

Nuclear Data Newsletter



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Contents					
From the Section Head Computer Codes, Data Libraries and Web News	1 2	Announcements Consultants and Interns NDS Meeting Reports	3 4 5	Selected Charts, Reports and Documents In Memoriam	10 10

From the Section Head

Let me start by wishing you all the best for 2022.

We are enduring close to two years of the COVID-19 pandemic now, and I will not make any predictions about what the 'new normal' will look like, and when this will happen. What I can tell you is that at the time of this writing, we are all back in the office at the IAEA.

The other big change, related to the first 1.5 years of the pandemic, is that we have actually seen some of you here at the IAEA during the various hybrid meetings that we have organized in the past half year.

You will see some pictures in this Newsletter with several participants in our meeting rooms while the others are online. Even the traditional meeting dinners in town have restarted!

The Nuclear Data Section is also hosting many consultants and interns lately, working on atomic databases, EXFOR, nuclear data evaluation, fission yields, processing codes and the stopping power database.

The third meeting of the CRP on Recommended Input Parameter Library (RIPL) for Fission Cross Section Calculations has been held. This addresses one of the most challenging part of nuclear reaction data modelling and evaluation, which is the ability to describe or predict cross sections and other data for actinides. The objective is to let nuclear model codes perform fission calculations more routinely.

Other meetings were held on Neutron Standards, the INDEN network, this time for structural materials and actinides, (alpha,n) reactions and nuclear data processing.

In the Atomic and Molecular Data Unit, we organized meetings on the Code Centre Network, the Global Network for the Atomic and Molecular Physics of Plasmas, Neutral Beams in Fusion Plasma, and Fusion Fuel Permeation.

As a related topic, this is also the time and place to congratulate the Japanese nuclear data community with the release of their JENDL-5 library.

As mentioned in this Newsletter another data library, TENDL-2021, was also released last month as well as a new version of the model code TALYS.

Looking forward to seeing more of you in real time the coming year.



Section Head with NDS support staff : Ulrike Perstl, Charisse Monfero, Lidija Vrapcenjak, Kira Nathani

Computer Codes, Data Libraries and Web News

Livechart data API

Users' feedback, which drives Livechart development, has recently focused on requesting a download tool to feed data directly into scripts for further processing or plotting.

Users would like to be able to perform custom data query and receive them back in a way that can easily be plugged into, for example, Python, Java, or Excel.

To address this demand, an Application Program Interface is now available from Livechart.

This first version produces data in Comma Separated Value format with some simple rules to construct a query. Data are then requested to, and received from, NDS servers through the Web.

A Jupiter Notebook with examples shows how to use the API with Python. Here below a 3D plotting of the cumulative fission yields of U-235, fast energy.



The API guide can be found at <u>https://www-nds.iaea.org/relnsd/vcharthtml/api_v0_guide.html</u> and, the Notebook

https://www-

nds.iaea.org/relnsd/vcharthtml/api v0 notebook.html.

Al+though admittedly the first test version with limited capabilities, users are already providing encouraging feedback, giving suggestions about new features and options.

EXFOR Web retrieval system

New section "Evaluator" for search EXFOR data by {Target, Projectile, MF, MT} has been added.

New option of automatic correction of EXFOR data on modern decay data (newer gamma line intensities from ENSDF) is now also available at

https://www-nds.iaea.org/exfor/.

ENDF Web database retrieval system

New features of the radioactive decay data (MF8.MT457) in ENDF interface output to JSON, plot, comparing data from different libraries (includes data from ENSDF and DDEP) <u>https://www-nds.iaea.org/endf/</u> are available.

GRUCON and EMPIRE

New version of GRUCON-2021: ENDF data processing code package <u>http://www-nds.iaea.org/grucon/</u> and Empire-3.2.2/2021.11: nuclear reaction model code system for data evaluation <u>https://www-nds.iaea.org/empire/</u> are available.

JENDL-5

The Japanese Evaluated Nuclear Data Library version 5 (JENDL-5) has been released on 27 December 2021 and is available at <u>https://wwwndc.jaea.go.jp/jendl/j5/j5.html</u>.

