



October 31, 2025

# Status Report: Nuclear Data Program

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Caroline Nesaraja

Physics Division, ORNL



U.S. DEPARTMENT  
of **ENERGY**

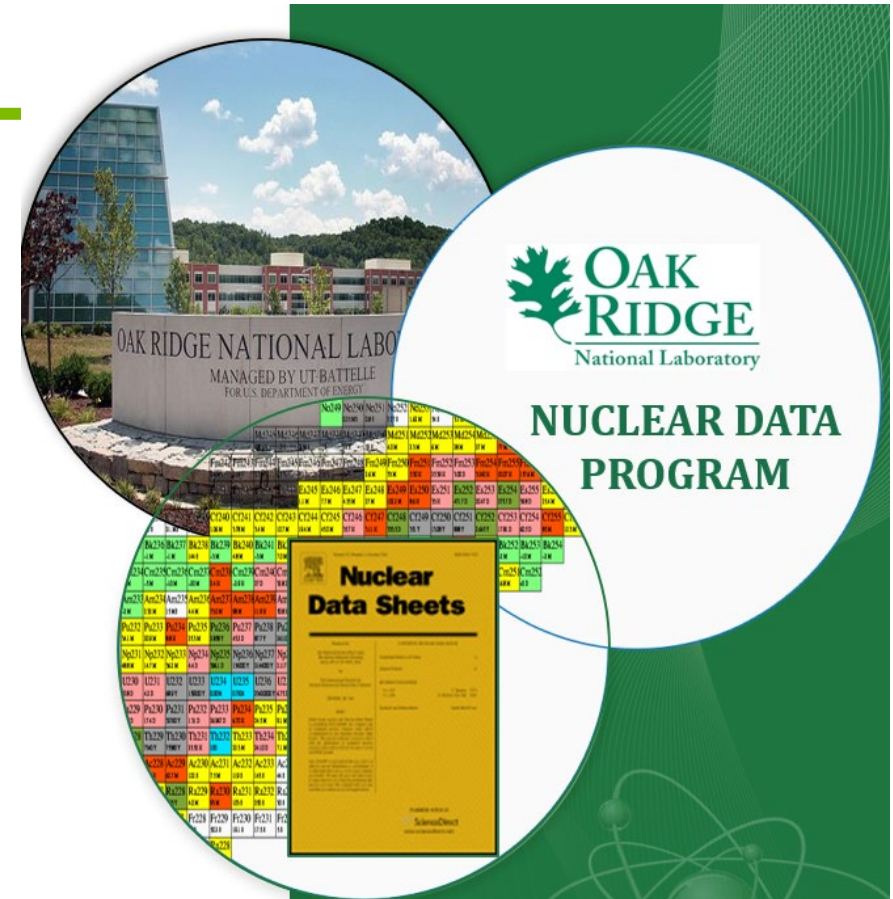
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# Members and Scope of Activities

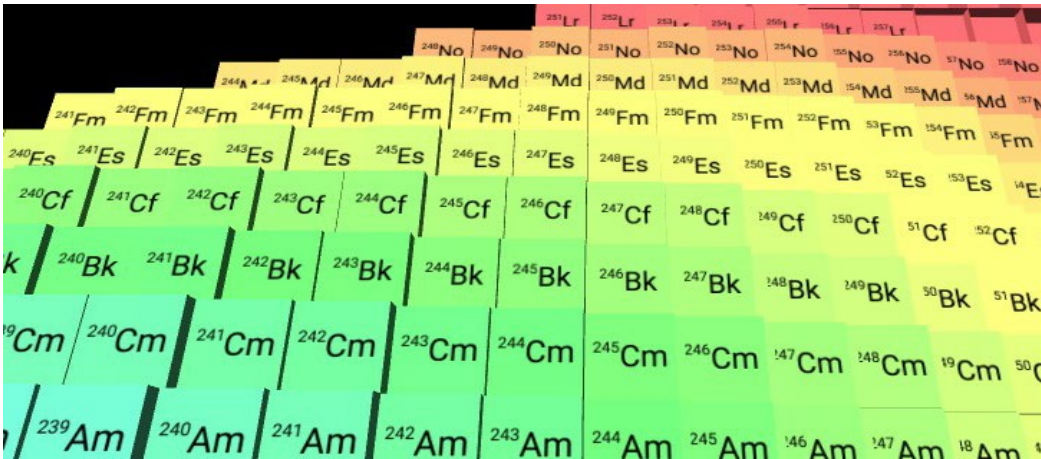
- Augusto Macchiavelli: (0.1 FTE)  
Group Leader Nuclear Structure and Nuclear Astrophysics, PI Nuclear Data Program
- Caroline Nesaraja: (1.0 FTE)  
Research Staff Member - ENSDF evaluator, Co-PI Nuclear Data Program
- Larry Zhang : (0.1 FTE)  
Student - nuclear astrophysics data  
(~2020- May 2025)



