

Japan Nuclear Reaction Data Centre (JCPRG)

Progress Report

JCPRG Steering Committee
Faculty of Science, Hokkaido University

IAEA's Technical Meeting on the International Network of Nuclear Reaction
Data Centres
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0. General

In this report, we give a brief review of the activities carried out by the "Japan Nuclear Reaction Data Centre (JCPRG)" since the last NRDC meeting in 2009. The main subjects of our activities are; (1) reaction data compilation, (2) evaluation of the astrophysical nuclear reaction data for light nuclei, and (3) cooperation of nuclear data activities in Asia. Our activities in detail are as follows.

- a) New reaction data compilation (NRDF and EXFOR)
- b) Conversion of old NRDF to EXFOR
- c) Bibliography compilation (CINDA)
- d) Evaluation of astrophysical nuclear reaction data based on theoretical calculations for light nuclei
- e) Collaboration among nuclear data physicists in Asia for the EXFOR compilation to form a stable base
- f) Database maintenance and services (NRDF, EXFOR/ENDF and CINDA)
- g) Development of software systems (GSYS)
- h) Customer services

0.1 Staff

Our activities have been carried out by 7 members (4 postdoctoral researchers, 1 graduate student and 2 technical staff). They have been supervised by the JCPRG Steering Committee, which consists of 10 senior researchers (9 nuclear physicists and 1 information scientist). Those activities have been supported by 2 secretaries. The centre also has close cooperation with the Nuclear Data Center (Drs. J. Katakura, K. Shibata

and S. Chiba) at JAEA and the nuclear experimental groups (Drs. H. Sakurai and T. Motobayashi) at RIKEN.

0.2 Budget

We have no regular budget. In 2010, 5 million JPY was allocated for Asia Africa Science Platform Program by Japan Society for the Promotion of Science (JSPS).

1. Reaction Data Compilation

1.1 NRDF

From April 2010 to March 2011, CPND and PhND in 50 new references have been compiled for NRDF. The data are released at the JCPRG website.

1.2 EXFOR

Since the last NRDC meeting, we have made 75 new entries and have revised or deleted 59 old entries. These were transmitted as 10 trans files (E062-E065, K006-K010, J009) to the NDS open area.

JCPRG is grateful for valuable comments from Naohiko Otsuka (NDS) and Emmeric Dupont (NEA-DB) and Vladimir Varlamov (CDEF).

Table 1. EXFOR E-entries sent from JCPRG to NDS IAEA.

TRANS	TRANS Status	ENTRY Tot.	ENTRY New	ENTRY Rev.
E062	Final (2010/6/5) *	15	7	8
E063	Final (2010/9/3)	26	11	15
E064	Final (2011/2/1)	17	11	6
E065	Prelim. (2011/4/4)	42	21	21

*The Prelim. file had been transmitted before the last NRDC meeting.

Table 2. EXFOR K-entries sent from JCPRG to NDS IAEA.

TRANS	TRANS Status	ENTRY Tot.	ENTRY New	ENTRY Rev.
K006	Final (2010/6/5) *	3	1	2
K007	Final (2010/6/5) *	7	1	6
K008	Final (2010/9/3)	3	2	1
K009	Final (2010/11/10)	12	12	0
K010	Final (2011/5/2)	8	8	0

*The Prelim. files had been transmitted before the last NRDC meeting.

Table 3. EXFOR J-entries sent from JCPRG to NDS IAEA.

TRANS	TRANS Status	ENTRY Tot.	ENTRY New	ENTRY Rev.
J009	Final (2010/9/3)	1	1	0

2. CINDA Data Compilation

We prepare CINDA batches for CPND published in Japan every year. From April 2010 to March 2011, one regular batch (26 added lines and 0 deleted lines) was prepared and sent to NEA-DB (Reader code J).

It covers the issues of 4 Japanese journals, JPJ(Vol.79 (1)-(12), Vol.80 (1)-(4)), PTP(Vol.123 (1)-(6), Vol.124 (1)-(6), Vol.125 (1)-(4)), NST(Vol.47 (1)-(12), Vol.48 (1)-(4)) and JNRS(Vol. 10 (2), Vol.11 (1)-(2)).

3. Nuclear Data Evaluation

Construction of a new database for the evaluations of astrophysical nuclear reactions based on theoretical calculations is in progress. We call this database as Nuclear Reaction Data Files for Astrophysics (NRDF/A). In the first version of NRDF/A (2006), we have assembled only 31 reactions for nuclei from C to Mg. In the second version (2008), the astrophysically important light nuclei up to Si are included to achieve the coverage for NACRE. As a result, the number of reactions to be compiled is 183. The NRDF/A of the bibliographic information for these reactions is now open as a Web page: <http://www.jcprg.org/nrdfa/>.

