

Japan Nuclear Reaction Data Center (JCPRG)

Faculty of Science, Hokkaido University

Steering Committee

Progress Report to the
IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres
20-23 April, 2010

0. General

In this report, we give a brief review of the activities carried out by the “Japan Nuclear Reaction Data center (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. In more detail we have pursued the following works:

- ① New reaction data compilation (NRDF and EXFOR),
- ② Conversion of old NRDF to EXFOR,
- ③ Bibliography compilation (CINDA),
- ④ Evaluations of astrophysical nuclear reaction data based on theoretical calculations for nuclei from C to Si,
- ⑤ Collaborations among nuclear data physicists in Asia for the EXFOR compilation to form a stable base,
- ⑥ Database maintenance and services (NRDF, EXFOR/ENDF and CINDA),
- ⑦ Development of software systems (GSYS),
- ⑧ Customer services.

0.1 Staff

Our activities have been carried out by 11 members (6 postdoctoral researchers, 2 graduate students and 3 technical staff). They have been supervised by the NRDF Steering Committee, which consists of 9 senior researchers (8 nuclear physicists and 1 information scientist). Those activities have been supported by 3 secretaries. The center also has close cooperation with the JAEA Nuclear Data Group (Drs. J. Katakura, K.

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

0.2 Budget

As the regular JCPRG budget ended at March 2001, we have no regular budget. In 2009, 9 million JPY was allocated for Astrophysical nuclear data by Japan Society for the Promotion of Science (JSPS).

1. Reaction Data Compilation

1.1 NRDF

From April 2009 to March 2010, CPND and PhND in **82 references** have been newly compiled for NRDF. The new data will be are released at the JCPRG web site. .

1.2 EXFOR

Since the 2009 NRDC meeting, we have made **79 new entries** and have revised or deleted **46 old entries**. These were transmitted as 7 trans files (E059-E062, K006-K007, J008) to the NDS open area. JCPRG is grateful for valuable comments from Svetlana Dunaeva (NDS) and Emmeric Dupont (NEA-DB).

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

TRANS	TRANS Status	ENTRY Tot.	ENTRY New.	ENTRY Rev.
E059	Final	25	7	18
E060	Final	55	55	0
E061	Final	19	7	12
E062	Prelim	15	7	8

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

TRANS	TRANS Status	ENTRY Tot.	ENTRY New.	ENTRY Rev.
K006	Prelim	3	1	2
K007	Prelim	7	1	6

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

TRANS	TRANS Status	ENTRY Tot.	ENTRY New.	ENTRY Rev.
J008	Final	1	1	0

2. CINDA Data Compilation

We have prepared CINDA batches for CPND published in Japan every year. Each batch covers 6 issues of each of 4 Japanese journals JPJ, PTP, NST and JNRS. Since the 2009 NRDC meeting, one regular batch (39 added lines and 0 deleted lines) were prepared and sent to NEA-DB (Reader code J).

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 31 reactions for nuclei from C to Mg. In the second version (2008), the astrophysical 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 on Web page: <http://www.jcprg.org/nrdfa/>.

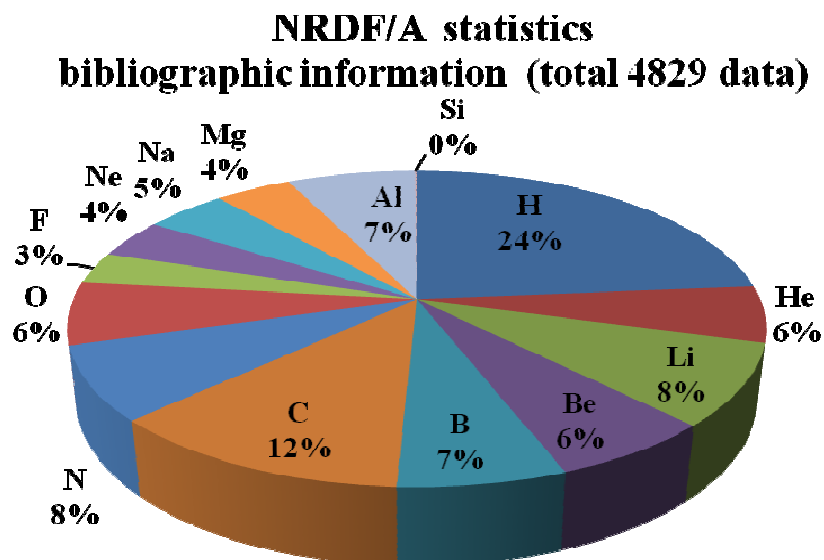
In 2009, a new version of NRDF/A including physical quantities has been accomplished. In Table 4 and Fig.1, the data compiled so far are shown.

Table 4. Lists of new theoretical and experimental data compiled in NRDF/A.
Figures are numbers of files.

Reaction	Exp.	Theor.
$d(^3\text{He},p)^4\text{He}$	3	0
$^3\text{He}(d,p)^4\text{He}$	1	0
$^3\text{He}(\alpha,\gamma)^7\text{Be}$	2	0
$^9\text{Be}(p,\gamma)^{10}\text{B}$	1	1
$^9\text{Be}(p,\alpha)^6\text{Li} +$ $^9\text{Be}(p,d)^8\text{Be}$	1	0
$^9\text{Be}(p,\alpha)^6\text{Li}$	2	1
$^9\text{Be}(p,d)^8\text{Be}$	1	0
Total	11	2

Phys. Quant.	Exp.	Theor.
s-factor	11	1
cross section	2	0
reaction rate	0	1
Total	13	2

Fig.1. Percentages of bibliographic data for every element included in NRDF/A.



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 Cording 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 highly appreciate the presentation by Mr. Zerkin of the new database format in the workshop held in Sapporo on 16-19 March, 2009. Based on the discussions, we started to develop a new format of NRDF using XML and to apply IntelligentPad technology for various utilities of database systems.

4.4 New version of the digitization system GSYS

User-friendliness is a notable advantage of the GSYS system. Strengthening this advantage, we have developed the new version of GSYS, which will be opened on our home page.

5. Asian Collaboration

Recently, studies on nuclear science in Asian countries are rapidly progressing, and many accelerators in these countries are in service, obtaining experimental reaction data [A. W. Thomas (chair), IUPAP Report **41**, "Research Facilities in Nuclear Physics"]. So far, however, there have not been other Asian data centers than JCPRG, compiling new experimental data measured in their countries on a stable base. It now is a good time to investigate problems in compilation of data in Asian countries for the EXFOR library and to have a more active collaboration between nuclear data researchers in Asian countries. In this year (2010), we get a JSPS budget to develop collaboration in the nuclear data activities among Asian countries.

6. Others

6.1. Representations in meetings

Togashi had a poster presentation of "Development of Web-based User Interface for Evaluated Covariance Data Files" in Nuclear Data Conference which was held at JAEA (Tokai, Japan) on November 26-27, 2009. The proceedings will be published.

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 Center", which was published as a paper in the AIP Conference Proceedings (2010).

6.2. Publication of NRDF Annual report 2008

The "NRDF Annual Report 2008" was published and distributed. The pdf file will be open on JCPRG homepage. We are now writing the manuscripts of the "NRDF Annual Report 2009" which will be published in June.