Neutron Cross Sections: (n,n'), (n,n'γ), (n,γ)

Ben Crider

NSAC Long Range Plan Town Hall on Nuclear Structure, Reactions, and Astrophysics
Nuclear Data Working Group
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Collaborators

LLNL: A.P.D. Ramirez
MSState: D.S. Araya, S. Vajdic
USNA: A. Perkoff, J.R. Vanhoy
UD + UK: E.A. Chouinard, S.E. Evans, S.F. Hicks
UK: E. E. Peters, Y. Xiao, S. W. Yates

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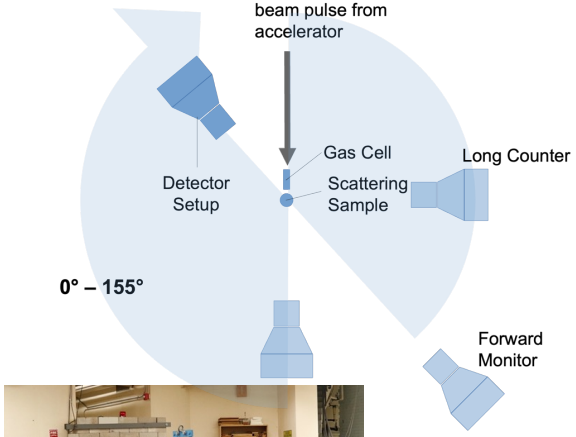
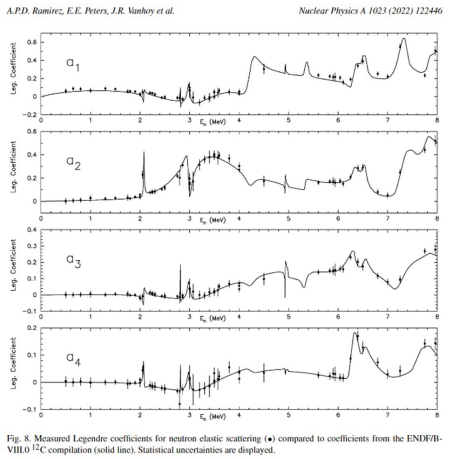
Neutron Scattering Cross Sections @ UKAL

- Neutron scattering cross sections highly important for:
  - Nuclear safeguards
  - Stockpile Stewardship
  - Nuclear Energy applications

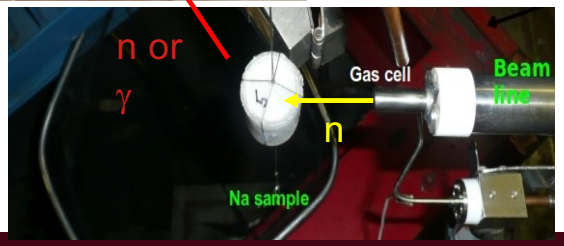
- Measurements are guided by high-priority data and evaluator requests
  - (n,n') and (n,n): ^{23}Na, ^{54,56}Fe, ^{12,13}C, ^{nat}Si, ^{nat,7}Li
  - (n,n'γ) – γ-ray production cross sections and level cross sections, including cross section for ^{19}F (197 keV 5/2$^+$, $t_{1/2}$ = 89.3(10) ns)



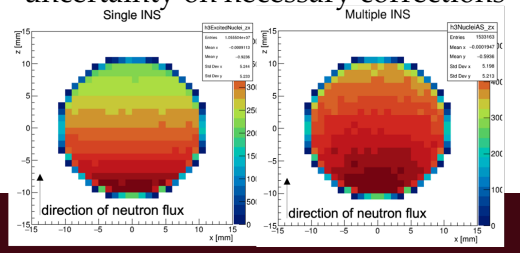
^{nat}C(n,n)^{nat}C



A.P.D. Ramirez *et al.*, Nucl. Phys. A **1024**, 122474 (2022).



GEANT4 modeling to minimize uncertainty on necessary corrections



https://www.energy.gov/science/np/articles/how-do-neutrons-interact-reactor-materials

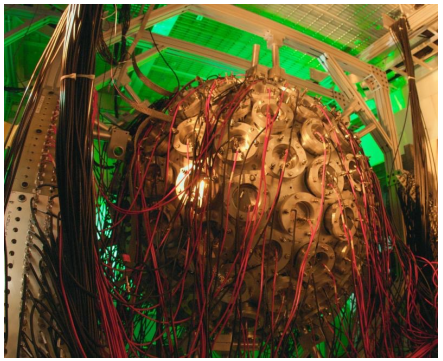
Neutron Capture Cross Sections @ LANSCE

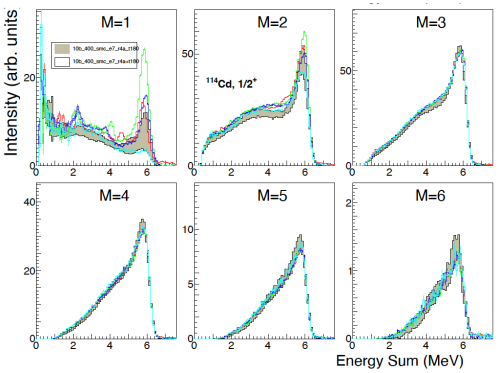
- Neutron capture cross sections highly important for:
  - Nuclear safeguards
  - Stockpile Stewardship
  - Nuclear Energy applications
  - Stellar nucleosynthesis modeling