This is the first major update of the previous version JENDL-4.0 which dates from 2010. Its application libraries including ACE format files will also be soon available. Among the features of JENDL-5 are:

- revision of a large part of JENDL-4.0 such as neutron reaction data, thermal scattering law and fission product yield
- integration of data in the JENDL special purpose files released so far
- an increased number of nuclides (795, from 406 as of JENDL-4.0)
- extension of the upper limit of the incident energy to 200 MeV (partially still 20 MeV)
- addition of activation cross section data
- first and new originally evaluated thermal scattering

law for 16 materials such as light and heavy water, benzene, and ethanol

- almost complete update of fission product yields and decay data
- data for reactions induced by light charged particles (proton, deuteron and alpha-particle) and photon.

JENDL-5 is also added to our ENDF database collection <u>https://nds.iaea.org/endf/</u> and to our ENDF Archive: <u>https://nds.iaea.org/public/download-endf/JENDL-5/</u>.



NUCLEAR MOMENTS

Recommended nuclear electric quadrupole moments using the updated reference data of P. Pyykko (2018) have been produced by N.J. Stone. The updated tables are available on the online Nuclear Moments database: <u>http://wwwnds.iaea.org/nuclearmoments/</u> and in INDC(NDS)-0833.

TALYS-1.96

A new release of the TALYS nuclear model code, TALYS-1.96 is available at <u>nds.iaea.org/talys</u>.

The tutorial is completely revised, has a more systematic reference guide and contains more sample cases than before. Among the new features are the capability to read in the distribution of excited fission fragments, after which TALYS calculated the fission product yield as well as all neutron observables such as nu(A), nubar, PFNS etc., the possibility to read in the OMP for actinides from the Reference Input Parameter Library, a better description of fast neutron capture cross sections, and a global increase of predictive power for charged-particle and photon-induced induced reactions.

TENDL-2021

A new release of the TALYS Evaluated Nuclear Data Library, TENDL-2021, is now available at

https://tendl.web.psi.ch/tendl_2021/tendl2021.html and succeeds the TENDL-2019 library.

The collection contains complete ENDF-6 formatted data files, including covariance data and energies up to 200 MeV, for 2813 isotopes (all stable or with half-life >1sec) for incident neutrons, photons, protons, deuterons, tritons, Helium-3, and alpha particles.

Among the new features are: use of the latest collections of neutron resonance parameters, with important input from the JEFF project, and further improved description of experimental thermal cross section values, including correct isomeric branching.

- Covariance matrices for all nuclides and all incident particles
- Improved charged-particle induced reactions, including sub actinide fission.
- Photonuclear data libraries based on the latest photon strength function models
- General improvement of implemented ENDF-6 procedures, resulting from users' feedback in the last 2 years.

Announcements

On 27 October 2021 the IAEA concluded a two-day international emergency exercise that tested responses to a simulated accident at a nuclear power plant (NPP) in the United Arab Emirates (UAE) together with 77 Member states and 12 International Organizations. Ludmila Marian, Scientific Data Manager in the Atomic and Molecular Data (AMD) Unit of the NDS received a Commemorative Coin for her efforts during the ConvEx-3.



15th International Conference on Nuclear Data for Science and Technology (ND2022)

24-29 July 2022 Virtual meeting



ND2022 is the latest in a series of conferences held every three years since 1978, most recently in Bruges, Belgium (ND2016) and Beijing, China (ND2019). This conference brings together international experts involved in generating and using nuclear data for a week of presentations and in-depth discussion.

ND2022 is being organized by Lawrence Livermore National Laboratory. The conference was planned for 24-29 July 2022 in Sacramento, California, but due to ongoing uncertainty related to the Covid19 pandemic it has been converted to a virtual event.

Conference topics include:

- Nuclear reaction measurements,
- Nuclear mass, structure and decay measurements,
- Theoretical nuclear physics,
- Special focus on fission including theory, measurements and modeling,
- Development of new experimental capabilities and facilities,
- Generating, improving and validating evaluated nuclear data libraries,
- Processing nuclear data to prepare evaluated libraries for use in application codes,
- Improving data formats, tools and quality assurance,
- Uncertainty quantification and covariances,
- Applying machine learning to the nuclear data pipeline, and
- Applications of nuclear data to fields ranging from reactor design to medical isotope production to nuclear non-proliferation to space exploration and stellar nucleosynthesis.