# Nuclear Structure Data ENSDF Evaluations:

ORNL responsibility: A= 241-249  
A = 69

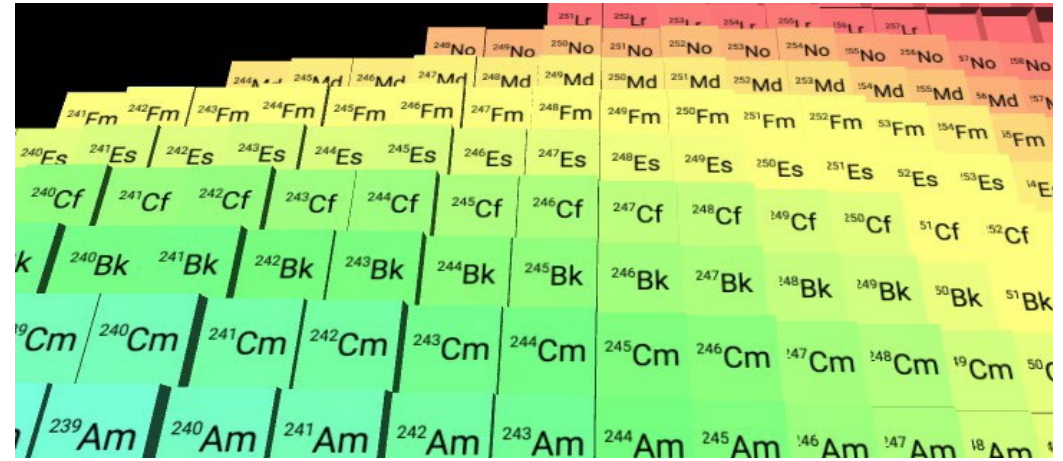
Status of these mass chains



Mass Chain	Current ENSDF Database (from NNDC website)	
241	C.D. Nesaraja. NDS 130, 183 (2015)	(Lit cut-off Sept. 2015)
242	M.J. Martin & C.D. Nesaraja. NDS 186, 263 (2022)	(Lit cut-off Dec. 2021)
243	C.D. Nesaraja & E.A. McCutchan. NDS 121, 695 (2014)	(Lit cut-off Sept. 2013)
244	C.D. Nesaraja. NDS 146, 387 (2017)	(Lit cut-off Aug. 2017)
245	C.D. Nesaraja. NDS 189, 1 (2023)	(Lit. cut-off Feb. 2023)
246	C.D. Nesaraja. NDS 198, 449 (2024)	(Lit. cut-off Jul. 2022)
247	C.D. Nesaraja. NDS 125, 395 (2015)	(Lit. cut-off Mar. 2014)
248	C.D. Nesaraja. NDS 204, 374 (2025)	(Lit. cut-off June.2024)
249	C.D. Nesaraja. NDS 195, 718 (2024)	(Lit. cut-off Oct. 2023)
69	C.D. Nesaraja. (submitted to NNDC post editorial review)	(Lit. cut-off Apr. 2023)

# Nuclear Structure Data ENSDF Evaluations:

Three mass chains were completed in various stages of the ENSDF pipeline process:



- **A=248** (C.D. Nesaraja)— 11 nuclides completed: responded to editorial comments and *published*.
- **A=69** (C.D. Nesaraja) — 13 nuclides completed: responded to reviewer and editorial comments and submitted to NNDC.
- **A=58** (B. Singh , C.D. Nesaraja) — 13 nuclides submitted to NNDC as a new mass chain
- **Updated  $^{249}\text{No}$**  (communication with co-author of Eur. Phys.J. A 58, 52 (2022) for the  $^{253}\text{Rf}$   $\alpha$  decay)
- **Reviewed** one mass chain -16 nuclides

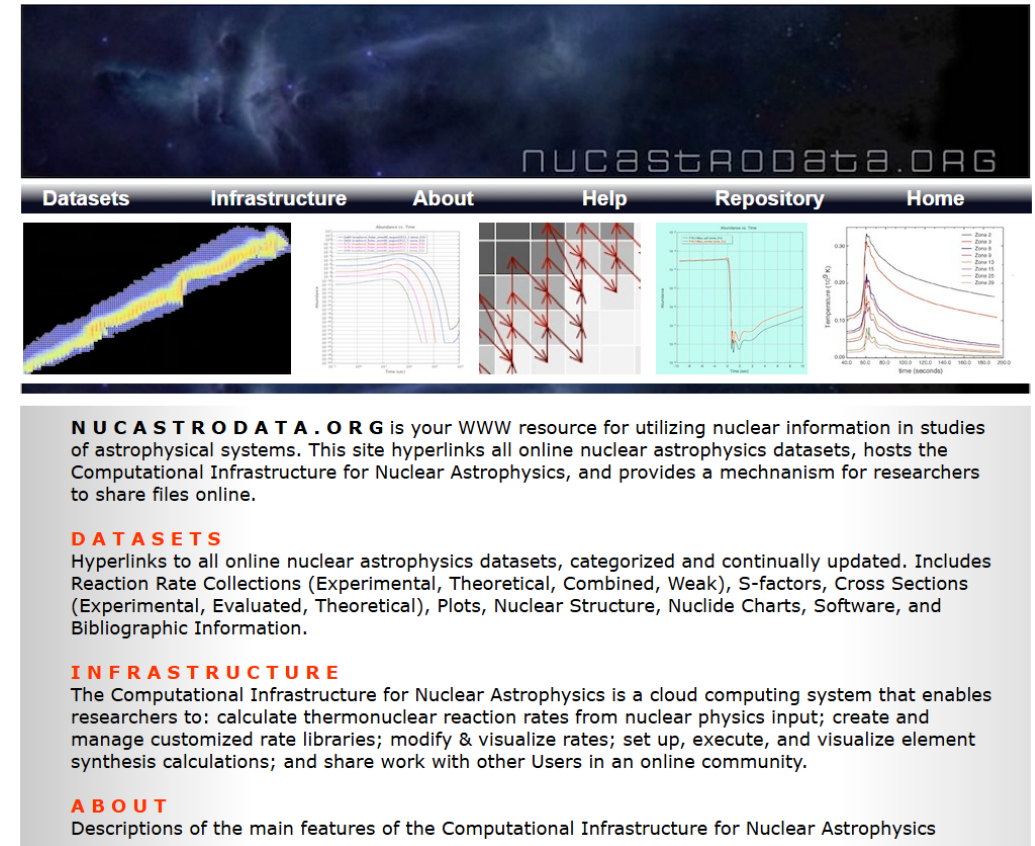
# Computational Infrastructure for Nuclear Astrophysics Data

- *Pipeline* for processing nuclear physics results into astrophysical models

- Users in over **150 institutions in 38 countries**:

Algeria, Argentina, Australia, Austria, Canada, Chile, China, Croatia, Cyprus, Denmark, Finland, France, Germany, Ghana, Greece, Hungary, India, Israel, Italy, Japan, Jordan, Malaysia, Mexico, Nepal, Poland, Romania, Serbia, Slovakia, South Africa, South Korea, Spain, Sweden, Switzerland, The Netherlands, Turkey, United Kingdom, United States, Venezuela

- Used for guiding future experiments via sensitivity studies, estimates of impacts for **experimental proposals, determining impact of measurements, uncertainty quantification** ...
- **Future of CINA : Still under discussion!!!**



**NUCASTRODATA.ORG** is your WWW resource for utilizing nuclear information in studies of astrophysical systems. This site hyperlinks all online nuclear astrophysics datasets, hosts the Computational Infrastructure for Nuclear Astrophysics, and provides a mechanism for researchers to share files online.

