



# Argonne Nuclear Data Program



U.S. DEPARTMENT OF  
**ENERGY**

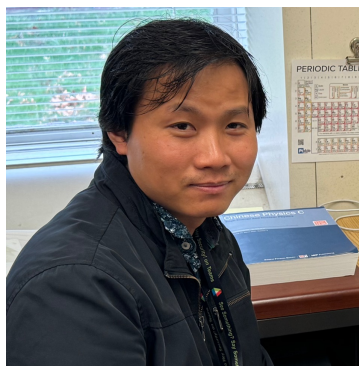
Office of  
Science

**Nuclear Physics**

1 FTE USNDP staff



Filip Kondev



Rikel Chakma

1 FTE post-doc - since February 2024  
funded by DOE/SC/NP via FOA with MSU

PhD, 2020 UParis-Saclay, IJCLab, Orsay  
former post-doc at GANIL, 2021-2023

# What we do

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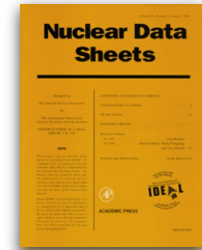
## Core Nuclear Data research activities

- ⇒ nuclear structure and decay data evaluations - **ENSDF**
- ⇒ evaluation of masses and other nuclear physics properties - **AME & NUBASE** libraries (presentation on Wednesday)
- ⇒ evaluations in support of **IAEA-led projects & topical evaluations** with leading nuclear scientists
  - medical isotopes, monitoring applications, decay heat, FP data for antineutrino spectra reconstructions, nuclear isomers, BE3 transition probabilities, etc.

## Other Nuclear Data research activities

- ⇒ intersections between basic & applied NP & astrophysics
- ⇒ targeted experiments (funded by DOE/SC/NP FOAs) & research activities at ANL (ATLAS & CARIBU), MSU (FRIB), RIKEN (RIBF), GSI and other NP facilities

# ENSDF Evaluations



- ⇒ **18 mass chains** assigned to ANL NDP
- ⇒ inherited  $A=176, 178, 179, 199, 208$  from LBNL, McMaster & ORNL - some are 15-18 years old

A	NDS	Evaluator
109	NDS 137 (2016)	S. Kumar, J. Chen & F.G. Kondev
110	NDS 113 (2012)	G. Gurdal & F.G. Kondev
176	NDS 107 (2006)	M.S. Basunia
177	NDS 159 (2019)	F.G. Kondev
178	NDS 110 (2009)	E. Achterberg, O. Capurro, G. Marti
179	NDS 110 (2009)	C.M. Baglin
188	NDS 150 (2018)	F.G. Kondev, D. Hartley, S. Juutinen
199	NDS 108 (2007)	B. Singh
<b>200</b>	<b>NDS 192 (2023)</b>	<b>F.G. Kondev</b> ← FY22
<b>201</b>	<b>NDS 187 (2023)</b>	<b>F.G. Kondev</b> ← FY21
<b>202</b>	<b>NDS (in press)</b>	<b>F.G. Kondev</b> ← FY23
203	NDS 177 (2021)	F.G. Kondev
204	NDS 111 (2010)	C.J. Chiara & F.G. Kondev
205	NDS 166 (2020)	F.G. Kondev
206	NDS 109 (2008)	F.G. Kondev ← FY24
207	NDS 112 (2011)	F.G. Kondev & S. Lalkovski
208	NDS 108 (2007)	M. Martin (ORNL)
209	NDS 126 (2015)	J. Chen & F.G. Kondev