The registration for the conference is still open:

<u>15th International Conference on Nuclear Data for Science</u> and Technology (ND2022) (24-29 July 2022): Registration <u>· Indico (bnl.gov)</u>

Consultants and Interns

Nuclear Data Section welcomed several interns and consultants during the second half of the 2021. They were all a fresh wind in the Section in particular in the pandemic times where the social contacts to the meeting participants were very limited.

With this, NDS was able to keep on educating younger generations and make the nuclear data field even more attractive. At the same time consultants advised us several issues and improved various databases and data libraries.

Consultants

Brett V. Carlson did work on the improvement of the analysis capabilities of the EMPIRE nuclear model code.

Vidya Devi from India will be working on creating and revising the EXFOR compilation work for one year. Her research field is in theoretical study of super deformed nuclei, and she has been working on EXFOR in India since 2008.

Dipti from India is working on evaluation of atomic collisional data relevant to fusion plasmas, development of a new ALADDIN database to improve search and data upload functionality, updates of plasma process classifications and an improved API, as well as the development of software tools for a further database, CollisionDB.

Daniel Lopez Aldama came from Cuba to work on nuclear data processing for data evaluation, applications and dissemination activities.

Dmitry Martyanov was working on update and optimizing of EMPIRE code with the latest optical model developments of the OPTMAN code.

Claudia Montanari from Argentina performed tasks on updating and developing the IAEA Stopping Power database in particular modifications to the online database to address the emerging data needs of the user community in basic and applied sciences.

Valentina Semkova from Bulgaria was working for the Nuclear Data Section for 3 months on development of EXFOR database, reviewing and assessing consistency of the existing entries according to the rules and formats of EXFOR, and all in order to provide the highest quality of data in EXFOR.

Valeria Raffuzzi is a Nuclear Engineer by education, and currently doing a PhD at the University of Cambridge. During her 3 months at the NDS she was working on nuclear data evaluation with the nuclear model code TALYS, and validation through experimental benchmarks.

Interns

Kazuki Fujio is a PhD student from Japan who came for a for a 6-months internship to work on nuclear reaction code TALYS, and calculate the fission yields and fission products with a microscopic model.

Ryosuke Shimizu is studying reactor physics at the Nuclear Reactor Engineering Laboratory of Hokkaido University and came to NDS for 3 months internship. He was involved in the development, improvement and/or dissemination of nuclear reaction data libraries (EXFOR).

We are glad to be a part of their carrier ladder and grateful for their contributions to NDS.

NDS Meeting Reports

(TM = Technical Meeting, RCM = Research Coordination Meeting, CM = Consultants' Meeting, WS = Workshop, CRP = Coordinated Research Project)

Third Research Coordination Meeting on Recommended Input Parameter Library (RIPL-4) for Fission Cross Section Calculations

20-23 December 2021, Vienna, Austria Hybrid event Scientific Secretary: R. Capote Noy 19 participants and IAEA staff

Nowadays modelling codes play a large role in nuclear data evaluation to complement existing experimental data providing theoretical data with uncertainties that can be combined with measurements to achieve high-fidelity nuclear data evaluations. Modelling codes require substantial numerical input, therefore the IAEA produced the Reference Input Parameter Library (RIPL) released in January 2009, which is available on the web through nds.iaea.org/RIPL-3/. However, it was identified that the improvement of fission input parameters is considered a high priority. To meet these needs, a new IAEA CRP was started in 2017. Due to the COVID pandemic a CRP has been extended for additional 27 months. A third Research Coordination Meeting was held in Vienna as a hybrid meeting with 4 attendees in person, and overall, 23 participants from 12 Member States attended virtually. The on-going program of work was reviewed and rescheduled; coordination of this work for the next two years was undertaken at the meeting. It was agreed that the final meeting of the CRP will be held in December 2023. The agenda and the presentations will be available at nds.iaea.org/index nds meetings.htm. A summary report is in preparation.