**DATASETS**  
Hyperlinks to all online nuclear astrophysics datasets, categorized and continually updated. Includes Reaction Rate Collections (Experimental, Theoretical, Combined, Weak), S-factors, Cross Sections (Experimental, Evaluated, Theoretical), Plots, Nuclear Structure, Nuclide Charts, Software, and Bibliographic Information.

**INFRASTRUCTURE**  
The Computational Infrastructure for Nuclear Astrophysics is a cloud computing system that enables researchers to: calculate thermonuclear reaction rates from nuclear physics input; create and manage customized rate libraries; modify & visualize rates; set up, execute, and visualize element synthesis calculations; and share work with other Users in an online community.

**ABOUT**  
Descriptions of the main features of the Computational Infrastructure for Nuclear Astrophysics



# Monte Carlo Routines for Quantifying Nova Nucleosynthesis Sensitivity to Hydrodynamic and Nuclear Rate Uncertainties

## Motivation

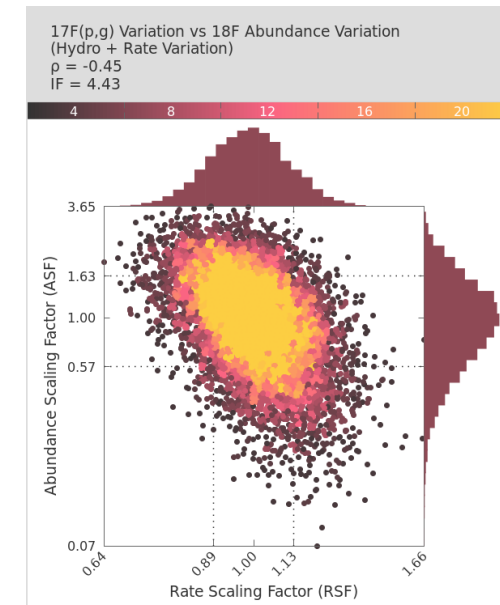
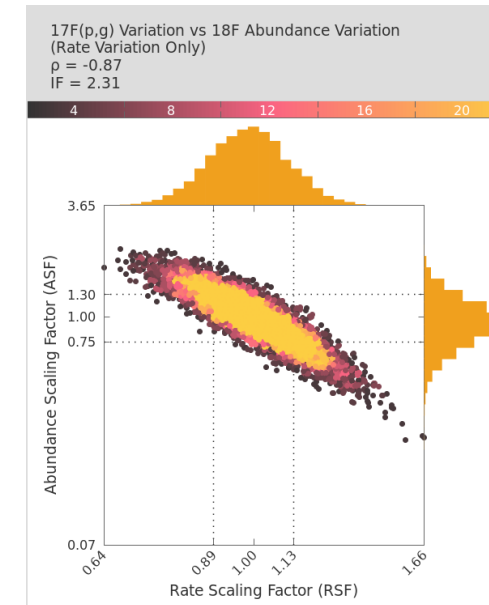
- Many studies exist where *either* hydrodynamics or nuclear rate parameters are treated as the inputs of interest for nova nucleosynthesis uncertainty quantification.
- This leads to potential cases where a nuclear rate parameter change that looks impactful, might be less so when a broader (but still realistic) range of hydrodynamic scenarios are considered (or vice-versa).
- Motivate new research by providing guidance as to which nuclear measurements might have the most impact for nova simulations

## Goals

- Develop robust, realistic methods to parametrize hydrodynamic profiles and nuclear reaction rates for nova nucleosynthesis Monte Carlo simulations.
- Run large batches (10k) of simulations to determine effects of varying these parameters on radioisotope production.
- Use known metrics/create new metrics to quantify impact and correlations between various hydrodynamic/nuclear rate variations and isotope final abundance.

