

IAEA Nuclear Data Section: Progress Report, 2010/11
Summary of Nuclear Data Activity by Staff of the IAEA Nuclear Data Section
April 2010 – May 2011

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1. Staff Changes

The authorized staff level of the Nuclear Data Section (NDS) consists of a total of 17 professionals and support staff. The latest staff changes include:

- Stanislav Simakov (Nuclear Data Service Unit Head) joined in July 2010.
- Svetlana Dunaeva (Nuclear Physicist) retired in October 2010;
- Valentina Semkova (Nuclear Physicist) succeeded Svetlana Dunaeva in October 2010;
- Marco Verpelli (Software Programmer) joins in May 2011.

2. Data Compilations

2.1 EXFOR transmission

Since the last NRDC Meeting, the following tapes have been transmitted

- 6 neutron final TRANS tapes (3144-3148 and V028) containing 35 new entries (17 compiled at NDS, 4 at India, 13 at CNDC, 1 at KAERI) and 281 revised entries;
- 5 CPND final TRANS tapes (D072-D076) containing 69 new entries (53 compiled at NDS, 7 at ATOMKI, 6 at UkrNDC, 3 at India) and 115 revised entries;
- 2 PhND final TRANS tapes (G020-G021), containing 10 new entries (2 compiled at NDS, 3 at UkrNDC, 5 at KAERI) and 13 revised entries.

Also 54 final TRANS tapes have been received at NDS. These final TRANS tapes contain 414 neutron entries (93 new, 311 revised), 477 CPND entries (250 new, 227 revised) and 105 PhND entries (46 new, 59 revised).

Based on these finalized TRANS tapes, 9 EXFOR Master Files have been created and distributed.

Two regular transmissions of the EXFOR/CINDA dictionaries (TRANS.9101-9102) in TRANS, DANIEL (backup) and archive format.

2.2 EXFOR quality control

Since the last NRDC Meeting, 76 preliminary TRANS tapes were received and checked (with feedback to the originating centres).

Two lists of compilation mistakes have been updated:

- Feedback from EXFOR users/compilers: http://www-nds.iaea.org/nrdc/exfor_err1.html;
- Feedback from WPEC SG-30: http://www-nds.iaea.org/nrdc/exfor_err3.html.

The correction process of the mistakes is regularly being monitored.

2.3 EXFOR coverage control

Under the EXFOR compilation control system, about 75 journal titles are regularly scanned and registered to the EXFOR Compilation Coverage Control System. The list of articles for compilation (<http://www-nds.iaea.org/exfor-master/x4compil/>) is updated every Monday. Since the last NRDC Meeting, about 500 journal issues have been scanned and added to the database for EXFOR compilation control system. When available, pdf files of registered articles have been also collected.

2.4 Workshops and Meetings in 2010/2011 relevant to EXFOR

- Workshop on Data Compilation of the Multinationally-maintained Experimental Nuclear Reaction Database (EXFOR), Vienna, 30 August – 3 September, 2010.
- Technical Meeting on Neutron Cross Sections Covariances, IAEA, 27-30 Sept. 2010.
- Consultancy Meeting on Neutron cross-section standards, IAEA, 13-15 Oct. 2010.
- The 4th DAE-BRNS Theme Meeting on EXFOR Compilation of Nuclear Data: Department of Physics, Panjab University, Chandigarh, India, 4 - 8 April, 2011.
- Consultancy Meeting on Neutron Source Spectra for EXFOR, 13 - 15 April 2011, IAEA, Vienna, Austria.
- 23rd Meeting of the Working Party on International Nuclear Data Evaluation Co-operation (WPEC), 12-13 May, NEA/OECD, Paris.

2.5 CINDA

CINDA Master file

The up-to-date CINDA Master File is available via the NDS compilers' Web site. An automatic update using the EXFOR and NSR databases has been carried out two times (March 2010, December 2010). MySQL-dump of the complete CINDA database was sent to NNDC.

2.6 Evaluated data libraries, files and programs

Various new and revised evaluated data libraries, files and programs for data checking, processing and graphical presentation were added, developed and distributed via the NDS Web site on DVD-ROM (see below).

