

**NSSC BY THE
NUMBERS**



**RESEARCH
HIGHLIGHTS**



NSSC IN THE NEWS

NSSC SCIENCE, TECHNOLOGY, AND POLICY NEWSLETTER



Nuclear Science and Security Consortium

In 2011, the National Nuclear Security Administration established the Nuclear Science and Security Consortium (NSSC), a five-year program to develop a new generation of laboratory-integrated nuclear experts. Since then, the NSSC has trained almost 400 students and postdoctoral scholars through a multidisciplinary program that provides hands-on training in nuclear science, technology, and policy. The NSSC enables a rich collaborative research environment between universities and the national laboratories, and fosters the development of science and technology underlying the nuclear security mission.

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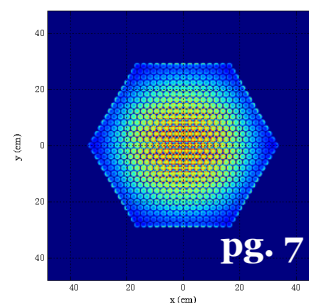
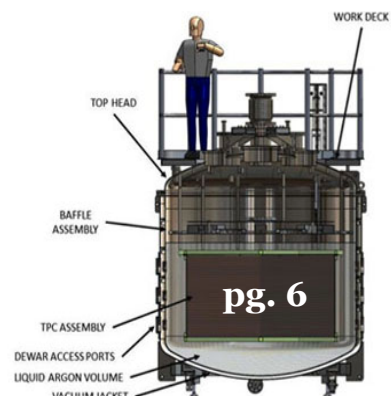
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Letter from the NSSC Program Director



The Nuclear Science and Security Consortium (NSSC) enlists seven of the Nation's premier educational institutions and four DOE national laboratories to grow and strengthen the human capital available for the Nation's nuclear security mission: Michigan State University (MSU), the University of Nevada, Las Vegas (UNLV), and Washington University in St. Louis (WUSTL) have joined with four University of California campuses (Berkeley, Davis, Irvine, and San Diego) and the University of California Institute on Global Conflict and Cooperation (UC/IGCC), together with the Lawrence Berkeley, Lawrence Livermore, Los Alamos, and Sandia National Laboratories.

The NSSC was established in 2011 through a \$25 million five-year grant awarded by the U.S. Department of Energy National Nuclear Security Administration (DOE NNSA) to support the Nation's nuclear nonproliferation mission through the training and education of experts in the nuclear science and security field. An additional \$1.5 million was awarded to NSSC in 2012, to expand nuclear science and security training and education to Minority Serving Institutions.

Over the last 4 years, NSSC has focused on broad recruitment of students at all levels, selecting those with solid science and engineering foundations, to undergo rigorous hands-on training at the undergraduate and graduate levels in the fields of nuclear physics, nuclear and radiation chemistry, nuclear engineering, nuclear instrumentation and nuclear security policy. The consortium's nickname is **SUCCESS PIPELINE**, which stands for Seven Universities Coordinating Coursework and Experience from Student to Scientist in a Partnership for Identifying and Preparing Educated Laboratory-Integrated Nuclear Experts.

Overall, more than 200 students, faculty and specialists have been directly involved with NSSC, working on more than 50 research projects. A number of additional students (more than 160), although not directly funded by NSSC, were "touched" by NSSC, by working in the research teams with the NSSC funded students and faculty. So far, we have awarded 83 NSSC Graduate Fellowships, 22 NSSC Postdoctoral Fellowships and have also supported 68 undergraduate students. Regarding MSIs, we awarded 5 multi-year research grants to University of Texas, El Paso, Clark Atlanta University, South Carolina State University, Hampton University and Fisk University. In addition, we awarded 18 NSSC Summer Scholarships to MSI students. The NSSC-funded students and faculty have a strong collaboration with 4 national laboratories, and work closely with over 60 lab researchers, who also provide mentorship to the NSSC students and post-docs.

