Texas A&M Nuclear Data Program

Evaluation of Nuclear Structure and Decay Data:
Proposal for New Evaluation Center

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Evaluation of Nuclear Structure and Decay Data OVERVIEW

- ***Scope:***

  Promote and accomplish mass-chain nuclear structure data evaluation at Texas A&M University - Cyclotron Institute as regular activity and foresee future developments.

- ***New Nuclear Data Evaluation Center at the Cyclotron Institute is continuing the effort we have invested in this respect since 2005 that was financed by a contract with the National Nuclear Data Center at Brookhaven National Laboratory.***

- ***The actual proposal is based on the financing addressed directly at Cyclotron Institute by DOE Grant***

NSDD Evaluation Centers

- ***North America:***
  - ***US – 6 centers -> Texas A&M the 7th center***
  - ***Canada – 1 center***
- ***Asia:***
  - ***China – 2 centers***
  - ***India – 1 center***
  - ***Japan – 1 center***
- ***Europe:***
  - ***Russia – 1 center***
  - ***Hungary – 1 center***
  - ***Romania – 1 center***
- ***Australia: 1 center***

I. Overview:
Texas A&M Nuclear Data Program under Contract with BNL/NNDC

Since 2005 – Continually

- *Intended to help the major crisis of evaluators (because of many retiring old evaluators)*
- *Initiated by J.C. Hardy, R.G. Helmer, J.K. Tuli*
- *N. Nica (PI, evaluator) and J.C. Hardy (scientific adviser)*
- *It placed Texas A&M from the very beginning as one of the most productive evaluation centers although officially we were not counted as an autonomous center*
- *67% FTE Mass Chain Evaluation*
- *evaluated 203 nuclei, 15 mass chains, published 14 papers (NDS)*

Texas A&M - Cyclotron Institute part of U.S. Nuclear Data Program under contract with NNDC-BNL (subcontract #100586): Period 2005 – 2016, 67% FTE Mass Chain Evaluation

- ***Initiated in 2005***
  - ***At Texas A&M by J.C. Hardy based on his precision measurements and evaluations on the superallowed 0+ to 0+ beta decay, as well as on his network of collaborators, particularly R.G. Helmer, a distinguished experimentalist and mass-chain data evaluator***
  - ***At BNL-NNDC by J.K. Tuli, A.A. Sonzogni, T.W. Burrows (mentor)***
  - ***Basically as part of the effort to bring new ENSDF evaluators, as effect of "evaluation crisis"***
- ***67% FTE, one major A-chain/FY***
- ***Texas A&M precision measurements of ICC are a major contribution to NSDD/USNDP***
  - ***9 major E3, M4 transitions, mostly α_K ICC, and fewer α_T:***
    - ***^{125}Te, ^{127}Te, ^{111}Cd, ^{119}Sn, ^{139}La, ^{134}Cs, ^{137}Ba, ^{197}Pt, ^{193}Ir***
  - ***1 fluorescence yield ω_K of Iridium: ^{191}Os(β^-)***
  - ***12 major publications***
  - ***BrIcc adopted the "Frozen Orbitals" calculations based on Texas A&M ICC measurements***