3. Services, software

Web Services

Further improvements have been implemented in the Web EXFOR-CINDA-ENDF retrieval systems since the last NRDC meeting:

- ENDF (Evaluated Nuclear Data Files):
 - Output MF33 covariance matrices for Fortran users
 - Output full pre-processed material (temperature=293.16 Kelvin, accuracy=0.1%)
 - ENDF-Archive: collection of evaluated data libraries (42) for ~FTP downloading: <http://www-nds.iaea.org/ndspub/download-endf/>
 - new evaluated libraries included in the ENDF database:
 - EAF-2010: European Activation File (816 materials/60MeV), UK
 - TENDL-2010: TALYS-based Evaluated Nuclear Data Library, 2010
 - JENDL-4.0 Japanese evaluated nuclear data library, 2010
- EXFOR:
 - Search for recently updated data
 - Display titles of original articles imported from NSR
 - Display range of products when coded as ELEM/MASS
 - Display range of angles and secondary energies
 - Search by DOI and NSR Keyno
 - Page with recent EXFOR Database Updates
 - Links to NDS PDF collection for internal users from the Web retrieval system
 - Output C5 and X4Std
 - Full EXFOR in C4 computational format was regularly produced (quarterly) and delivered to WPEC group SG-30

The Web EXFOR-CINDA-ENDF retrieval system is functioning at NNDC (USA), BARC (India) and IPEN (Brazil). Statistics for usage of the Web retrieval system are presented on figures below.

Web-Tools for EXFOR compilers and ENDF/ENSDF evaluators:

- Web-ZVView: remote plotting on the Web server without downloading actual program
- EXFOR Uploading system: checking user's EXFOR file by x4check, run remote processing (ORDER, CHEX, XTRACT, X4TOC4), search for duplications of references, search similar data in EXFOR and ENDF databases, common plotting, etc.
- ENDF Uploading system: run ENDF utility codes and Prepro on Web server on user's evaluation, comparison user's data with EXFOR and ENDF databases, including plotting
- Web-tools for ENSDF evaluators: run ENSDF analysis codes on Web server

CD-ROMs

The following CD-ROMs are united now to one DVD-ROM:

- EXFOR/CINDA for Windows
- EXFOR/CINDA for Applications (Linux, Windows and Macintosh)
- EndVer/GUI with Prepro-2010 (Linux, Windows and Macintosh)
- ENDF Libraries (25)

4. Nuclear Data Developments

Although direct nuclear data developments are outside the immediate operations of the NRDC, the relevant activities undertaken in the Nuclear Data Sections are listed below.

On-going Co-ordinated Research Projects (CRPs):

- Reference database for ion beam analysis (2005-2010)
- Reference database for neutron activation analysis (2005-2010)
- Updated decay data library for actinides (2005-2010)
- Heavy charged-particle interaction data for radiotherapy (2007-2010).
- Minor Actinide Neutron Reaction Data (MANREAD) (2007-2011);
- Nuclear Data Library for Advanced Systems: Fusion Devices (FENDL-3) (2007-2012);
- Prompt Fission Neutron Spectra of Actinides (2009-2013);
- Development of a Reference Database for Particle-Induced Gamma-ray Emission (PIGE) (2011-2015).

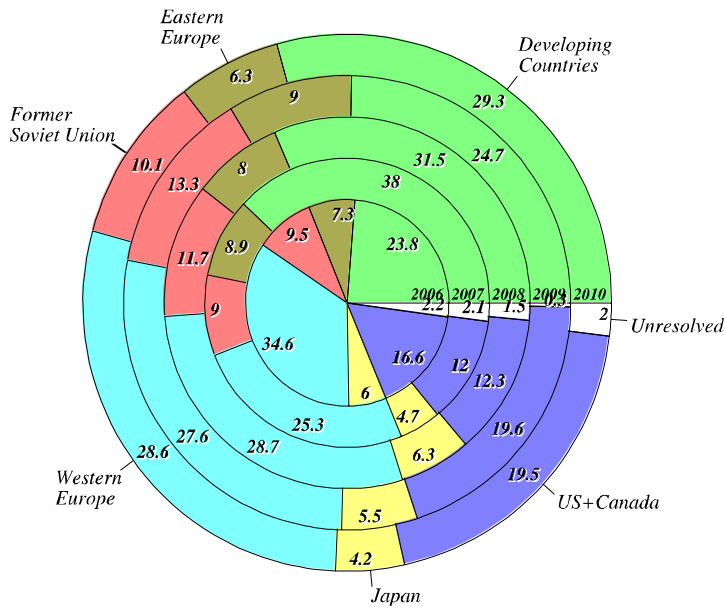
Data Development Projects (DDP):

