

Recent Activities & Initiatives in the ORNL Nuclear Data Program – USNDP 2011



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NUCLEAR DATA ACTIVITIES

Nuclear Structure Data

(M. Martin & C. Nesaraja)

- A-chain Evaluations

Nuclear Astrophysics Data

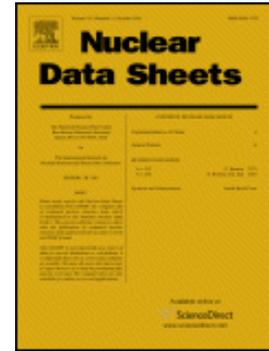
(M. Smith, C. Nesaraja *et al.*)

- Evaluation and assessments of reactions & structure critical for stellar explosion studies
- Closely coupling research and data activities

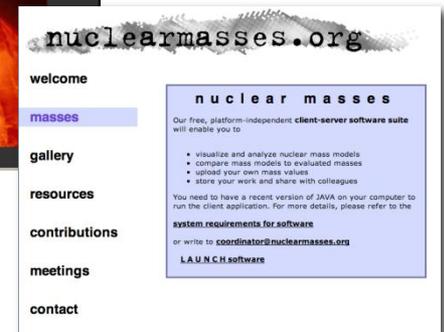
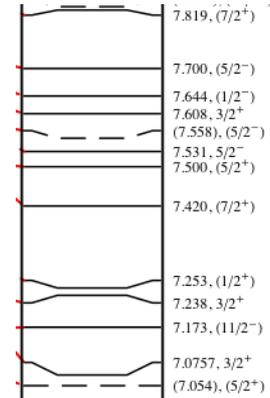
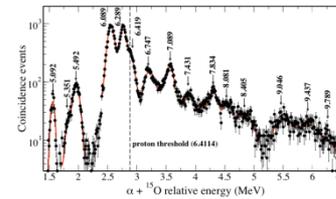
Online Software Systems

(M. Smith & E. Lingerfelt)

- Improve and expand functionality of the Computational Infrastructure for Nuclear Astrophysics
- nuclearmasses.org for the latest compiled, evaluated and theoretical masses
- Cloud Computing Initiative in Nuclear Data



Evaluated Nuclear Structure Data File (ENSDF)



NUCLEAR STRUCTURE DATA

Responsibility: Actinide Evaluations A=241 – 249 or others requested from NNDC

A=152 evaluation submitted
(Murray Martin)

A=69 evaluation submitted
(Caroline Nesaraja)

Current work:

- Review of other mass chain as requested by NNDC
- Evaluation mass chain : A=241-249

NUCLEAR ASTROPHYSICS DATA

⁸¹Ge

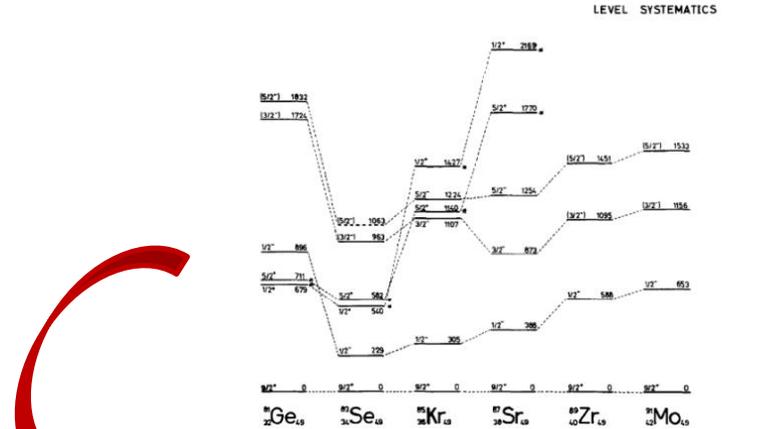
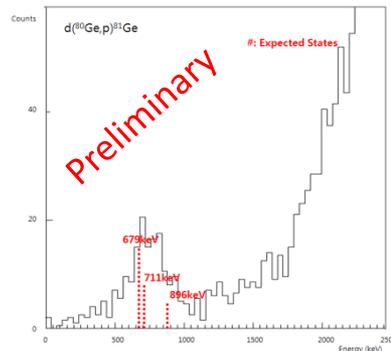
Motivation: **Properties of ⁸¹Ge levels** important for constraining models for r-process nucleosynthesis