Under the NSSC umbrella, new programs, options, curricula, courses, and training programs have been developed. A series of workshops, panels, and summer schools have been organized on the topics critical to nuclear security. After 4 years, we have students/postdocs emerging from our program with the knowledge and appropriate leadership skills, that allow them to pursue careers in nuclear security area. We are proud to report that 25 NSSC trained fellows and affiliates have already accepted full staff (or postdoctoral) positions at the national security laboratories.

Prof. Jasmina Vujic, NSSC Program Director

NSSC Overview

NSSC Leadership Team



Program Director

Jasmina Vujic

Dept. of Nuclear Engineering
UC Berkeley



Associate Director

Bethany Goldblum

Dept. of Nuclear Engineering
UC Berkeley



Executive Director

Karl Van Bibber

Dept. of Nuclear Engineering
UC Berkeley



Liaison to NNSA

Kai Vetter

Dept. of Nuclear Engineering
UC Berkeley/LBNL



Deputy Executive Director

Michael Thoennessen

Dept. of Physics & Astronomy
and National Superconducting
Cyclotron Laboratory
Michigan State University



Director for Laboratories

Ed Hartouni

Lawrence Livermore
National Laboratory

NSSC Partner Institutions

7 Universities

University of California, Berkeley

University of California, Davis

University of California, Irvine

Michigan State University

Washington University in St. Louis

University of Nevada, Las Vegas

Institute on Global Conflict & Cooperation/UCSD

5 Minority-Serving Institutions

Clark Atlanta University

Fisk University

Hampton University

South Carolina State University

University of Texas, El Paso

4 National Laboratories

Lawrence Berkeley National Laboratory

Lawrence Livermore National Laboratory

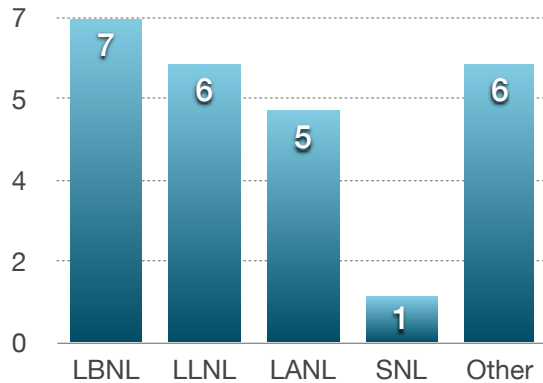
Los Alamos National Laboratory

Sandia National Laboratories

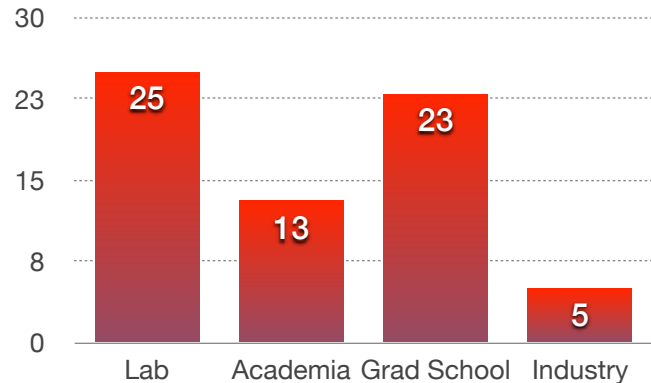


NSSC by the Numbers

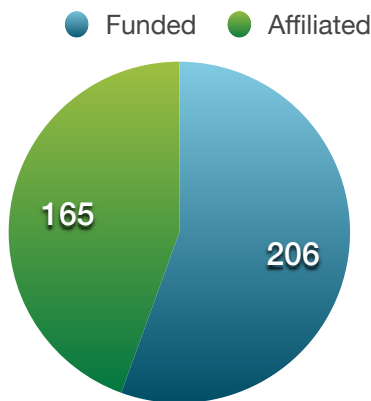
25 NSSC fellows & affiliates have been hired by the national laboratories to date.