- Support and extension of dosimetry cross section library for fission and fusion applications IRDF-2002;
- Maintain the international neutron cross-section standards file;
- Hosting the phase-space database for external beam radiotherapy;
- Development of the evaluation methodology including covariances, nuclear reaction codes EMPIRE and GANDR;
- Carrying out new evaluations and their verifications for JEFF and ENDF projects;
- Validation of the decay heat produced in fission;
- Benchmarking of the spallation models.

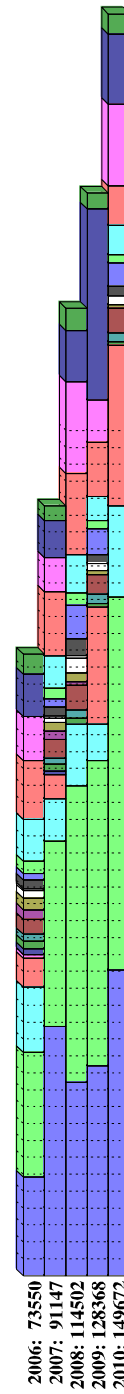
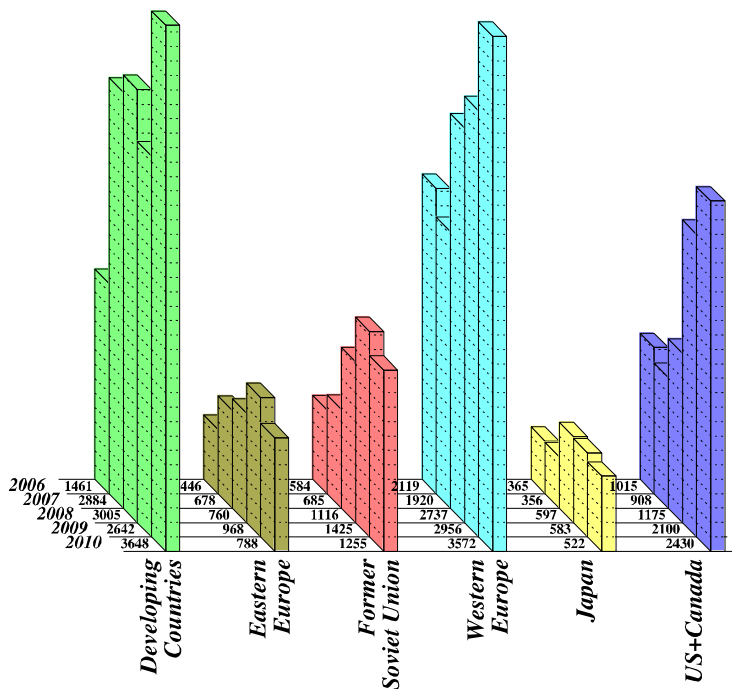
NDS+IPEN+BARC

Nuclear Data Services: Web Statistics

Geographical Distribution (%)