## Positive development

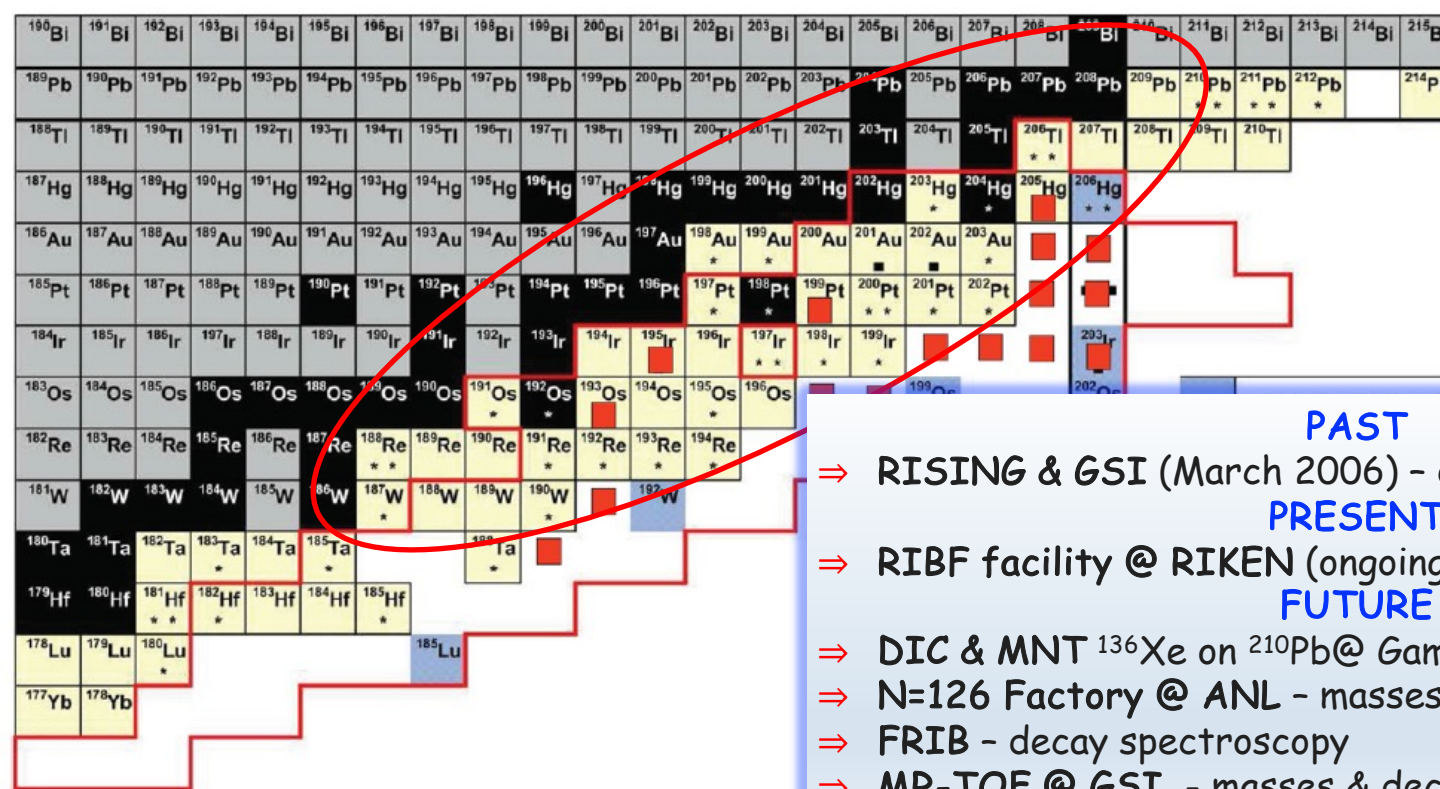
- ⇒ fully-funded ANL staff in FY24 - increased ENSDF contributions & productivity

## FY24 - 0.6 FTE on ENSDF

- ⇒ completed  **$A=206$**  - promptly reviewed (thank you Chris M!) - currently being prepared for publication in *NDS*
- ⇒  **$A=229$**  with J. Tuli and E. Browne (LBNL) is near completion
- ⇒ addressed reviewer's comments & published  **$A=202$**  in *NDS*
- ⇒ reviewed  **$A=69$**