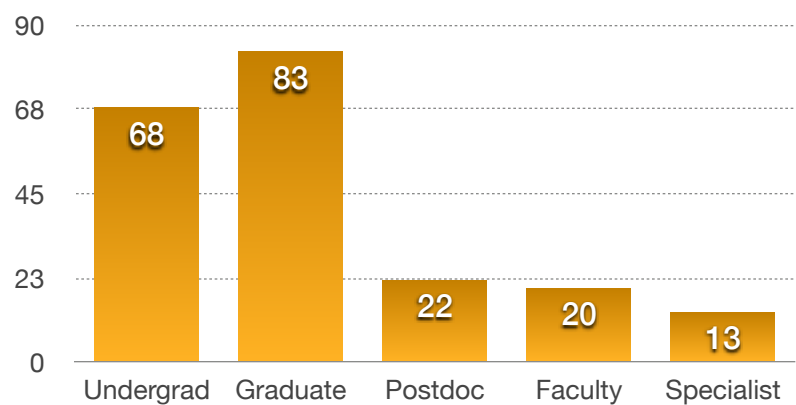
NSSC fellows have continued on to related graduate programs and positions at the national laboratories, universities, think tanks, and industry.



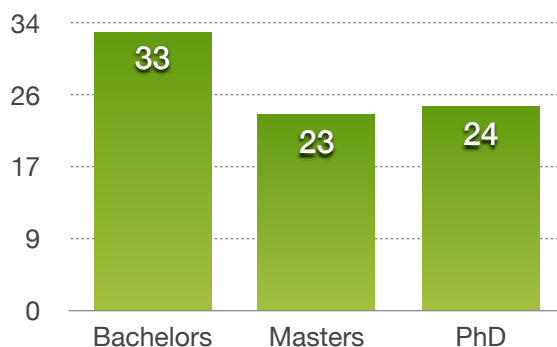
NSSC has supported over 370 personnel at 7 institutions to date.



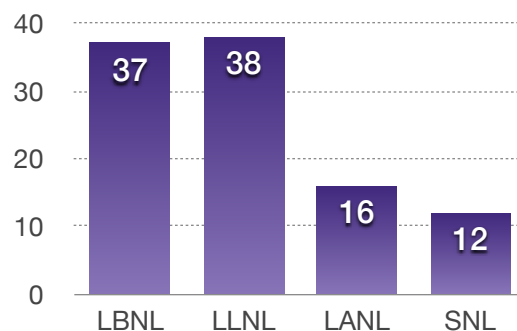
A breakdown of NSSC supported personnel to date is outlined below.



NSSC fellows have earned 80 degrees to date.



Over 100 NSSC fellows have conducted research in-residence at partner labs.



Nuclear Physics Focus Area



Experiments at the forefront of nuclear physics are an essential ingredient for the development of scientific capabilities. Such experiments draw the most talented scientists to nuclear security relevant fields and lead to technological developments that benefit nuclear security mission needs. The science-based research in this focus area encompasses basic nuclear properties, applied nuclear physics, neutrino physics, and high-accuracy fission yield characterization.

Focus Area Lead:

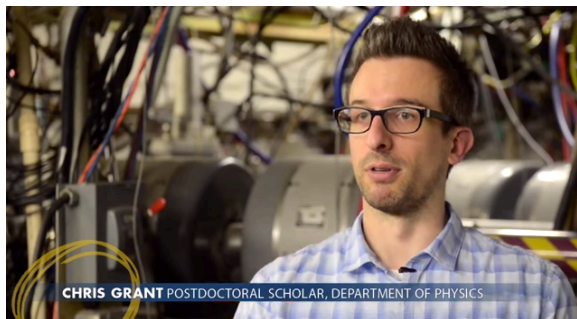
Eric Norman, UCB

Research program current areas of focus:

- Basic nuclear structure physics with GRETINA
- Neutron physics using a modular neutron array (MoNa)
- Beta-delayed neutron studies
- CUORE double beta decay
- Anti-neutrino reactor monitoring
- Low background measurements
- Nuclear data



NSSC Postdoc in the Spotlight



Christopher Grant

Postdoctoral Research Associate
Department of Physics
University of California, Davis