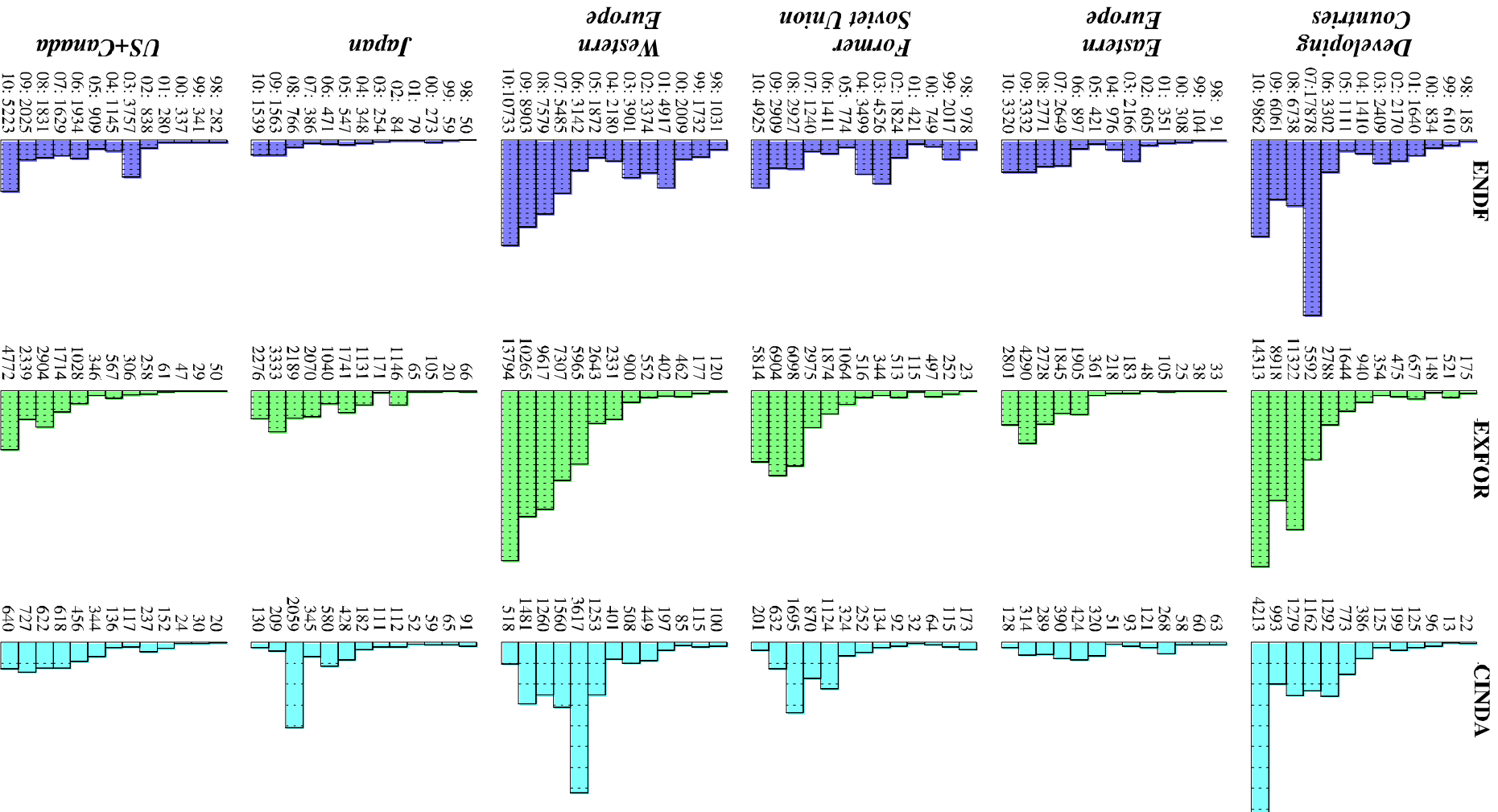


**Average per Month
(Number of accesses + retrievals)**



- | Service | Comment |
|------------------------|--------------|
| Computer Codes | |
| Documents | |
| OtherData | |
| IBANDL | |
| PGAA | |
| PhotoNuclear | |
| R IPL | Theory |
| FENDL | Fusion |
| Masses | |
| IRDF | Dosimetry |
| Thermal Capture | |
| Wallet Cards | |
| Med.Radioisotope.Prod. | |
| NGAtlas | Activation |
| RNAL | |
| ENSDF | Structure |
| MIRD | Medical |
| NuDat/LiveChartNucl | |
| CINDA+NSR Bibliography | |
| EXFOR | Experimental |
| ENDF | Energy |

IAEA Web statistics: geographical distribution of nuclear reaction databases' retrievals