Mass Chain Evaluation: *200 nuclei, 15 A-chains*

- 1. N.Nica, *Nuclear Data Sheets for A = 252*, Nucl.Data Sheets 106, 813 (2005)
- 8 nuclei: ^{252}Cm, ^{252}Bk, ^{252}Cf, ^{252}Es, ^{252}Fm, ^{252}Md, ^{252}No, ^{252}Lr
- 2. N.Nica, *Nuclear Data Sheets for A = 140*, Nucl.Data Sheets 108, 1287 (2007)
- 16 nuclei: ^{140}Te, ^{140}I, ^{140}Xe, ^{140}Cs, ^{140}Ba, ^{140}La, ^{140}Ce, ^{140}Pr, ^{140}Nd, ^{140}Pm, ^{140}Sm, ^{140}Eu, ^{140}Gd, ^{140}Tb, ^{140}Dy, ^{140}Ho
- 3. D.Abriola *et al.*, *Nuclear Data Sheets for A = 84*, Nucl.Data Sheets 110, 2815 (2009)
- 1 nucleus: ^{84}Y
- 4. N.Nica, *Nuclear Data Sheets for A = 147*, Nucl.Data Sheets 110, 749 (2009)
- 16 nuclei: ^{147}Xe, ^{147}Cs, ^{147}Ba, ^{147}La, ^{147}Ce, ^{147}Pr, ^{147}Nd, ^{147}Pm, ^{147}Sm, ^{147}Eu, ^{147}Gd, ^{147}Tb, ^{147}Dy, ^{147}Ho, ^{147}Er, ^{147}Tm
- 5. N.Nica, *Nuclear Data Sheets for A = 97*, Nucl.Data Sheets 111, 525 (2010)
- 14 nuclei: ^{97}Br, ^{97}Kr, ^{97}Rb, ^{97}Sr, ^{97}Y, ^{97}Zr, ^{97}Nb, ^{97}Mo, ^{97}Tc, ^{97}Ru, ^{97}Rh, ^{97}Pd, ^{97}Ag, ^{97}Cd
- 6. J.Cameron, J.Chen, B.Singh, N.Nica, *Nuclear Data Sheets for A = 37*, Nucl.Data Sheets 113, 365 (2012)
- 10 nuclei: ^{37}Na, ^{37}Mg, ^{37}Al, ^{37}Si, ^{37}P, ^{37}S, ^{37}Cl, ^{37}Ar, ^{37}K, ^{37}Ca
- 7. N.Nica, J.Cameron, B.Singh, *Nuclear Data Sheets for A = 36*, Nucl.Data Sheets 113, 1 (2012)
- 10 nuclei: ^{36}Na, ^{36}Mg, ^{36}Al, ^{36}Si, ^{36}P, ^{36}S, ^{36}Cl, ^{36}Ar, ^{36}K, ^{36}Ca
- 8. N.Nica, B.Singh, *Nuclear Data Sheets for A = 34*, Nucl.Data Sheets 113, 1563 (2012)
- 11 nuclei: ^{34}Ne, ^{34}Na, ^{34}Mg, ^{34}Al, ^{34}Si, ^{34}P, ^{34}S, ^{34}Cl, ^{34}Ar, ^{34}K, ^{34}Ca
- 9. B.Singh, N.Nica, *Nuclear Data Sheets for A = 77*, Nucl.Data Sheets 113, 1115 (2012)
- 12 nuclei: ^{77}Ni, ^{77}Cu, ^{77}Zn, ^{77}Ga, ^{77}Ge, ^{77}As, ^{77}Se, ^{77}Br, ^{77}Kr, ^{77}Rb, ^{77}Sr, ^{77}Y
- 10. N.Nica, *Nuclear Data Sheets for A = 148*, Nucl.Data Sheets 117, 1 (2014)
- 16 nuclei: ^{148}Xe, ^{148}Cs, ^{148}Ba, ^{148}La, ^{148}Ce, ^{148}Pr, ^{148}Nd, ^{148}Pm, ^{148}Sm, ^{148}Eu, ^{148}Gd, ^{148}Tb, ^{148}Dy, ^{148}Ho, ^{148}Er, ^{148}Tm
- 11. N.Nica, *Nuclear Data Sheets for A = 141*, Nucl.Data Sheets 122, 1 (2014)
- 16 nuclei: ^{141}Te, ^{141}I, ^{141}Xe, ^{141}Cs, ^{141}Ba, ^{141}La, ^{141}Ce, ^{141}Pr, ^{141}Nd, ^{141}Pm, ^{141}Sm, ^{141}Eu, ^{141}Gd, ^{141}Tb, ^{141}Dy, ^{141}Ho
- 12. N.Nica, *Nuclear Data Sheets for A = 157*, Nucl.Data Sheets 132, 1 (2016)
- 15 nuclei: ^{157}Nd, ^{157}Pm, ^{157}Sm, ^{157}Eu, ^{157}Gd, ^{157}Tb, ^{157}Dy, ^{157}Ho, ^{157}Er, ^{157}Tm, ^{157}Yb, ^{157}Lu, ^{157}Hf, ^{157}Ta, ^{157}W
- 13. N.Nica, *Nuclear Data Sheets for A = 158*, Nucl.Data Sheets
- 15 nuclei: ^{158}Nd, ^{158}Pm, ^{158}Sm, ^{158}Eu, ^{158}Gd, ^{158}Tb, ^{158}Dy, ^{158}Ho, ^{158}Er, ^{158}Tm, ^{158}Yb, ^{158}Lu, ^{158}Hf, ^{158}Ta, ^{158}W
- 14. N.Nica, *Nuclear Data Sheets for A = 140*, Nucl.Data Sheets – *to be published*
- 17 nuclei: ^{140}Sb, ^{140}Te, ^{140}I, ^{140}Xe, ^{140}Cs, ^{140}Ba, ^{140}La, ^{140}Ce, ^{140}Pr, ^{140}Nd, ^{140}Pm, ^{140}Sm, ^{140}Eu, ^{140}Gd, ^{140}Tb, ^{140}Dy, ^{140}Ho
- 15. N.Nica, A =155, *Nuclear Data Sheets for A = 1455, Nucl.Data Sheets – to be published*
- 16 nuclei: ^{155}Ce, ^{155}Pr, ^{155}Nd, ^{155}Pm, ^{155}Sm, ^{155}Eu, ^{155}Gd, ^{155}Tb, ^{155}Dy, ^{155}Ho, ^{155}Er, ^{155}Tm, ^{155}Yb, ^{155}Lu, ^{155}Hf, ^{155}Ta
- Work în Progress
- 16. N.Nica, A =160, *in progress, to be published in Nucl.Data Sheets*
- 17 nuclei: ^{160}Pr, ^{160}Nd, ^{160}Pm, ^{160}Sm, ^{160}Eu, ^{160}Gd, ^{160}Tb, ^{160}Dy, ^{160}Ho, ^{160}Er, ^{160}Tm, ^{160}Yb, ^{160}Lu, ^{160}Hf, ^{160}Ta, ^{160}W, ^{160}Re,