The spins of the adopted levels for ⁸¹Ge have no firm assignments and are partly based on the systematics of odd-mass N=49 isotones and from beta decay studies

For example the spin assignment of the 1st (679 keV), (1/2⁺) and 3rd (879 keV) (1/2⁻) excited states needs to be confirmed

⁸⁰Ge(d,p)⁸¹Ge in inverse kinematics was measured at HRIBF, ORNL.

Results are being analyzed and is the **PhD thesis** of **Sunghoon Ahn (UTK)**



P. Hoff et al. 1981

Full evaluation Coral M. Baglin Nuclear Data Sheets 109, 2257 (2008) 15-Aug-2008
⁸¹Ge levels

E _{level} [#]	J ^π	T _{1/2} [#]	XREF	Comments
0.0	(9/2 ⁺)	7.6 s ^Δ 6	AB	%β ⁻ =100 J ^π : shell model systematics for N=49 nuclei.
679.14 4	(1/2 ⁺) ^Δ	7.6 s ^Δ 6	AB	%β ⁻ =100 %IT<1 (1981Ho24).
711.207 23	(5/2 ⁺)	3.9 ns 2	AB	J ^π : log ft=6.5 (log ft th =8.7) from (5/2 ⁻); D or E2 γ to (9/2 ⁺); therefore, J ^π =(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺). 5/2 ⁺ is favored by systematics since BE2W↓=0.038, comparable to that for the analogous 5/2 ⁺ to 9/2 ⁺ transition in ⁸³ Se.
895.63 4	(1/2 ⁻)	<0.5 ns	AB	J ^π : E1 γ to (1/2 ⁺); systematics of N=49 isotones. See comment on J ^π (679 level).
1241.44 3	(1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺)		AB	J ^π : E1 γ to (1/2 ⁺); γ to (1/2 ⁺).
1286.466 23	(5/2 ⁺ , 7/2 ⁻)		Δ	J ^π : γ to (9/2 ⁺); γ from (3/2 ⁻).
1303.23 3	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)		Δ	J ^π : log ft th =9.6 from (5/2 ⁻); γ to (9/2 ⁺).
1409.93 4	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)		Δ	J ^π : log ft th =8.6 from (5/2 ⁻); 1549γ to (9/2 ⁺).
1548.504 24	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)		Δ	J ^π : γ to (5/2 ⁻); γ from (3/2 ⁻) and (7/2 ⁻).
1577.02 11	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)		Δ	J ^π : log ft th =8.8 from (5/2 ⁻); γ to (9/2 ⁺).
1723.97 3	(3/2 ⁻ , 5/2 ⁻)		Δ	J ^π : log ft th =8.8 from (5/2 ⁻); γ to (9/2 ⁺).
1731.04 4	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)		Δ	J ^π : log ft th =8.8 from (5/2 ⁻); γ to (9/2 ⁺).
1805.54 7	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)		Δ	J ^π : γ to (1/2 ⁺), to (5/2 ⁻) and to (7/2 ⁻).
1816.23 5	(3/2 ⁻)		Δ	J ^π : γ to (1/2 ⁺), to (5/2 ⁻) and to (7/2 ⁻).