6. Publications (2010-2011)

6.1 Journals

<p>JENDL-4.0: A New Library for Nuclear Science and Engineering by K. Shibata, O. Iwamoto, T. Nakagawa, N. Iwamoto, A. Ichihara, S. Kunieda, S. Chiba, K. Furutaka, N. Otuka, T. Ohsawa, T. Murata, H. Matsunobu, A. Zukeran, S. Kamada, J. Katakura, <i>J. Nucl. Sci. Technol.</i>, 48 (2011) pp. 1-30.</p>
<p>Radiation deep penetration calculations for the IFMIF testcell wall by S.P. Simakov, J. Li, U. Fischer, <i>Fusion Eng. Design</i>, 85 (2010) 1924-1927.</p>
<p>Elastic Scattering of $^7\text{Li} + ^{27}\text{Al}$ at Several Angles in the 7 - 11 MeV Energy Range by D. Abriola, et. al. 19th Int. Conf. on Ion Beam Analysis, 7-11 September 2009, <i>Nucl. Instr. Meth. Phys. Res. B268</i> (2010) pp. 1793-1796.</p>
<p>Radiative recombination rate coefficients for highly-charged tungsten ions by M.B. Trzhaskovskayaa, V.K. Nikulin, R.E.H. Clark, <i>Atomic Data and Nuclear Data Tables</i> 96 (2010) 1-25.</p>
<p>Measurements of emission spectra from hot, dense germanium plasma in short pulse laser experiments by D.J. Hoarty, S.F. James, C.R.D. Brown, B.M. Williams, H.-K. Chung, J.W.O. Harris, L. Upcraft, B.J.B. Crowley, C.C. Smith, R.W. Lee, <i>High Energy Density Physics</i> 6 (2010) pp.105-108.</p>
<p>Nuclear Data Sheets for A = 72 by D. Abriola and A.A. Sonzogno, <i>Nucl. Data Sheets</i> 111 (2010) pp. 1-140.</p>
<p>Cyclotron production of the ^{105}Ag, ^{100}Pd, ^{100}m, ^{105}Rh radionuclides by natPd(p,x) nuclear processes by M.U. Khandaker, K. Kim, G. Kim, N. Otuka, <i>Nucl. Instr. Meth. Phys. Res. B268</i> (2010) pp. 2303-2311.</p>
<p>The $^{235}\text{U}(n,f)$ prompt fission neutron spectrum at 100 K input neutron energy by N. Kornilov, F.-J. Hamsch, I. Fabry, S. Oberstedt, T. Belgya, Z. Kis, L. Szentmiklosi, S. Simakov, <i>Nucl. Sci. Eng.</i> 165 (2010) pp.117-127.</p>
<p>Neutron activation cross sections for zirconium isotopes by V. Semkova, E. Bauge, A.J.M. Plompen, D.L. Smith, <i>Nucl. Phys. A832</i> (2010) pp.149-169.</p>
<p>High resolution measurements of the $^{241}\text{Am}(n,2n)$ reaction cross section by C. Sage, V. Semkova, O. Bouland, P. Dessagne, A. Fernandez, F. Gunsing, C. Năstren, G. Noguère H. Ottmar, A.J.M. Plompen, P. Romain, G. Rudolf, J. Somers, F. Wastin, <i>Phys. Rev. C81</i>(2010)064604.</p>
<p>Neutron physics of the Re/Os clock. I. Measurement of the $(n,?)$ cross sections of ^{186}Re, ^{187}Re, ^{188}Os at the CERN n_TOF facility by M. Mosconi, A. Mengoni, R. Capote, et al., (the n_TOF Collaboration), <i>Phys. Rev. C82</i>(2010) 015802.</p>
<p>Neutron physics of the Re/Os clock. II. The $(n,n?)$ cross section of ^{187}Os at 30 keV neutron energy by M. Mosconi, M. Heil, F. Käppeler, R. Plag. A. Mengoni, <i>Phys. Rev. C82</i> (2010) 015803.</p>
<p>Neutron physics of the Re/Os clock. III. Resonance analyses and stellar $(n,?)$ cross sections of ^{186}Re, ^{187}Re, ^{188}Os by A. Mengoni, R. Capote, et al., (the n_TOF Collaboration), <i>Phys. Rev. C82</i>(2010)015804.</p>
<p>Assessment of the tritium production in the HFTM specimen cells of IFMIF by A. Klix, U. Fischer, S.P. Simakov, <i>IEEE Transactions on Plasma Science</i> (2010) 38 pp. 259-264.</p>
<p>Measurements of X- and γ-ray emission probabilities in the β^- decay of ^{233}Pa by F.G. Kondev, I. Ahmad, J.P. Greene, M.A. Kellett, A.L. Nichols, <i>Appl. Radiat. Isot.</i> 68 (2010) pp. 2382-2386.</p>
<p>Nuclear data evaluation methodology including estimates of covariances by R. Capote, D.L. Smith, A. Trkov, <i>EPJ Web of Conferences</i> 8 (2010) 04001.</p>
<p>High temperature, high density opacity measurements using short pulse lasers by D.J. Hoarty, S.F. James, C.R.D. Brown, B.M. Williams, T. Guymer, M. Hill, J. Morton, D. Chapman, R. Shepherd, J. Dunn, G. Brown, M. Schneider, P. Beiersdorfer, H. K. Chung, J.W.O. Harris, L. Upcraft, C.C. Smith, R.W. Lee, <i>J. Physics: Conference Series</i> 244 (2010) 012002.</p>
<p>Depression of reactivity by the collision energy in the single barrier $\text{H} + \text{CD}_4 \rightarrow \text{HD} + \text{CD}_3$ reaction by Weiqing Zhang, Yong Zhou, Guorong Wu, Yunpeng Lu, Huilin Pan, Bina Fu, Quan Shuai, Lan Liu, Shu Liu, Liling Zhang, Bo Jiang, Dongxu Dai, Soo-Ying Lee, Zhen Xie, B.J. Braams, J.M. Bowman, M.A. Collins, Dong H. Zhang, Xueming Yang, <i>Procs. Nat. Acad. Sci.</i>, 107 29 (2010) pp.12782-12785.</p>
<p>Evidence for vinylidene production in the photodissociation of the allyl radical by Chao Chen, B. Braams, D.Y. Lee, J.M. Bowman, P.L. Houston, D. Stranges, <i>Phys. Chem. Letters</i>, 1 12 (2010) pp.1875-1880.</p>
<p>Ab-Initio-based potential energy surfaces for complex molecules and molecular complexes by J.M. Bowman, B.J. Braams, S. Carter, C. Chen, G. Czako?, B. Fu, X. Huang, E. Kamarchik, A.R. Sharma, B.C. Shepler, Y. Wang, Z. Xie, <i>Phys. Chem. Letters</i> 1 12 (2010) pp. 1866-1874.</p>