- Full data sets on $^{110\text{-}114}$Cd(n,γ)
  - ^{114}Cd(n,γ) analysis nearly completed and majority component of Tutu Assumin-Gyimah PhD dissertation
  - $^{110\text{-}113}$Cd(n,γ) are contaminant subtracted to isolate their yields, need neutron flux normalization

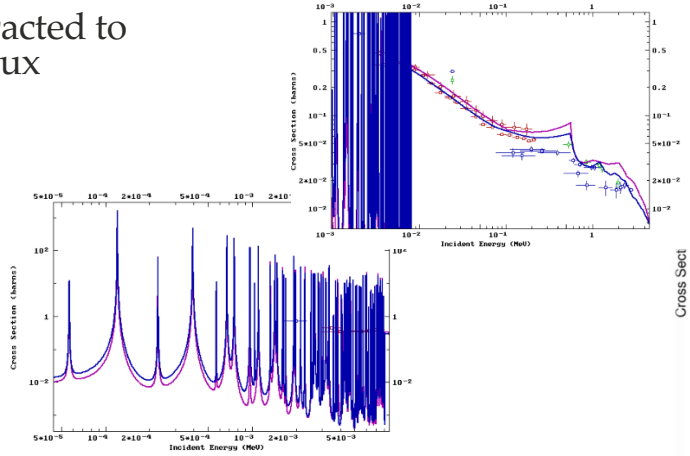
- Initial data taken on ^{134,136}Xe(n,γ)

DANCE

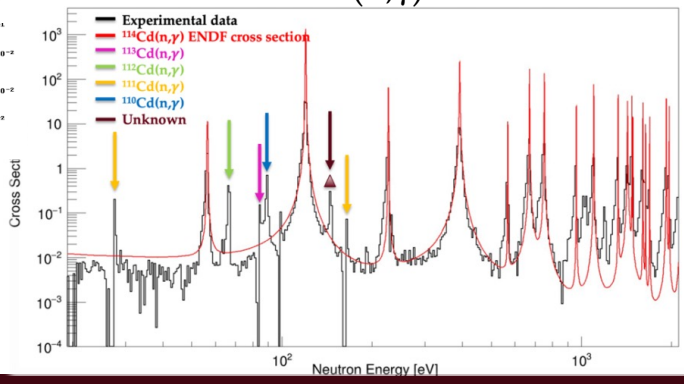




GEANT4 simulations completed for ^{114}Cd(n,γ) with DICEBOX input – M. Krtička



^{114}Cd(n,γ)



Stephan Vajdic

^{112,113}Cd(n,γ)

Daniel Araya

^{110,111}Cd(n,γ)

Kofi "TuTu" Assumin-Gyimah

^{114}Cd(n,γ)

An example of the outcomes attained by supporting undergraduate research at an ARUNA facility (UKAL) – courtesy Sally Hicks

Only the 24 University of Dallas students' outcomes after graduation are noted. Other undergraduate students are from the USNA and U of KY. Some students are recent grads and are still searching. This research was funded by the Department of Energy – NNSA/NEUP/NP.

Undergraduate students are highlighted by yellow. Red denotes careers/advanced degrees in a nuclear-related field.

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Neutron elastic and inelastic scattering differential cross sections on carbon

A.P.D. Ramirez [a,b], E.E. Peters [a], J.R. Vanhoy [c,*], S.F. Hicks [d,b], L.A. Alasagas [c], D.K. Alcorn-Dominguez [c], S.T. Block [d], S.T. Byrd [d], E.A. Chouinard [d], B.M. Combs [d], B.P. Crider [b], E.C. Derdyn [d], L. Downes [d], J.A. Erlanson [c], S.E. Evans [d], A.J. French [d], E.A. Garza [c], J. Girgis [d], T.D. Harrison [c], S.L. Henderson [d], T.J. Howard [d], D.T. Jackson [d], J.J. Kersting [d], A. Kumar [a], S.H. Liu [a], C.J. Lueck [d], E.M. Lyons [d], B.J. McDonough [d], M.T. McEllistrem [b,1], T.J. Morin [d], S. Mukhopadhyay [b], T.A. Nguyen [d], M. Nickel [d], S. Nigam [a], R.L. Pecha [d], J. Potter [a], F.M. Prados-Estévez [a,b], B.G. Rice [c], T.J. Ross [a,b], Z.C. Santonil [d], J. Schneiderjan [d], L.C. Sidwell [d], A.J. Sigillito [d], J.L. Steves [c], B.K. Thompson [c], D.W. Watts [c], Y. Xiao [a,b], S.W. Yates [a,b]

Industry, Compass Minerals Ministry

MD U. Of KY (radiation oncology)

High school physics teacher

Laboratory Tech, Eastfield College

Ph.D. U. of Wisc (Nuc Eng) **Sandia National Lab**

Industry, Raytheon

Ph.D. Texas Tech (CE), Jacobs

Ph.D. Candidate U. of FL (Nuc Eng) **LANL**

M.S. Notre Dame (EE), RF Eng at Lockheed Martin

Data analyst, Coach Net

Nurse

Ph.D. Candidate, U. of Kansas (Part Phy)

M.S. UTA (EE), SPARX Engineering

GNC Engineer, Lockheed Martin

UD Student

Ph.D. candidate, TAMU (Nuc Eng)

M.S. U. of KY (Rad Oncology)

Ph.D. Notre Dame (Nuc Phy)

MD, Psychiatry, U. of Southern CA

Ph.D. Candidate, UC Santa Barbara, Photonics

MD U. Of KY, Internal Medicine

Ph.D. Princeton (EE); Faculty U. of PA