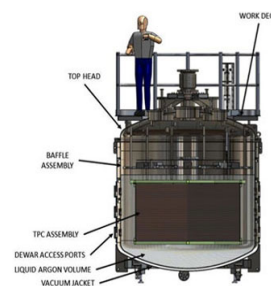
NSSC PI: Robert Svoboda

Laboratory Mentor:

Christopher Mauger, LANL



Grant's research focuses on measuring the $^{40}\text{Ar}(n,p)^{40}\text{Cl}$ reaction cross section, a background for neutrino detection in liquid argon, for the Cryogenic Apparatus for Precision Tests of Argon Interactions with Neutrinos (CAPTAIN) program. This work couples fundamental particle physics and applied nuclear science. Grant collaborates with scientists at the UC Davis Crocker Nuclear Laboratory and Los Alamos National Laboratory.



CAPTAIN

NSSC Nuclear Engineering Focus Area

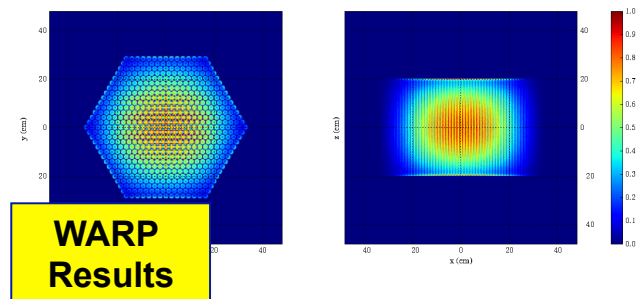


Focus Area Lead:
Rachel Slaybaugh, UCB

Research program current areas of focus:

- Modeling and simulation
- High performance computing
- Detector material characterization
- Beta-delayed gamma-ray analysis
- Novel scintillators

Safeguards and monitoring for the entire nuclear fuel cycle are crucial for nuclear security and threat reduction. This focus area integrates safeguards research and development with a broader multidisciplinary nuclear energy research program. Research encompasses experimental activities in detector material characterization and novel scintillator development, studying methods for high performance computing, and performing modeling and simulation for difficult measurement problems in the nuclear fuel cycle.



NSSC Student in the Spotlight

Joshua Brown

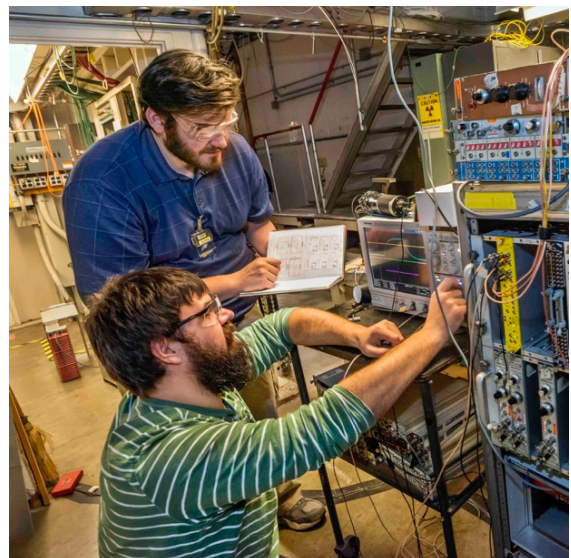
Graduate Student
Department of Nuclear Engineering
University of California, Berkeley



NSSC PI: Bethany Goldblum

Laboratory Mentor: David Reyna, SNL

Brown's research focuses on measurement of the light yield of EJ-309, a liquid pulse-shape discriminating scintillator, over a broad range of neutron energies using a deuteron-breakup neutron source at the 88-Inch Cyclotron at Lawrence Berkeley National Laboratory. This work supports detection of special nuclear material using Sandia's Neutron Scatter Camera. Brown conducts research in collaboration with Lawrence Berkeley and Sandia National Laboratories.