Consultants' Meeting on Evaluation of Nuclear Data for Neutron-induced Reactions on Structural Materials

13-17 December 2021, Vienna, Austria Hybrid event Scientific Secretary: G. Schnabel 16 participants and IAEA staff

The fourth yearly meeting on structural materials within the framework of the International Nuclear Data Evaluation Network (INDEN) was held in December 2021 with the participation of experts from seven Member States and two International Organizations to discuss the status of ongoing evaluation work on structural materials, such as Fe, Cu, Zr, and Pb. Issues and challenges associated with established evaluations and evaluation candidates, such as those produced within INDEN, were discussed in detail. The meeting was held in hybrid format. However, due to the pandemic situation at the time, only two participants were able to travel to the IAEA to attend in person. The meeting agenda included twelve technical presentations, which are https://www-nds.iaea.org/index-meetingavailable at crp/CM-INDEN-strucmat-2021-12/.

Joint ICTP-IAEA Virtual Workshop on Atomic Processes in Plasmas: Data-driven Research

4-8 October 2021 Virtual event

Directors: C. Hill, L. Marian (IAEA), M. Bautista (USA), Yuri Ralchenko (USA), U. von Toussaint (Germany) Local organizer: G. Thompson



This School assisted PhD students and other early-stage career researchers to develop their quantitative understanding of the fundamental processes that produce the observed behaviour and properties of plasmas; through lectures and practical computing sessions they also gained skills in the application of modern data science techniques to the calculation and evaluation of data on these processes.

Nuclear Data Newsletter No. 72, January 2022

Scientists in developing countries without extensive experimental research facilities particularly benefit from such training in modern, data-driven computational physics. Further practical details are available at <u>the ICTP webpage</u> for this event (indico.ictp.it/event/9657).

Technical Meeting of the Global Network for the Atomic and Molecular Physics of

Plasmas (GNAMPP)

6-10 December 2021 Virtual event Scientific Secretary: C. Hill 68 participants and IAEA staff

This large, virtual meeting brought together experts from the IAEA's Global Network for the Atomic and Molecular Physics of Plasmas (GNAMPP) to discuss aspects of the collisional-radiative properties of tungsten and hydrogen in the edge plasma of fusion devices. Three Working Groups were established: 1. Atomic and Molecular Data Recommendation and Validation with Collisional-Radiative (CR) Models; 2. Experimental and Comparison Activities with CR Models focussing on W and Hydrogen Experiments with Fusion Devices and Linear Plasma Devices; and 3. Photon Opacity Modelling of Hydrogenic Atomic and Molecular Species. This meeting is part of a Technical Meeting series on edge plasma modelling, involving the participation of 21 Member States, which will continue with a further virtual event in 2022.



Further details of this meeting, and the GNAMPP Network are available at <u>https://amdis.iaea.org/GNAMPP/</u>.

Technical Meeting on Neutron Data Standards

6-10 December 2021 Virtual event Scientific Secretary: G. Schnabel 29 participants and IAEA staff

As most neutron cross section measurements are relative to the neutron data standards, precise knowledge of the latter is essential to extract absolute cross section data. The development of the neutron data standards is coordinated under the auspices of the IAEA and the last version was released in 2017. This meeting held in December 2021 is the second one since the last release to review existing data and new measurements as well as methodological developments in preparation for the release of the next version. 23 participants from 7 Member States and one International Organization attended the meeting. The program consisted of 18 technical presentations. Discussions were held on a new potential release of Standards. It is expected that a new Standard fit will be available in December 2022; differences to current version will need to be assessed.

The agenda and the presentations are available at <u>https://www-nds.iaea.org/index-meeting-crp/TM-NDS-2021-12/.</u>

Third Research Coordination Meeting on Data for Atomic Processes Related to Neutral Beams in Fusion Plasma

24-26 November 2021, Vienna, Austria Virtual event Scientific Secretary: C. Hill 12 participants and IAEA staff

This event, which was originally planned as a hybrid meeting, was forced into a virtual format by the lockdown imposed by the Austrian authorities in November 2021. Participants from 9 Member States reviewed their progress in the production and evaluation of fundamental data for modelling penetration and photoemission processes of the neutral beams used for heating and for diagnostic purposes in fusion plasmas, and initiated the comparison of their calculations for the state-resolved collisional cross sections of Be⁴⁺ and H atoms at projectile energies relevant to neutral beam modelling. More details are available at https://amdis.iaea.org/meetings/neutral-beams-rcm3/.