Shared-proton mode lights up the infrared spectrum of fluxional cations H5⁺ and D5⁺ by T.C. Cheng, B. Bandyopadhyay, Yimin Wang, S. Carter, B.J. Braams, J.M. Bowman, M.A. Duncan, Phys. Chem. Letters 1 4 (2010) pp.758-762.

Global potential energy surfaces for O(3P) + H2O(1A1) collisions by P.F. Conforti, M. Braunstein, B.J. Braams, J. M. Bowman, Chem. Phys. 133 16 (2010) 164312.

197Au(n,?) cross section in the resonance region by C. Massimi, R. Capote, A. Mengoni, et al., (the n_TOF Collaboration), Phys. Rev. C81 (2010) 044616.

The 92Zr(n,?) reaction and its implications for stellar nucleosynthesis by G. Tagliente, R. Capote, A. Mengoni, et al., (the n_TOF Collaboration), Phys. Rev. C81 (2010) 055801.

Neutron-induced fission cross section of 234U and 237Np measured at the CERN Neutron Time-of-Flight (n_TOF) facility by C.Paradela, R. Capote, A. Mengoni, et al., (the n_TOF Collaboration), Phys. Rev. C82 (2010) 034601.

Neutron cross-sections for next generation reactors: New data from n_TOF by N. Colonna, R. Capote, A. Mengoni, et al., (the n_TOF Collaboration), Appl. Radiat. Isot. 68 (2010) pp. 643-646.

Spectrum of prompt fission neutrons from 235U(n,F) by V.M. Maslov, N.A. Tetereva, V.G. Pronyaev, A.B. Kagalenko, K.I. Zolotarev, R. Capote, T. Granier, B. Morillon, F.-J. Hamsch, J.-C. Sublet, Atomic Energy 108 6 (2010) pp. 432-443.

6.2 Conference Presentations and Proceedings

Analysis of proton-induced reactions by using simulation by H. Iwamoto, Y. Iwamoto, Y. Hirata, N. Otuka, K. Niita, JAEA-Conf 2010-005 pp. 81-86.

