Nuclear Data Group Report
LBNL+UCB

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NSDD Technical Meeting, IAEA, Vienna, April 8-12, 2019

Nuclear Data Group Members (LBNL+UCB)

- **L. A. Bernstein (LBNL + UCB) (Group Leader)**
- **M. S. Basunia (LBNL)**
- **A. M. Hurst (UCB)**
- **J. C. Batchelder (UCB)**
- **R. B. Firestone* (UCB)**
- **E. Browne* (UCB)**
- **J. K. Tuli* (UCB)**
- **Andrew Voyles (LBNL Postdoc)**
- **Graduate students:**
  - Jonathan Morrell
  - Amanda Lewis
  - Eric Matthews
  - Morgan Fox
  - Austin Lo
  - Christopher Brand

***Under contract with UCB**

Activities:

- **ENSDF**
  - Responsibility: 33 mass chains: 21-30, 81, 83, **90**-93, 166-171, 184, 186, 187, 191-193, 210, 211, **212**, 213, 214
- **XUNDL**
  - Since 2014, depending on the need
- **Photon Strength Function Database and EGAF**
  - IAEA CRP on Photon Strength Functions
    - Responsible for providing a systematic study of M1, E1, and E2 photon strengths
  - (n,γ) measurements. Statistical model calculations
    - σ_γ, σ_0, structure, decay data, S_n
- **(n,n'γ) – Baghdad Atlas**
  - Compilation/Evaluation
- **Experimental effort:**
  - Targeted experiment (DOE, NDIWG, NE,.. funded)
  - **Facilities: 88" cyclotron, LBNL**; Neutron Generator, UCB; Guided neutron beam in Budapest, Hungary, FRM, Germany, and Cyclotron facility at the University of Oslo

Evaluation/Compilation

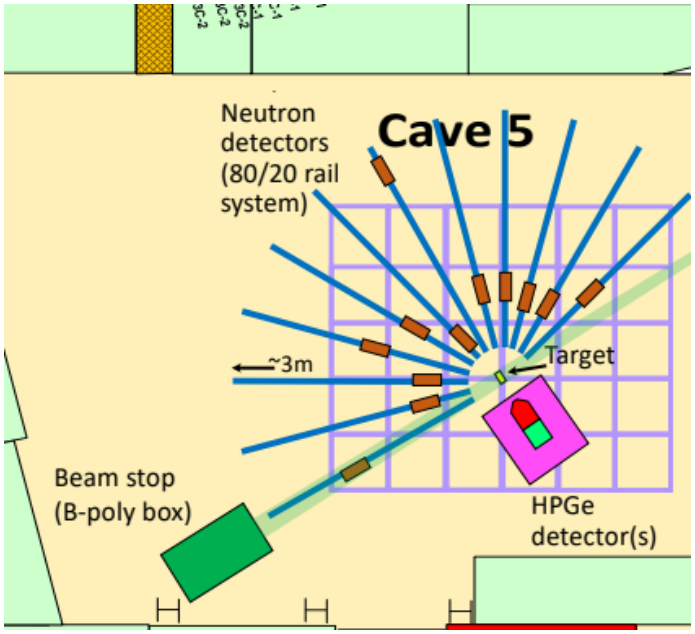
- **ENSDF:**
  - A=59, Basunia, NDS 143, 1, 2017
  - A=99, Browne and Tuli (BNL+UCB), NDS 145, 25, 2017
  - A=193, Basunia, NDS 143, 1, 2017
  - A=170, C.M. Baglin, *et al.*, NDS 153, 1, 2018
  - A=171, C.M. Baglin, *et al*. NDS 151, 334, 2018
- **In Progress:**
  - A=24 (Basunia, Hurst)
  - A=233 (Tuli, Browne)
- **In NSD pipeline:**
  - A=23 (Basunia, Chakraborty), A=186 (Batchelder *et al.*), A=82 (Tuli, Browne), A=229 (Tuli, Browne)
- **Reviewed:**
  - Three mass chains

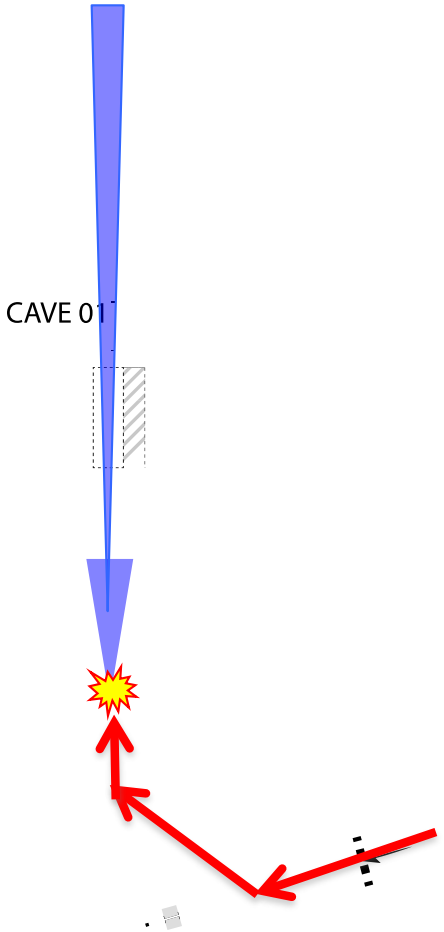
Evaluation/Compilation (con't)