# Impact On Nuclear Physics Research

- ⇒ ANL region of evaluation activities is closely connected to our research interest in the *nuclear structure & astrophysics* areas - region *south of  $^{208}\text{Pb}$  ( $N=126$ )*
- sought out as a collaborator in many research campaigns - interactions with leading nuclear scientists @ world's leading facilities - provide benefits to ND evaluation: up-to-date, complete, comprehensive & reliable evaluated data



## PAST

- ⇒ RISING & GSI (March 2006) - decay spectroscopy

## PRESENT

- ⇒ RIBF facility @ RIKEN (ongoing) - decay spectroscopy

## FUTURE

- ⇒ DIC & MNT  $^{136}\text{Xe}$  on  $^{210}\text{Pb}$ @ Gammasphere (ANL)  
⇒ N=126 Factory @ ANL - masses & decay spectroscopy  
⇒ FRIB - decay spectroscopy  
⇒ MR-TOF @ GSI - masses & decay spectroscopy

# Topical Evaluations

new activities in FY24

Atomic Data and Nuclear Data Tables 103–104 (2015) 50–105

Configurations and hindered decays of *K* isomers in deformed nuclei with  $A > 100$

F.G. Kondev<sup>a,\*</sup>, G.D. Dracoulis<sup>b,1</sup>, T. Kibédi<sup>b</sup>



IOP Publishing

Reports on Progress in Physics

Review of metastable states in heavy nuclei

G D Dracoulis<sup>1,4</sup>, P M Walker<sup>2</sup> and F G Kondev<sup>3</sup>

Reports on Progress in Physics



both are highly cited

FRIB-TA Topical Program: Nuclear Isomers in the Era of FRIB

G. Wendell Misch\* and M. R. Mumpower<sup>†</sup>  
Los Alamos National Laboratory

arXiv:2304.10608

Filip Kondev<sup>‡</sup>

Argonne National Laboratory



Review (Evaluation) of *BE3 transition probabilities* - impact on FRIB & ATLAS with Tibor Kibedi (ANU)

Eur. Phys. J. Spec. Top.  
<https://doi.org/10.1140/epjs/s11734-024-01096-4>

THE EUROPEAN PHYSICAL JOURNAL  
SPECIAL TOPICS

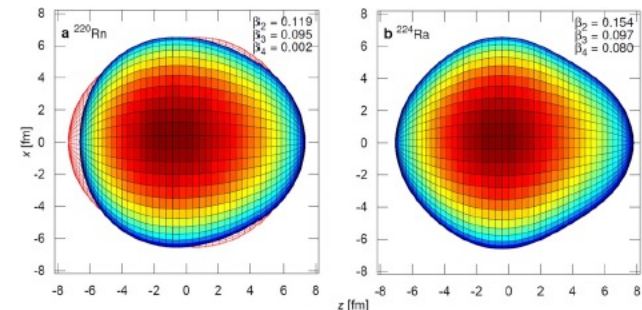
Review

**K isomers in atomic nuclei**

P. M. Walker<sup>1,a</sup> and F. G. Kondev<sup>2,b</sup>

updated data

- ⇒ beta decaying K isomers – using existing ND
- implications to ND evaluation – presented at the last NSDD meeting @IAEA