Former NSSC Postdoc, Brian Daub (top), currently a staff scientist at LLNL, works with Josh Brown (bottom) at the 88-Inch Cyclotron at LBNL (credit: Roy Kaltschmidt, LBNL)

NSSC Radiochemistry Focus Area



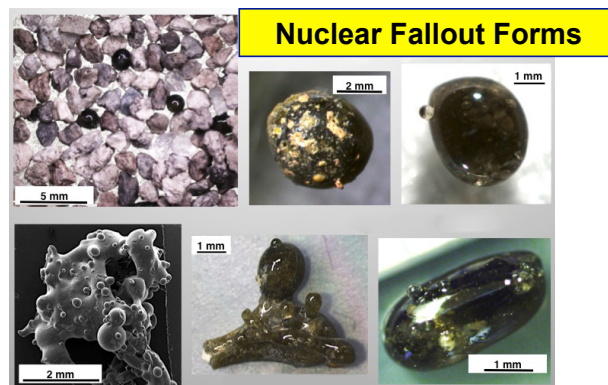
Nuclear chemistry and radiochemistry provide vital capabilities to support the nuclear security mission. This focus area supports the development of the next generation of radiochemists by providing the necessary skills to advance scientific understanding, capabilities, and technologies in radiochemistry, forensics, and isotopic signatures. Research activities include advanced radiochemical separations, molecular nuclear forensics, fallout sample characterization, and radiochemical diagnostics.

Focus Area Lead:

Ken Czerwinski, UNLV

Research program current areas of focus:

- Isotope ratio measurements
- Actinides in soil samples
- Radiochemical separations
- Fallout sample characterization
- Heavy & superheavy elements
- Molecular nuclear forensics



NSSC Student in the Spotlight



Keri Campbell

Graduate Student
Department of Radiochemistry
University of Nevada, Las Vegas

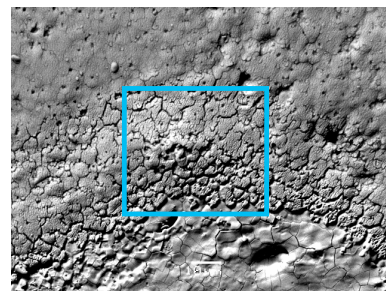
NSSC PI: Ken Czerwinski

Laboratory Mentor:

Peter Stark, James Barefield, LANL



Campbell's research focuses on synthesis, characterization, and laser ablation mass spectroscopy of uranium, neptunium, and plutonium oxides. Her work involves rapidly analyzing actinide and fission product concentration and isotopes in oxide matrices. These radioanalytical capabilities support threat reduction and global security missions. Campbell collaborates with scientists at Los Alamos National Laboratory.



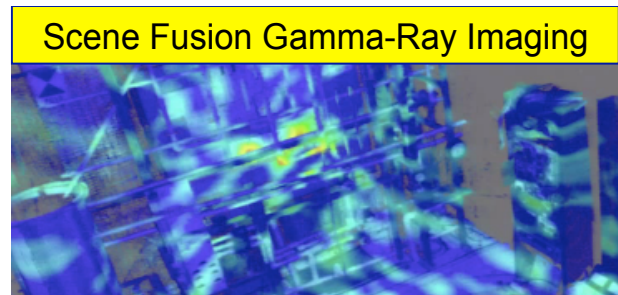
1000x magnification back scatter image of ablation zone in (U,Ce)O₂

NSSC Radiation Detection and Instrumentation Focus Area



Focus Area Lead:
Kai Vetter, UCB

Instrumentation and radiation detection are crucial for nuclear security. They bridge basic and applied sciences, and foster the prevention and detection of proliferation-relevant activities. This focus area collaborates with enduring applied research programs at the national laboratories in the development of advanced detection technologies and algorithms to advance capabilities to monitor nonproliferation and arms control treaty implementation.