Technical Meeting on (α,n) Nuclear Data Evaluations and Data Needs

8-12 November 2021, Vienna, Austria Hybrid event Scientific Secretary: P. Dimitriou 62 participants and IAEA staff

This technical meeting to address the needs for accurate and reliable (alpha,n) data across a broad range of basic science and applications fields was held virtually. The meeting reviewed the status and identified gaps in experimental data, evaluated libraries and neutron sources codes used in (i) fission and fusion reactors operations, (ii) spent fuel and nonproliferation, (iv) rare-event detection, and (iv) nuclear astrophysics. Participants agreed on the importance of international cooperation in addressing the data needs and made recommendations for future actions. The summary report of the meeting will be published in INDC(NDS)-0836. More details are available on IAEA Technical Meeting on (alpha,n) nuclear data evaluation and data needs (8-12 November 2021): Overview · Indico for IAEA Conferences (Indico)

Consultants' Meeting of the International Nuclear Data Evaluation Network (INDEN) on Actinide Evaluation in the Resonance Region

1-4 November 2021, Vienna, Austria Hybrid event Scientific Secretary: R. Capote Noy 23 participants and IAEA staff



The International Nuclear Data Evaluation Network (INDEN) aims to enhance and broaden multi-lateral collaborations on nuclear data evaluations, taking advantage of available expertise in Member States. This is demonstrated in the activities of the INDEN working group on "Actinide Evaluations in the Resonance Region", which held its fourth meeting in Vienna. This event was planned and held as the first hybrid meeting of the Section taking the opportunity to be able to get 54 participants to attend in person in Vienna, a luxury these days. Overall, 27 participants from 9 Member States attended the meeting. Extensive time was allocated for presentations and associated discussions. The future plans and current status of on-going evaluation efforts of neutron induced reactions on fissile targets was reviewed. New normalization fission integrals for all fissile actinides were presented. Good convergence of U-235 evaluations was observed. The INDEN webpage is available at https://wwwnds.iaea.org/INDEN. Latest evaluated files from the working group are available there. Work is on-going on new evaluations for both U-233 and Pu-239 targets. Further information, including meeting presentations is available on nds.iaea.org/index-meeting-crp/CM-INDENthe web: 2021-res/. The Meeting summary report is in preparation.

Technical Meeting on Artificial Intelligence for Nuclear Technology and Applications

25-29 October 2021 Virtual event

Scientific Secretary: M. Barbarino (Physics Section)

NDS Organizers: C. Hill, L. Marian, G. Schnabel

The Technical Meeting on Artificial Intelligence (AI) for Nuclear Technology and Applications (AI4Atoms) provided an international, cross-cutting forum to discuss, identify and foster cooperation on AI methodologies and tools in food and agriculture, human health, nuclear data, nuclear fusion, nuclear physics, nuclear power, nuclear security, radiation protection, safeguards verification, water and environment, and the ethics of nuclear and AI. The meeting highlighted how database development and data accessibility can be real enablers for AI applications. It emphasized the importance of establishing, where practical, centralized and federated repositories gathering well-curated data to allow AI application; promoting federated learning (moving models rather than data) for training the model from one database to another database and building literature libraries to collect references for AI in nuclear technologies and applications, as well as supporting regulation and training, and promoting ethical guidance. The Nuclear Data Section organized the Nuclear Data working group sessions, that focused on AI for management, analysis and verification of nuclear, atomic and molecular data. These sessions were composed of 13 invited presentations followed by discussions. The Nuclear Data working group was the second event on the topic of AI organized by the NDS Section, following-up the Consultants Meeting on Machine Learning (ML) for Nuclear Data held in December 2020. The report from the AI4Atoms TM is scheduled for publication in 2022.

The meeting website is located at https://conferences.iaea.org/event/245/

Technical Meeting on Nuclear Data Processing

18-22 October 2021, Vienna, Austria Hybrid event Scientific Secretary: R. Capote Noy 43 participants and IAEA staff

This meeting was a follow-up of previous meetings held on this subject (latest one in September 2019). Only two participants were able to come to Vienna, so it was mostly a large virtual meeting.