# Collaborations with IAEA & broader ND community

Eur. Phys. J. A (2023) 59:78  
<https://doi.org/10.1140/epja/s10050-023-00969-x>

THE EUROPEAN  
PHYSICAL JOURNAL A



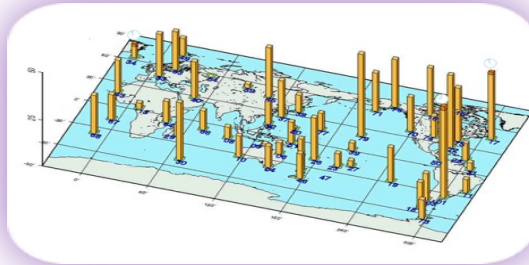
Review

## Improving fission-product decay data for reactor applications: part I—decay heat

A. L. Nichols<sup>1,2</sup>, P. Dimitriou<sup>3,a</sup>, A. Algora<sup>4,5</sup>, M. Fallot<sup>6</sup>, L. Glot<sup>6</sup>, F. G. Kondev<sup>7</sup>, T. Yoshida<sup>8</sup>, M. Karny<sup>9</sup>,  
G. Mukherjee<sup>10</sup>, B. C. Rasco<sup>11</sup>, K. P. Rykaczewski<sup>11</sup>, A. A. Sonzogni<sup>12</sup>, J. L. Tain<sup>4</sup>

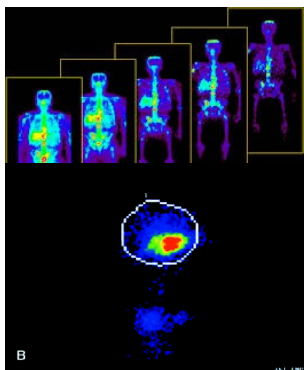
## Improving Data for Decay Heat Applications

⇒ recommended nuclear decay data  
and future data needs for ~120  
radionuclides in the FP region



## Decay Data Library for Monitoring Applications

⇒ 40 radionuclides in the FP region  
⇒ ANL staff is technical coordinator



## IAEA-CRP on Medical Isotopes production

- ⇒ 3 review articles
- recommended CS & decay Nuclear Data
- ⇒ 2023 IAEA TM
- future data needs

Contents lists available at ScienceDirect

Nuclear Inst. and Methods in Physics Research, A

journal homepage: [www.elsevier.com/locate/nima](http://www.elsevier.com/locate/nima)

Branching ratio and  $\gamma$ -ray emission probabilities in the decay of the  $J^\pi = 13/2^+$  isomer in  $^{197}\text{Hg}$

O. Lebeda<sup>a</sup>, F.G. Kondev<sup>b,\*</sup>, J. Červenák<sup>a</sup>

ELSEVIER

NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH

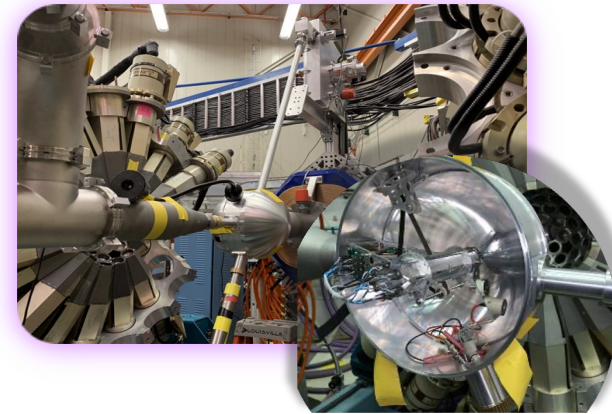
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⇒ resolved discrepancies for  $^{67}\text{Cu}$  &  
 $^{197\text{m}}\text{Hg}$  theragnostic radionuclides