Research program current areas of focus:

- Gamma-ray imaging systems
- Position sensitive HPGe detectors
- Image reconstruction and 3D data fusion
- Coherent elastic neutrino-nucleus scattering with Ge
- Background characterization with RadWatch and RadMap

NSSC Student in the Spotlight

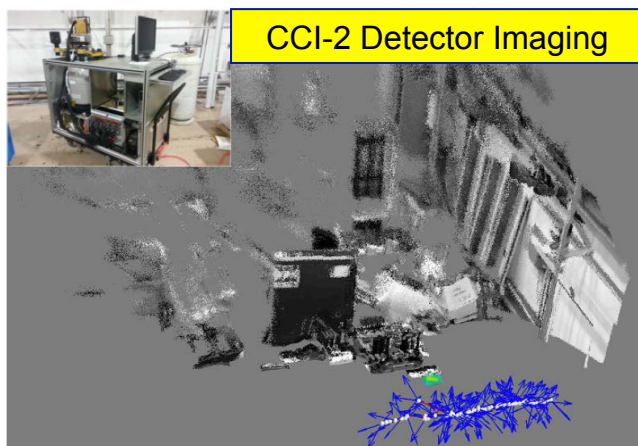
Ross Barnowski

Graduate Student
Department of Nuclear Engineering
University of California, Berkeley



NSSC PI: Kai Vetter

Laboratory Mentor: Lucian Mihailescu, LBNL



Barnowski's research focuses on 3D volumetric and real-time gamma-ray imaging. His research, which involves the use of Compact Compton Imager (CCI-2) and High-Efficiency Multimode Imager (HEMI) detection systems, has various nonproliferation and verification applications. He conducts this research in collaboration with Lawrence Berkeley National Laboratory.

NSSC Nuclear Security Focus Area



Education in nuclear security policy complements the technical training provided by the NSSC to address the need for knowledgeable practitioners in the nonproliferation field and to foster collaboration across technical and social science fields. The policy program involves innovative classroom learning through the Nuclear Security Policy course at UC Berkeley, extracurricular opportunities to engage in nuclear security issues through the Nuclear Policy Working Group, and experiential learning through the Public Policy and Nuclear Threats Boot Camp. Cutting-edge research in high-priority areas, including cross-domain deterrence and international cooperation on nuclear security, is conducted with national laboratory and academic partners.

Focus Area Lead:
Michael Nacht, UCB

Research program current areas of focus:

- Cross domain deterrence
- International cooperation on nuclear security
- Network science for nonproliferation
- Framework for neutron detection in international safeguards
- Textbook on *Nuclear Security: Policy & Technology* in progress
- Nuclear Policy Working Group (NPWG) – New Chapters!



NSSC Postdoc in the Spotlight



David Sweeney

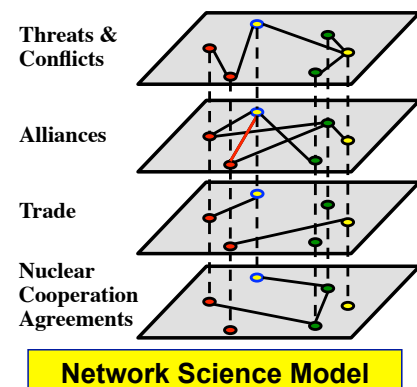
Postdoctoral Research Associate
Department of Nuclear Engineering
University of California, Berkeley

NSSC PI: Bethany Goldblum

Laboratory Mentor: Jim Kornell, NSTec



Sweeney's research involves network science for nonproliferation, that is specifically focused on nuclear weapons proliferation network modeling. He conducts this research in collaboration with National Security Technologies, LLC.



From Lab to Lecture with Lee Bernstein

Dr. Lee Bernstein, LLNL scientist, joined the Department of Nuclear Engineering at the University of California, Berkeley in Spring 2015 as an Adjunct Professor.