Arjan Koning pointed out that the situation for processing codes is healthier than ever before, when only PREPRO and NJOY were available. Now, with new initiatives all over the world, there are at least six new fully operational processing codes for fast and thermal neutron transport. The meeting assessed the current status and availability of nuclear data processing systems, putting emphasis on their capability/capacity to support Monte Carlo calculations, including the treatment of self-shielding in the unresolved resonance region and with special emphasis on the Thermal Scattering Law processing. More details, including the presentations, are available from: nds.iaea.org/indexmeeting-crp/TMNDP-2021/.

The summary report of the meeting will be published as a report INDC(NDS)-0834 (2022).

Technical Meeting of the International Atomic and Molecular Code Centres Network

18-20 October 2021 Virtual event Scientific Secretary: C. Hill 21 participants and IAEA staff



The 7th biennial meeting of the AMD Unit's Code Centres Network was held virtually and focussed on computational simulations of radiation damage in nuclear materials, particularly (1) collisional cascade simulations of neutronirradiated fusion reactor materials and (2) density functional theory calculations of the energetics, evolution and properties of radiation-induced defects in such materials. Participants from eight Member States met online over three days to discuss data needs and priorities in this important field, and to assess the progress made on the population and functionality of the Unit's CascadesDB and DefectDB databases. The CSaransh visualisation and analysis tool, as implemented on the collisional cascade data of CascadesDB, and the latest methodologies for modelling high-dose damage were particular topics of interest addressed by the meeting.

Further details are available on the AMD Unit's website at: <u>https://amdis.iaea.org/meetings/ccn-7/</u>.

Joint ICTP-IAEA Virtual Workshop on Atomistic Modelling of Radiation Damage in Nuclear Systems

4-8 October 2021 Virtual event Directors: K. Heinola, C. Hill, J.-C. Sublet (IAEA) Local organizer: N. Seriani

This Workshop, which was held online from 4-8 October 2021, assisted PhD students and early-career researchers in developing a qualitative and quantitative understanding of the atomistic modelling of radiation damage on materials, both for existing fission and proposed fusion reactors.

Atomistic modelling is the simulation of the behaviour of complex systems by explicitly taking its smallest constituent parts into account. In the context of radiation damage in nuclear materials, these simulations involve the bulk and surface atoms of reactor components and their interactions with energetic neutrons and plasma in the form of free atoms, molecules and ions. The computational techniques employed include molecular dynamics, density functional theory, and a variety of Monte Carlo methods; this Workshop provided an introduction to some popular software used to implement these techniques, with practical sessions on the free packages LAMMPS and SDTrimSP. Further practical details are available at the ICTP website page for this event.



In addition, the twelve hours of lectures and computing practicals/demonstrations were recorded and have now been turned into a course on the Agency's online learning platform (Learning Management System, LMS): <u>https://elearning.iaea.org/m2/course/view.php?id=1207</u>

Technical Meeting on the Nuclear Fusion Fuel Permeation in Reactor First Wall Components

4-6 October 2021, Vienna, Austria Hybrid event Scientific Secretary: K. Heinola
10 in person and 36 virtual participants and IAEA staff



This event was initially planned as an in-person meeting but was transformed to a hybrid event due to the worsening global pandemic situation at that time. 46 participants presenting 14 Member States and one international research institute, ITER, joined with IAEA staff to discuss and review the current data status and data needs as well as physics understanding on fusion fuel permeation in reactor wall components and materials. Participants of the Hydrogen Permeation CRP (F43025) used this opportunity to provide progress report on their CRP activities. The meeting comprised of sessions and discussions for Ion-driven permeation, permeation, Gas-driven Plasma-driven permeation, atomistic modelling (simulations and fundamental calculations), Ion Beam experiments and permeation studies using neutron-irradiated materials. Of particular interest were the several round-robin activities either ongoing (Gas-driven permeation; neutron irradiation of fusion materials) or being launched/planned (fuel retention studied with TDS; fuel permeation multi-scale simulations). The status of each round-robin activity was summarized and reviewed by the corresponding activity coordinator. Each project's next steps were discussed and agreed, and new participants were welcomed to join the activities.