C. Baglin (A=81, NDS 2008)

ONLINE SOFTWARE SYSTEMS- CINA



Computational Infrastructure for Nuclear Astrophysics (CINA) streamlines the incorporation of the latest data into astrophysics simulations

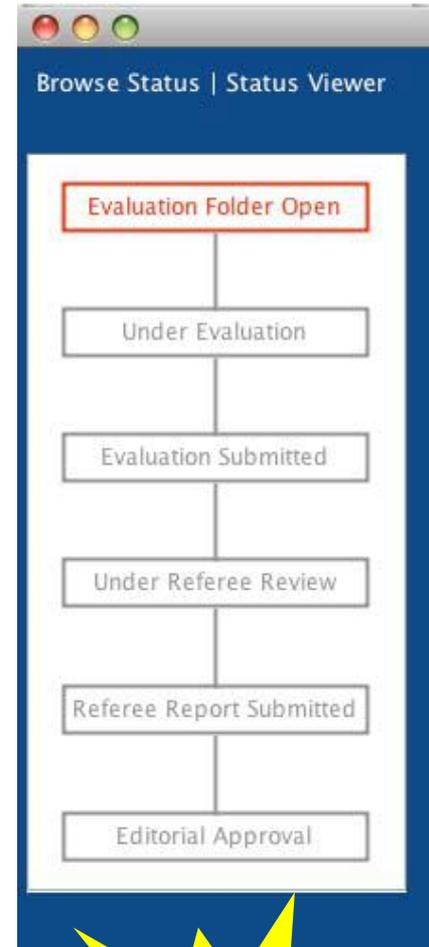
CINA is a platform-independent suite of computer codes that are freely available online at nucastrodata.org

One Tool In CINA

Rate Evaluation Toolkit

Provides a set of software tools to handle the **workflow** of evaluations (from initiation to peer review to incorporation into the new REACLIB)

This tool can be **customized** to help all USNDP evaluations (ENSDF ...)



users in
115
institutions
& in
29
countries

ONLINE SOFTWARE SYSTEMS- Nuclear Masses

nuclearmasses.org

welcome

masses

gallery

resources

contributions

meetings

contact

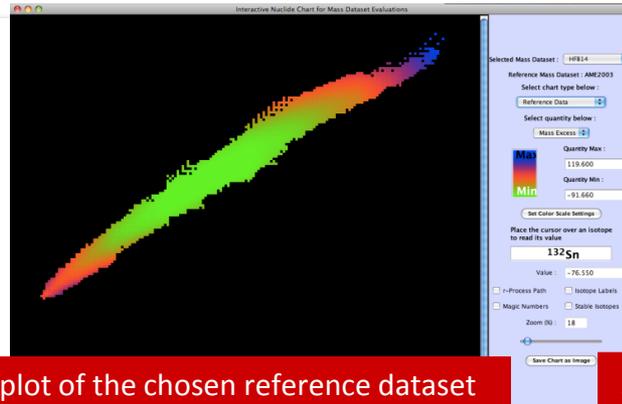
nuclear masses

Our free, platform-independent client-server software suite will enable you to

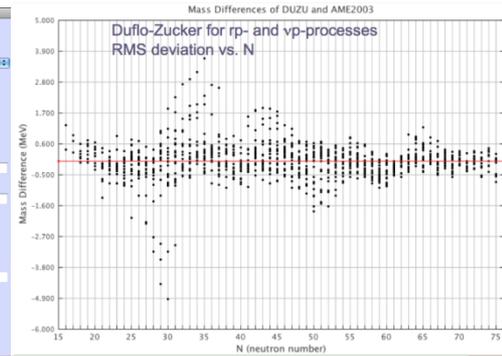
- visualize and analyze nuclear mass models
- compare mass models to evaluated masses
- upload your own mass values
- store your work and share with colleagues

You need to have a recent version of JAVA on your computer to run the client application. For more details, please refer to the [system requirements for software](#) or write to coordinator@nuclearmasses.org