Development of Web-based user interface for evaluated covariance data files by T. Togashi, K. Kato, R. Suzuki, N. Otuka, JAEA-Conf. 2010-005, pp. 69-74.

Study of neutron-induced fission cross sections of U, Am, and Cm at n_TOF by P.M. Milazzo, R. Capote, et al., (the n_TOF Collaboration), Procs. VIII Latin American Symposium on Nuclear Physics and Applications, Eds. R. alcaron, H.F. Arellano, P.L. Cole, A.J. Kreiner, AIP Conf. Procs. 1265 (2010) pp. 477-482.

Astrophysics at n_TOF facility by G. Tagliente, R. Capote, et al., (the n_TOF Collaboration), Procs. VIII Latin American Symposium on Nuclear Physics and Applications, Eds. R. alcaron, H.F. Arellano, P.L. Cole, A.J. Kreiner, AIP Conf. Procs. 1265 (2010) pp. 160-165.

Neutron-induced activation cross sections on hafnium isotopes from the threshold to 20 MeV by V. Semkova, R. J. Tornin, N. Janeva, N. Koyumdjieva, A. Moens, A.J.M. Plompen, K. Volev, Procs. of Scientific Workshop on Neutron Measurements, Theory and Applications Nuclear Data for Sustainable Nuclear Energy, 28-30 April 2009, Geel, Belgium, Ed. F. J. Hamsch, JRC Scientific and Technical Reports, EUR 23883 EN-2010, pp. 155-159, ISBN 978-92-79-11705-3, ISSN 1018-5593.

IFMIF test facilities - 3 years of EVEDA by F. Arbeiter, U. Fischer, P. Garin, R. Heidinger, V. Heinzl, A. Klix, A. Möslang, St. Simakov, K. Tian, P. Vladimirov, Jahrestagung Kerntechnik (Berlin 2010): INFORUM GmbH, 2010, compact 810.

Comparative study of the tungsten irradiation conditions in IFMIF and DEMO by S.P. Simakov, P. Pereslavtsev, U. Fischer, A. Möslang, Jahrestagung Kerntechnik (Berlin 2010): INFORUM GmbH, 2010, compact 811.

Modelling d-Be and d-C neutron sources for SPIRAL-2 by Majerle, S.P. Simakov, Jahrestagung Kerntechnik (Berlin 2010): INFORUM GmbH, 2010, compact 812.

The role of nuclear data for fusion technology studies by R.A. Forrest, Procs. Int. Conf. Nuclear Energy for New Europe 2010, 6-9 September 2010, Portorož, Slovenia, pp. 001.1-001.8.

Nuclear science and data needs for advanced nuclear systems by R.A. Forrest, Procs. Int. Conf. on Asian Nuclear Prospects 2010 (ANUP2010), Chennai, India, 11-13 October 2010.

Nuclear data evaluation methodology including estimates of covariances by R. Capote, D.L. Smith, A. Trkov, EPJ Web of Conferences 8 (2010) 04001.

Nuclear reaction data file for astrophysics (NRDF/A) in Hokkaido University Nuclear Reaction Data Center by K. Kato, M. Kimura, N. Furutachi, T. Togashi, A. Makinaga, N. Otuka, Procs. Tours Symp. Nuclear Physics and Astrophysics - VII, Kobe, Japan, 16-20 November 2009, AIP Conf. Proc. 1238 (2010) pp.199-204.

7. Visits and Inter-centre Cooperation

- V. Zerkin (NDS) to NNDC/BNL: software development for management and Web-retrieval of ENDF, CINDA and EXFOR Relational Databases. 8 - 26 November 2010.
- N. Otsuka (NDS) to NNDC/BNL: compilation of experimental covariance matrix for the EXFOR library. 18-24 November 2010.
- K. Zolotarev (CJD) to NDS/IAEA: assistance in the implementation of corrections for EXFOR data. 2 - 13 May 2011.
- V. Pronyaev (CJD) to NDS/IAEA: development of the data exchange format (EXFOR) for compilation of covariances, 24 September - 30 October 2010.
- B. Pritychenko (NNDC/BNL) to NDS/IAEA: latest version of NSR database and Web application have been installed. 29 November - 3 December 2010.