- **XUNDL**
  - Compilation of 56 datasets from 35 papers
- **EGAF related:**
  - ^{139}La(n,γ) – A. M. Hurst, A. Sweet, *et al.*
  - ^{187}Re(n,γ) – Trevor Warren (US Army), A. M. Hurst, J. J. Carroll
- **Horizontal evaluation:**
  - Beta-delayed proton emitters – J. C. Batchelder – submitted for publication in Atomic and Nuclear Data Tables.
- **Baghdad Atlas compilation/evaluation**
  - Relational database of inelastic-neutron scattering gamma-ray data.
    http://nssc.berkeley.edu/research/nuclear-data/atlas/
    http://www.nndc.bnl.gov/lbnlatl.html
    https://nucleardata.berkeley.edu/

Experiment/Facility Development

- **88-Inch Cyclotron, LBNL**
  - Cave 0 - Medical radioisotope production cross sections:
    - $^{nat}Fe(p,x)^{51,52m,52g}Mn$, $^{139}La(p,6n)^{134}Ce$, $^{nat}Zr(d,x)^{86,87,88}Y$, $^{86}Sr(p,n)^{86}Y$, $^{86}Sr(d,x)^{86,87}Y$, ^{84}Rb, etc.
    - Neutrons from d-breakup
  - Cave 5 development for the $^{238}U(n,n'\gamma)$ differential cross section measurements





Workshop:

Organization:

- The Workshop on Applied nuclear Data Activities (WANDA), January 22-24, 2019 in Washington DC, NY – L. Bernstein (Organizer).
- The 6th International Compound Nuclear Reactions Workshop, September 24-28, 2018 LBNL, Berkeley – L. Bernstein (co-organizer).
- The Nuclear Data Road mapping Enhancement Workshop (NDREW) held in Washington DC, January 19-22, 2018 – L. Bernstein (co-organizer).
- Hosted the 22nd NSDD technical meeting in May 22–26, 2017, Berkeley, California.

Contribution:

- The IAEA Coordinated Research Project on Photonuclear Data and Photon Strength Functions meetings in Vienna, October 16-20, 2017 and December 17-21, 2018 - R. B. Firestone
- The Workshops on Nuclear Level Density and Gamma Strength in Oslo, 8-12 May, 2017 and in Svalbard, 22-25 May, 2018 – Firestone, Bernstein, Voyles
- The IAEA CRP on Nuclear Data Portal Web Tools in Vienna, July 30 – August 1, 2018 - A. M. Hurst
- The ICTP-IAEA Workshop on Nuclear Structure and Decay Data: Theory, Experiment and Evaluation, October 15 -26, 2018, ICTP, Trieste – M.S. Basunia

Publications/Other items

- **Published about 30 articles: (Selected ones)**
  - ^{64}Zn,^{47}Ti(n,p) – A. S. Voyles *et al.,* Nucl. Inst. Meth. Phys. Res. B**410**, 230 (2017)
  - ^{56}Fe(n,γ) – R. B. Firestone *et al.,* Phys. Rev. C **95**, 014328 (2017).
  - Nb(p,x) – A. S. Voyles *et al.,* Nucl. Inst. Meth. Phys. Res. B**429**, 53 (2018)
  - ^{139}La(n,γ) – A. M. Hurst *et al.*, Phys. Rev. C **99**, 024310, 2019
  - ^{35}Cl(n,p) ^{35}S – J. C. Batchelder *et al.*, Phys. Rev. C – accepted
- **Two graduate students received doctoral degrees (August 2018) working with the nuclear data group:**
  - **Leo Kirsch** (Gamma Strength from Quasi-Continuum Lifetimes using ^{56}Fe(p,p')) and
  - **Andrew Voyles** (Nuclear Excitation Functions for Production of Novel Medical Radionuclides).
- **Website development:**

  "Nuclear Structure Experimental Issues", formerly known as the "High-Priority Nuclear Structure Request List": http://nucleardata.berkeley.edu/hpnsrl/

Future Plans

- **ENSDF , XUNDL, Photon Strength Function database, EGAF**
- **NSR (new)**
- **(n,n′γ)**
  - Development of a new reaction benchmark based on the updated Atlas of Gamma-ray from the Scattering of Reactor Fast Neutrons
- **Experiments:**
  - Medical isotope productions including ^{64,67}Cu, ^{193m}Pt, ^{51,52}Mn, ^{134}Ce, ^{72}Se, ^{68}Ge and ^{225}Ac
  - Next three years:
    - A collaborative effort to develop a new set of evaluated fission product yields
    - An effort to improve the ^{238}U(n,n') cross section evaluation.

    Both efforts will utilize the intense neutron beams from the 88-Inch cyclotron and funding comes from the new Nuclear Data Interagency Working Group process started in the United States

Collaborators

- UCB - Nuclear Engineering – K. van Bibber, J. Vujic, B. Goldblum, J. James, M. Fratoni
- Berkeley Geochronology - P. Renne
- LLNL – D. L. Bleuel, R. L. Vogt
- LANL – F. M. Nortier, M. Devlin, M. E. Fassbender, T. Kawano
- BNL - D. Brown, D. Medvedev, C. Cutler
- University of Wisconsin – J. W. Engle
- Budapest Reactor – T. Belgya, L. Szentmiklosi
- Garching FRM-II Reactor – Zs. Revay
- Charles University, Prague – M. Krticka, F. Becvar
- University of Oslo - S. Siem, M. Guttormsen
- U.S. Army Research Laboratory – J. J. Carroll
- Air Force Institute of Technology – J. Bevins, T. Warren
- Bangladesh Atomic Energy Commission – S. Uddin