From 2009, a new version of NRDF/A including physical quantities has been developed. In 2010, we updated bibliographic information (17 photonuclear reactions including 387 data) and 2 data files (5 proton-induced reactions including 7 data listed in Table. 4).

Table 4. Lists of new theoretical and experimental data compiled in NRDF/A.

Reaction	Exp.	Theor.
$^{25}\text{Al}(p,\gamma)^{26}\text{Si}$	1	0
$^2\text{H}(p,\gamma)^3\text{He}$	0	1
$^7\text{Li}(p,\gamma)^8\text{Be}$	0	1
$^9\text{Be}(p,\gamma)^{10}\text{B}$	0	1
$^{11}\text{B}(p,\gamma)^{12}\text{C}$	0	1
Total	1	4

Physical Quantity	Exp.	Theor.
s-factor	1	0
Reaction rate	0	5
Resonance energy	1	0
Proton partial width	1	0
Total	3	5

4. System Development

4.1 Database Search System

- NRDF (<http://www.jcprg.org/nrdf/>)
- NRDF/A (<http://www.jcprg.org/nrdfa/>)
- EXFOR/ENDF (<http://www.jcprg.org/exfor/>)
- CINDA (<http://www.jcprg.org/cinda/>)

4.2 Coding Software

- NRDF/EXFOR editor "HENDEL" (<http://www.jcprg.org/manuals/hendel/>)
- Digitization System "GSYS" (<http://www.jcprg.org/gsys/>)

4.3 XML format for nuclear reaction data

We constructed an automatic conversion program for an XML format of "Nuclear Reaction Data File" (XNRDF). XML is easy to extend and support some applications. Therefore we expect that XNRDF is useful for development of our database system and applicable to IntelligentPad technology.

5. Asian Collaboration

From October 25 to 29, 2010, the AASPP 1st Asian Nuclear Reaction Database Development Workshop was held in the Hokkaido University. The workshop was organized as a part of the Asia-Africa Science Platform Program (AASPP) of the Japan Society for the Promotion of Science (JSPS).

The workshop was the first event to be attended by representatives of nuclear reaction data centres in Asia (Japan, China, India and South Korea) that are members of the International Network of Nuclear Reaction Data Centres (NRDC). The session was designed to strengthen collaboration among nuclear reaction data centres in Asia and promote the dissemination and improvement of data compilation techniques.

The workshop covered the analysis of the present status of nuclear data collection and compilation in Asia. Technical issues involved in data compilation were also discussed from the viewpoints of nuclear physics and information science.

The directors of the nuclear reaction data centres in Asia also met in the workshop and agreed to bolster partnerships among their institutions and promote

personnel exchanges. They also decided to hold the next meeting in Beijing, China. Through these activities, close cooperation is to be developed among researchers involved in the data collection in Asia and the JCPRG, and these relationships are expected to continue in the future.

6. Others

6.1. Presentations in meetings

At August 6, 2010, JCPRG and RIKEN Nishina Center had a RIKEN Mini-Workshop at RIBF Facility to understand the present status of compilation done by JCPRG and discuss future plan of the research contract. In the workshop, we agreed to develop the relationship between JCPRG and RIKEN Nishina Center and to make the communication about how to compile the reaction data of unstable nuclei smooth by putting the contact persons at each center.

The Tours Symposium on Nuclear Physics and Astrophysics VII was held in Kobe, Japan on November 16-20, 2009. Kato had a talk of "Nuclear Reaction Data File for Astrophysics (NRDF/A) in Hokkaido University Nuclear Reaction Data Centre", which was published as a paper in the AIP Conference Proceedings, 1238, 199-204 (2010).

In the 2nd International Ulaanbaatar Conference on Nuclear Physics and Applications (Ulaanbaatar, Mongolia, July 26-30, 2010), D. Ichinkhorloo had a talk of, " ${}^6\text{Li}+n$ Reactions in the Continuum Discretized Coupled Channels method", and T. Matsumoto also presented a paper of "New description of four-body breakup reaction".

6.2. Publication of NRDF Annual Report

The "NRDF Annual Report 2009" was published and distributed. The pdf file is available on the JCPRG website. We are now writing the manuscripts of the "NRDF Annual Report 2010" which will be published in near future.