Progress Report
on Nuclear Structure and Decay Data Activities
at Texas A&M University

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I. Program overview

Texas A&M University (TAMU) by the Cyclotron Institute got implied in the nuclear data evaluation effort in the frame of the U.S. Nuclear Data Program (USNDP) in order to promote and accomplish specific evaluation activities as well as other experimental activities in support of data evaluation. We joined the effort in 2005 under contract with the National Nuclear Data Center (NNDC) with 0.67 FTE for data evaluation. We also devoted 0.33 FTE at Cyclotron Institute for precise experimental measurements, especially of the internal conversion coefficients (ICC's), in direct support to ENSDF data evaluation. Since 2017 TAMU became an autonomous NSDD evaluation center continuing the previously defined program. In 2018 a full FTE effort will be devoted to data evaluation.

II. Nuclear Data Evaluations Activities for ENSDF

The main part of the nuclear data evaluation activities at TAMU is that of the nuclear structure and decay data evaluations for the ENSDF database for the following nuclei assigned to the our center: **A=140, 141, 147, 148, 153, 155, 157, 158, 160**. On average these nuclei in the so called rare earth region of the periodic table have been very intensely studied by a variety of techniques and are massive A chains contributing with big amounts of data to the ENSDF database. In total we evaluated more than 240 nuclei and 18 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 141, 1 (2017)
  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 – Nucl.Data Sheets 154, 1 (2018)
  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 = 155, 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
- 16. N.Nica, A =160, *Nuclear Data Sheets for A = 160, Nucl.Data Sheets – to be published*
  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
- 17. N.Nica, A =153, *submitted to NNDC*
  16 nuclei: ^{153}La, ^{153}Ce, ^{153}Pr, ^{153}Nd, ^{153}Pm, ^{153}Sm, ^{153}Eu, ^{153}Gd, ^{153}Tb, ^{153}Dy, ^{153}Ho, ^{153}Er, ^{153}Tm, ^{153}Yb, ^{153}Lu, ^{153}Hf
- 18. N.Nica, *Nuclear Data Sheets for A = 147 – in progress*
  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

The status of TAMU nuclei is the following (A chain, followed by the literature cutoff in parentheses):

- ✓ *140 (Nov 2018) completed*
- ✓ *158 (Feb 2017) completed*
- ✓ *157 (Dec 2015) completed*
- ✓ *148 (Oct 2013) completed*

- ✓ *141 (Jun 2012) completed*
- ➢ *155 (Jan 2004) after review with evaluator*
- ➢ *160 (Jun 2005) in review with NNDC*
- ➢ *153 (Dec 2005) in review with NNDC*
- ➢ *147 (Nov 2008) in progress*

Since Apr 2017 we fully evaluated A=160 and A=153, published A=158 and A=140 and started the new evaluation of A=147 which is in progress. We also completed the complex review work of a massif A chain (about one month of continuous work).

III. Other Activities

In this period of time we also contributed the mass chain evaluation effort with experimental ICC measurements aimed at consolidating the theoretical approach of calculating the ICC's in ENSDF database. Following our series of measurements the Dirac-Fock calculations with the "frozen orbital" approach for inclusion of the atomic vacancy effect on the converted electron were implemented in the code BrIcc. We finalized and published the ninth case in this series (Phys.Rev. C 98, 054321 (2018): the 39.8-keV E3 transition in ^{103}Rh, a complex case that was studies by both β^- and ε respective decays. In total we published 14 major publications on this important topic. A new ICC case is currently under measurement, the 30.8-keV, M4 transition in ^{93m}Nb. The scope of the series of measurements is to test the validity of the "frozen orbital" theory over a large domain of Z and A numbers in the nuclear chart.

We also contributed indirectly the data effort by completing high quality benchmark nuclear data measurements ($T_{1/2}$'s and branching ratios) by β-γ spectroscopy done at the Momentum Achromat Recoil Spectrometer (MARS) at Cyclotron Institute with several measurements of which in this interval were completed ^{30}S ($T_{1/2}$, Phys.Rev. C 97, 035501 (2018) and ^{26}Si (branching ratios, submitted to PRC).