## Results

- First-of-its-type MC routine that combines both types of variations, for more accurate quantification
- Updated list of nuclear reactions that are considered impactful for production of key radioisotopes
- Use metrics to determine effects of reducing *any* given nuclear rate uncertainty for nova nucleosynthesis simulations, accounting for hydrodynamic uncertainty



# Publications

## 1. C.D. Nesaraja

Nucl.Data Sheets 204, 374 (2025)

*Nuclear Data Sheets for A=248*

## 2. Stepaniuk, M., et. al.

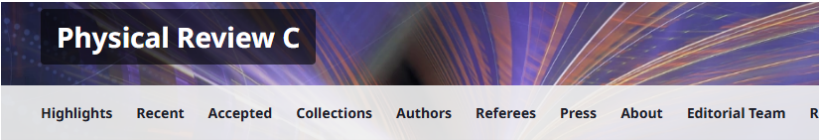
Phys.Rev. C 110, 054321 (2024)

*Decay studies of the  $\beta$ -delayed neutron emitters  $^{87}\text{Br}$  and  $^{88}\text{Br}$  measured by means of the Modular Total Absorption Spectrometer at ORNL HRIBF*

## 3. C.D. Nesaraja

Nucl.Data Sheets 198, 449 (2024)

*Nuclear Data Sheets for A=246*



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### Decay studies of the $\beta$ -delayed neutron emitters $^{87}\text{Br}$ and $^{88}\text{Br}$ measured by means of the Modular Total Absorption Spectrometer at ORNL HRIBF

M. Stepaniuk <sup>1,\*</sup>, M. Karny <sup>1,2</sup>, A. Fijałkowska <sup>1,3</sup>, K. P. Rykaczewski <sup>4</sup>, B. C. Rasco <sup>4,5</sup>, R. K. Grzywacz <sup>2,3,4</sup>, M. Wolińska-Cichocka <sup>2,4,6</sup>, J. M. Allmond <sup>4</sup>, J. C. Batchelder <sup>7</sup> et al.

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Phys. Rev. C **110**, 054321 – Published 21 November, 2024

DOI: <https://doi.org/10.1103/PhysRevC.110.054321>



Nuclear Data Sheets  
Volume 204, September 2025, Pages 374–441



### Nuclear Data Sheets for A=248 ☆

C.D. Nesaraja

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<https://doi-org.ornl.idm.oclc.org/10.1016/j.nds.2025.07.002>

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#### Abstract

Available information pertaining to the nuclear structure of ground and excited states for all known nuclei with mass numbers A=248 has been compiled and evaluated. The adopted level and decay schemes, as well as the detailed nuclear properties and configuration assignments based on experimental data, are presented for these nuclides. When there are insufficient data, expected values from systematics of nuclear properties and/or theoretical calculations are utilized. Unexpected or discrepant experimental results are also noted. This work supersedes the 2014 evaluation by M.J. Martin (2014Ma86).



Nuclear Data Sheets  
Volume 198, December 2024, Pages 449–534



### Nuclear Data Sheets for A=246 ☆

C.D. Nesaraja

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<https://doi-org.ornl.idm.oclc.org/10.1016/j.nds.2024.11.002>

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#### Abstract

Available information pertaining to the nuclear structure of ground and excited states for all known nuclei with mass number A = 246 have been compiled and evaluated. The adopted level and decay schemes, as well as the detailed nuclear properties and configuration assignments based on experimental data, are presented for these nuclides. When there are insufficient data, expected values from systematics of nuclear properties and/or theoretical calculations are utilized. Unexpected or discrepant experimental results are also noted. In cases where weighted averaging procedures have been used, the assigned uncertainty in the result is generally not lower than the lowest uncertainty in the data points used in the procedure.