier to use. During the course of this development, ENSDF-format data sets will be created from published papers for testing purposes, and for the XUNDL database.

The compilation and electronic dissemination of most recent data on reaction gammas will be done continuously as data become available. Upkeep of the RadWare database will be continued.

Other types of data that could be automatically or semi-automatically converted to XUNDL datasets will be investigated; these may include user-contributed level schemes in various formats.

Nuclear Reaction Evaluations for Astrophysics

Evaluations are being made of nuclear reactions and structure properties important to understanding stellar explosions, the interior of our sun, and other phenomena in nuclear astrophysics. Special attention is focused on reactions on radioactive isotopes that will be measured in the near future at facilities such as ORNL's Holifield Radioactive Ion Beam Facility. The results are put into formats requested by astrophysics community and distributed over the WWW.

Accomplishments

A web-site, which disseminates the rates of nuclear reactions important to nuclear astrophysics has been updated. This site includes plots, tabular values, FORTRAN equations, temperature derivatives, downloadable subroutines, and a graphical search engine for 180 reactions and their inverses. Evaluations were made of the $^{14}\text{O}(\alpha,p)^{17}\text{F}$ and $^{17}\text{F}(p,\gamma)^{18}\text{Ne}$

nuclear reactions which have been measured at ORNL's HRIBF and are important for stellar explosions.

Work in Progress

We are currently evaluating the $^{18}\text{F}(p,\gamma)$ and $^{18}\text{F}(p,\alpha)$ reactions, which will also be measured at HRIBF, and the $^{17}\text{O}(p,\gamma)$ and $^{17}\text{O}(p,\alpha)$ reactions important for understanding the evolution of Red Giant Stars.

Future Plans

Evaluations of the $^{18}\text{F}(p,\gamma)$ and $^{18}\text{F}(p,\alpha)$ reactions, important for stellar explosions, and $^{17}\text{O}(p,\gamma)$ and $^{17}\text{O}(p,\alpha)$ reactions, important for understanding the evolution of Red Giant Stars, will be completed. Evaluated cross sections for the 19 reactions important for the solar neutrino problem will be converted into reaction rates, parameterized, and compared to analytical approximations and to other rate evaluations. Additionally, evaluations of capture reactions on radioactive isotopes such as ^{33}Cl , ^{25}Al , and ^{26}Si will be started to help understand stellar explosions and support the HRIBF experimental program.

Recent Papers

M.S. Smith et al., "Recent Nuclear Astrophysics Data Activities in the U.S.", in Proc. 10th Int. Symp. On Capture Gamma-Ray Spectroscopy and Related Topics, ed. S. Wender, American Inst. Physics, New York, p.243, 2000.

M.S. Smith et al., "Nuclear Astrophysics Data at ORNL", in Nuclei in the Cosmos V, eds. N. Prantzos, S. Harissopulos, Editions Frontieres, Paris, p. 497, 1998.