*Including, participation to national and international nuclear data evaluation events, and review work.

II. New Project: Texas A&M Nuclear Data Program under DOE Grant and new NSDD Evaluation Center

New Proposal with Cyclotron Institute Grant 2017-2019:

- *67% FTE Mass Chain Evaluation*
- *N. Nica (PI, evaluator) and J.C. Hardy (scientific adviser)*
- ***Arguments for running as independent program:***
  - *Texas A&M University operates at rather low overhead costs so cost-wise we are going to be among the efficient centers in the USNDP effort*
  - *Promote new Evaluation Center during FY2017*

II. New Project:
Texas A&M Nuclear Data Program under DOE Grant and new NSDD Evaluation Center

New Proposal with Cyclotron Institute Grant 2017-2019:

Arguments for running as independent program:

- ***Increasing gradually the FTE margin for the PI (Ninel Nica)***
- ***Hiring inexpensive undergraduate student workers***
- ***Adding (if possible) some post-doc FTE fraction to the ENSDF effort.***
- ***These are the main ways to add value to the whole NSDD effort.***

A-Chain Evaluation Responsibility @Texas A&M University

- ***140, 141, 147, 148, 153, 155, 157, 158, 160, All but 153 were previously full-evaluated by N. Nica (140 twice)***

II. New Project: Texas A&M Nuclear Data Program under DOE Grant and NSDD Data Center

Promoting Scientific Research Programs related to data evaluation:

- *Continuing the Internal Conversion Coefficients precision measurements program*
- *Promoting original research ideas from reevaluating existing data*

III. Texas A&M University Nuclear Data Center

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