# Other ND activities



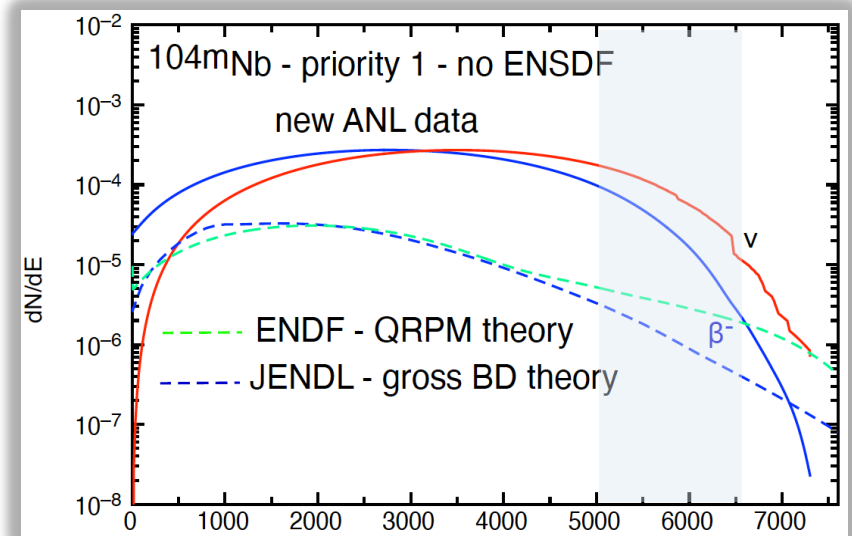
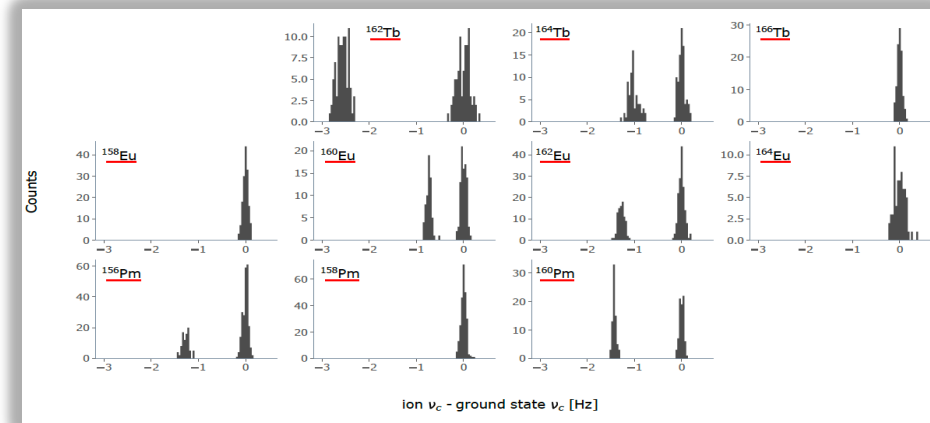
**Targeted Experiments**  
⇒ ATLAS @ CARIBU facilities  
⇒ state-of-the-art equipment  
**ND FOAs (INDWG)**  
4 funded/2 completed  
DOE/SC/NP and NNSA/NA-22



⇒ novel ion-counting FPY program @CARIBU  
• ground states & isomers (FPY & IR)

⇒ decay data station @Gammasphere  
• improving FP decay data for science & applications

collaboration between ANL & LLNL



# ANL-ND near-future (3-5 years) vision

## High Priority Activities - NSAC ND & 2024 NP LRP

- ⇒ Continue contributing to **ENSDF** - top priority since **it is struggling**
  - maintain closer connections with the broader NP research community
- ⇒ Continue contributing to **AME & NUBASE** - impact on science & applications
  - maintaining the **currency** and **quality** is a high priority - aiming at 4-5 years cycle -> the next libraries likely in **2026**

## Other Priority Activities

- ⇒ Continue collaborations with IAEA-NDS, other USNDP & NSDD groups & broader nuclear physics community on ND **topical evaluations** - impact in high-priority areas, e.g. **BE3 Transition Probability Evaluation** with ANU
- ⇒ Continue ND experimental activities - **nuclear structure, masses, astrophysics** & intersections with the **applied programs**
  - **ATLAS & CARIBU**: emphasis on properties of neutron-rich nuclei in the deformed, light rare-earth region, FP and heavy nuclei & nuclear isomers
    - **N=126 Factory**: the region south of  $^{208}\text{Pb}$  - **overlaps** with the Nuclear Data evaluation responsibilities
    - **nuCARIBU**: contributions to ND FOA's and other InterAgency ND projects
  - **MSU (FRIB), RIKEN, GSI & others**: research at the forefront of nuclear science - collaborative agreements with little or no cost to ANL NDP