

22St NSDD Meeting, Berkeley, USA, May 22-26, 2017

LBL/UCB Report (Reporting Period - May, 2015 - April, 2017)

Nuclear Data activities under the Nuclear Data Group of LBNL+UCB (Earlier known as Isotopes Project at LBNL) cover nuclear structure data evaluation, experiments and evaluation of neutron capture gamma ray data for Evaluated Gamma ray Activation File (EGAF), and nuclear reaction studies for applied applications using neutrons from local facilities, like deuteron breakup reaction at 88-Inch Cyclotron at LBNL and DD neutron generator at the University of California at Berkeley (UCB) and other facilities like, Nuclear research reactors at Budapest, Hungary and FRM, Germany, and Cyclotron facility at the University of Oslo through an International Collaboration. Organized Nuclear Data Needs and Capabilities for Applications (NDNCA) workshop and lead to produce a white paper.

In this reporting period – mass chains $A=21$, $A=22$, $A=26$, $A=183$, were published in the Nuclear Data Sheets. Mass chains, $A=57$ (Collaboration), $A=59$, $A=193$, $A=170$, $A=171$, are in the production process for publication. Also five nuclides, ^{23}O , ^{167}Re , ^{169}Re , ^{196}Os , and ^{215}U , were updated in ENSDF. Compilation of nuclear structure data for XUNDL was done for 44 papers and generated 97 data sets. In addition, ^{11}B and ^7Li (update) for ENDF and important Pu experimental data were made available to the nuclear data community through a nuclear-data-archaeologist, Naohiko Otsuka of IAEA in this reporting period. Neutron capture studies of ^2H , $^{6,7}\text{Li}$, ^9Be , $^{10,11}\text{B}$, $^{12,31}\text{B}$, $^{14,15}\text{N}$, $^{16,17,18}\text{O}$, ^{56}Fe , ^{185}Re targets related to EGAF were carried out and published in the Phys. Rev. C.

Two targeted horizontal activities are being pursued by our group as well. The first is a compilation of $(n,n'\gamma)$ data from Baghdad Atlas into a SQL database that has been completed and recently released through web for the users (nucleardata.berkeley.edu). The plan is to expand this compilation into a full horizontal evaluation of $(n,n'\gamma)$ by incorporating adopted levels and gammas information from ENSDF together with more recent measurements at international experimental facilities. This effort is being spearheaded by Aaron Hurst and UC visiting student Kaixin Song from Xi'an Jiaotong University in China. The second activity is a horizontal evaluation effort of beta-delayed proton emitters being led by Jon Batchelder in collaboration with Caroline Nesaraja from ORNL.

In total thirty-two journal papers/conference proceedings/meeting reports related to experimental activities have been published, authored/co-authored by nuclear data group members, in this reporting period. This includes a report related to NSDD_2015 action item #8 “ENSDF to XML - Work with LLNL on proposed format, liaise with IAEA and report to network” titled: "An XML-hierarchical data structure for ENSDF", A.M. Hurst, LBNL-1004483 (2016)". This was also presented at the Nuclear Data Week meeting at BNL in November 2015.

The LBNL/UC group has also participated in and led several targeted experimental activities. These include a measurement of $^{56}\text{Fe}(p,p'\gamma)$ reaction studies continued using GRETINA array after a complementary (n,n') at the 88-Inch cyclotron by UC student Leo

Kirsch and Lee Bernstein. This research work will address the nuclear data need for the CIELO (Collaboration International Evaluated Library Organization) project. Data analyses are in progress. Mr. Kirsch's work has added several new levels and transitions to this important nucleus. The group has also performed two cross section measurements at the 88-Inch cyclotron ($^{54}\text{Fe}(p,\alpha)^{51}\text{Mn}$ and $^{90}\text{Zr}(d,\alpha n)^{86}\text{Y}$) for medical isotope production that were identified as high-need by the international community. This work was carried out by three other students, Mr. Andrew Voyles from UC, Mr. Alexander Springer from Karlsruhe Institute of Technology in Germany and Ms. Haleema Zaneb from Lahore Regional University in Pakistan. In addition to these measurements, Andrew Voyles also submitted a paper for publication in April 2017 describing measurements of the $^{64}\text{Zn}(n,p)^{64}\text{Cu}$ and $^{47}\text{Ti}(n,p)^{47}\text{Sc}$ cross sections using the High Flux Neutron Generator (HFNG) on the UC Berkeley campus.

Future plan of Nuclear Data Group at LBNL will continue activities for ENSDF, XUNDL, and EGAF databases. The group will also lead the effort to compile and evaluate inelastic neutron scattering cross sections important for applications. In addition, specific interest will be devoted to targeted cross section and decay data measurements in support of isotope production. These will involve activation measurements using the High Flux DD Neutron Generator on the UC Berkeley campus, neutrons from the 88-Inch Cyclotron thick target deuteron breakup source, a new quasi-mono energetic capability from the $^7\text{Li}(p,n)$ reaction and light-ion charged particle beams (e.g., p, d etc.). The experimental activities of Nuclear Data Group at LBNL helping to establish better connection with databases like ENSDF, ENDF, EXFOR and in many occasions to identify problems and resulting in fixing the datum in the database.

In this reporting period group members at LBNL and UCB-NE includes Lee A. Bernstein, M. S. Basunia, Aaron M. Hurst, Jon Batchelder, Richard B. Firestone, Eddie Browne, Coral M. Baglin (until Sept. 2016) along with students Andrew Voyles, Adriana Ureche, Leo Kirsch, Amanda Lewis, and visiting students Alexander Springer (Germany), Haleema Zaneb (Pakistan) in the Nuclear Data Group.