Technical Meeting of the International Atomic and Molecular Data Centres Network 1-3 September 2021

Virtual event Scientific Secretary: K. Heinola 15 participants and IAEA staff

The International Atomic and Molecular Data Centres Network (DCN) monitors and discusses fusion data needs. objectives, recent developments, current and future requirements in atomic, molecular and plasma-wall interaction processes. DCN meets biennially and the 26th DCN held in 2021 was a fully virtual event. Meeting participants represented ten Member States and reports were given by ten national Data Centers and lectures by three guest experts. A special focus of this meeting was in processes related to Tungsten giving support to AMD Unit's meeting series initiated in Spring 2021 on collisionalradiative processes on Tungsten and Hydrogen in fusion reactor edge plasma region. Coordinated activities on data and uncertainty evaluations were further discussed in a special session and next steps for an Uncertainty Quantification Workshop were outlined. The idea behind this activity is to add the uncertainties to atomic data and then propagate those uncertainties into plasma models. The primary objective of the activity is to develop robust and reliable methods/workflows to generate error bars for atomic quantities from the various codes and then to apply these uncertainties to the fusion models to determine the precision and any correlation between them that is necessary to affect the interpretation of the plasma model.



Selected Charts, Reports and Documents

IAEA-NDS-0223 Rev. 4 ACEMAKER-2.0: A code package to produce ACE-formatted files for MCNP calculations, prepared by D. Lopez Aldama and A. Trkov, August 2021.

IAEA-NDS-0238 PREPRO 2021: 2021 ENDF/B Preprocessing Codes, prepared by Dermott E. Cullen, July 2021.

INDC(NDS)-0831 The analysis of experimental data for the isotopes of Ni, prepared by N. Dzysiuk, June 2021.

INDC(NDS)-0823 Machine Learning for Nuclear Data, Summary Report of the Consultants' Meeting, 8-11 December 2020, Vienna, Austria, prepared by D. Neudecker, N. Dwivedi, E. Alhassan and G. Schnabel, October 2021.

INDC(NDS)-0832 Processing Evaluated Photonuclear Data for Actinides from the IAEA/PD-2019 Library, prepared by D. Lopez Aldama and R. Capote Noy, August 2021.

INDC(NDS)-0833 Table of Nuclear Electric Quadrupole Moments, prepared N.J. Stone, October 2021.

INDC(NDS)-0838 26th Meeting of the A+M Data Centres Network, Summary Report of an IAEA Technical Meeting, 1-3 September 2021, prepared by D. Dipti, K. Heinola, C. Hill, October 2021.

INDC(USA)-109 Renormalization of Pile Oscilator Thermal Neutron Capture Cross Section Data, prepared R.B. Firestone, October 2021.

Available cost-free on request only for teachers and scientists from developing countries:

Chart of the Nuclides 2014 JAEA Nuclear Data Centre.

Karlsruher Nuklidkarte *Wall chart of the nuclides and folding chart with booklet, 10th edition (2018).*

In Memoriam

Shaofei Zhu



We regret to inform you that Shaofei Zhu passed away on 1st November 2021.

He was born in China and also finished his BS studies at the University of Science and Technology.

He obtained his Ph. D from the University of Notre Dame in 2004 and worked at Argonne National Laboratory until 2019. Shaofei then joined National Nuclear Data Center at Brookhaven National Laboratory as physicist in the field of nuclear structure and decay data, especially gamma-ray spectroscopy and evaluation of nuclear data.

He was greatly appreciated for his professional dedication friendliness and readiness to help and mentor.

He will be greatly missed by all who knew him.

Nuclear Data Services – Contact Points

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Computer codes of US origin to all countries (there are charges and release restrictions): Radiation Safety Information Computational Center (RSICC), Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831-6003, USA. Tel. +1 865-574-6176; Fax +1 865-241-4046; Email: pdc@ornl.gov

Computer codes of non-US origin to all countries (there may be release restrictions): NEA Data Bank (see above) Contact: A. Dufresne, Email: <u>Alice.DUFRESNE@oecd.org</u>, Tel.: +33 1 73 21 28 30

IAEA-NDS on-line services at Website <u>https://nds.iaea.org/</u> Users in India, China, Russia and neighbouring countries may use IAEA-NDS mirror websites:

http://www-nds.org.in (India); http://www-nds.ciae.ac.cn/ (China); http://www-nds.atomstandard.ru/ (Russia).

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