LAUNCH software



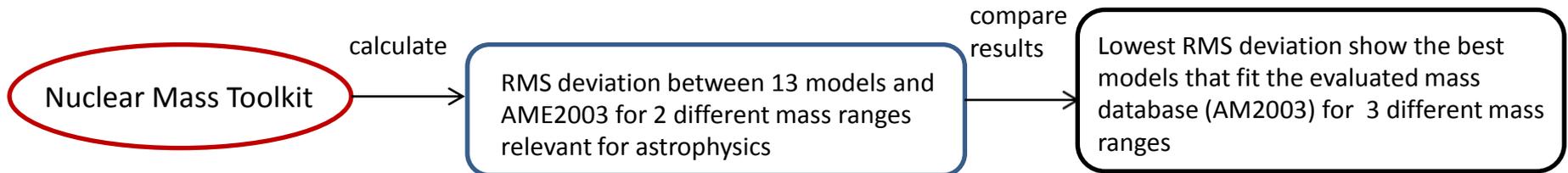
plot of the chosen reference dataset
- AME2003 evaluated masses



simple analyses of datasets are possible

nuclearmasses.org launched to aid research in nuclear masses and provide software support for new mass evaluation efforts worldwide

- SHARE and ACCESS work with scientific community (experimentalist, theorist, evaluators)
- VISUALIZE, ANALYZE & COMPARE mass datasets



M. Smith DNP 2011

Such comparisons enable researchers to **use rms deviations** from AME2003 as a **criteria** to **select a mass model** for their particular application

Publications/ Presentations

Publications

1. Phys.Rev. C **84**, 042801 (2011)

P.D. O'Malley et al.

Search for a resonant enhancement of the $7\text{Be} + d$ reaction and primordial 7Li abundances

2. Phys. Rev. C **84**,034601 (2011)

K.L. Jones, et al.

Direct reaction measurements with a ^{132}Sn radioactive ion beam

3. Phys.Rev. C **83**, 052801 (2011)

A.S.Adekola et al.

First proton-transfer study of $^{18}\text{F} + p$ resonances relevant for novae

4. Eur.Phys.J. A **47**, 66 (2011)

B.H.Moazen et al.

Direct studies of low-energy resonances in $^{31}\text{P}(p, \alpha)^{28}\text{Si}$ and $^{35}\text{Cl}(p, \alpha)^{32}\text{S}$

Presentations

1. Joint ATLAS-HRIBF-NSCL-FRIB Users Meeting

August 18 - 20, 2011

M.S. Smith

Sample of Online Resources for Nuclear Astrophysics

2. 2011 Fall Meeting of the APS Division of Nuclear Physics

October 26-29, 2011

East Lansing, MI

i) New Features in the Computational Infrastructure for Nuclear Astrophysics

M.S. Smith

ii) Comparison of Nuclear Mass Models with the Nuclear Mass Toolkit [online at nuclearmasses.org](http://nuclearmasses.org)

M.S. Smith

iii) Poster Session

-Systematic Search for Waiting Points in Nova Explosions

A. Bennett et al.

-Recent Augmentations of the Functionality of the Thermonuclear Reaction Rate Calculator (TReRaC)

K. Thomsen et al.

iv) Workshop on Energy Needs in Nuclear Data:
Cloud Computing for Nuclear Data

3. ORNL Seminar

June 23, 2011

Exploding Stars on your Computer

M.S. Smith

Summary/Future Work

Nuclear Structure/ Nuclear Astrophysics Data Evaluation and Assessments

- Mass chain evaluation $A=241-249$

Computational Infrastructure for Nuclear Astrophysics

- **Implement** a set of workflow tool for international collaboration in Nuclear Astrophysics
- **Explore** how work flow tools can be utilized in the **broader Nuclear Data Community**

Nuclear Masses

- **Explore** role of nuclearmasses.org in future mass evaluation efforts

Personnel & Funding

Scientific Permanent staff: 2 heads, USNDP funded 1.2 FTE

Scientific Temporary staff (Postdocs, long term visitors): 1 head, USNDP funded 0.15 FTE

Scientific External collaborators: many but none funded by USNDP

Technical/Support staff: 1 head, USNDP funded 0.5 FTE

New hires:

- none

Resigned/Retired:

- none