Lee Bernstein works with undergraduate Gabriel Kaufman at the 88-Inch cyclotron at Lawrence Berkeley National Laboratory (credit: Roy Kaltschmidt, LBNL)

The NSSC and the Department of Nuclear Engineering at UC Berkeley have been working together to bring scientists from partner national laboratories into the classroom to provide students with an opportunity to learn from experts at the national laboratories. Dr. Bernstein is a staff scientist at Lawrence Livermore National Laboratory and affiliate at Lawrence Berkeley National Laboratory. He leads the Data Evaluation for Applied Nuclear Science (DEANS) project at UC Berkeley as a part of the US Nuclear Data Program (USNDP) and is an advisor to the Nuclear Data Services Section of the International Atomic Energy Agency.

Workshop on Nuclear Data Needs and Capabilities for Applications

May 27 - 29, 2015 | Lawrence Berkeley National Laboratory

Dr. Lee Bernstein organized the 2015 Workshop on Nuclear Data Needs and Capabilities for Applications (NDNCA) at Lawrence Berkeley National Laboratory, hosted by the United States Nuclear Data Program and the Nuclear Science and Security Consortium.

Topical sessions included:

- Nuclear Energy Data Needs
- Capabilities for Data Measurements
- National Security Data Needs
- Nuclear Data Needs for Isotope Production



2015 NDNCA Workshop Attendees (credit: Erika Suzuki, UCB/NSSC)

The Nexus of Science, Technology, and Policy

Power of the Public: How can social media, cell phones, and satellite imagery be used to prevent the spread of nuclear weapons?

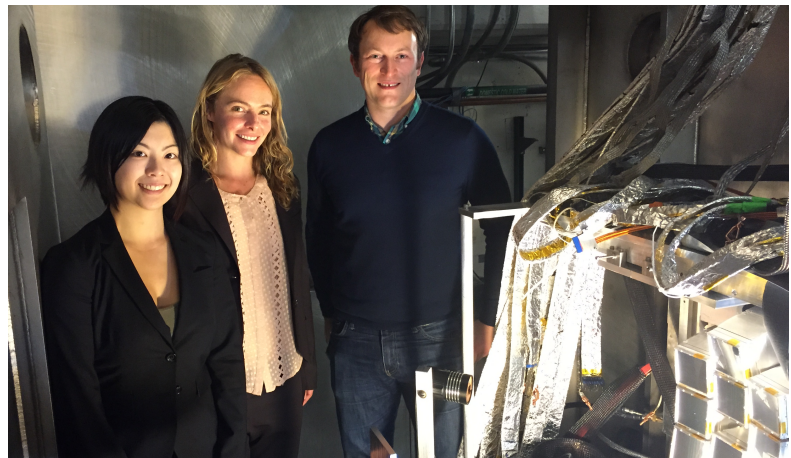


Zoe Gastelum (SNL), Frank Pabian (LANL), Maynard Holliday (Pentagon), Bryan Lee (MIIS/CNS), Jim Kornell (NSTec)
 (credit: Joseph Curtis, UCB/LBNL)

The Nuclear Policy Working Group held its third annual Expert Panel Discussion on Nuclear Security Policy – The Power of the Public for Nuclear Nonproliferation – on April 7, 2015 at UC Berkeley. The panel was live webcast & shown at viewing parties at Michigan State University (MSU), UC Davis, UC Irvine, and Monterey (Middlebury) Institute of International Studies (MIIS). Panelists discussed the potential role of open source tools in arms control verification and nonproliferation, as well as the legal and ethical ramifications of the use of publicly or commercially available data, such as social media posts or satellite imagery, for nuclear security applications.

Nuclear Policy Working Group

The NPWG was founded in 2012 by Dr. Bethany Goldblum at UC Berkeley. The NPWG provides extracurricular opportunities to learn about and conduct collaborative research on nuclear security issues for undergraduate and graduate students, as well as postdocs and professionals, in both the technical and social scientific fields. Since Fall 2014, the NPWG has launched three satellite chapters at NNSC partner institutions: MSU, UC Davis, and UC Irvine.



Erika Suzuki (NPWG Deputy Director), Bethany Goldblum (NPWG Director), and Andy Rogers (Former NNSC affiliate/ currently University of Massachusetts, Lowell faculty) visiting the National Superconducting Cyclotron Laboratory at MSU in Fall 2014

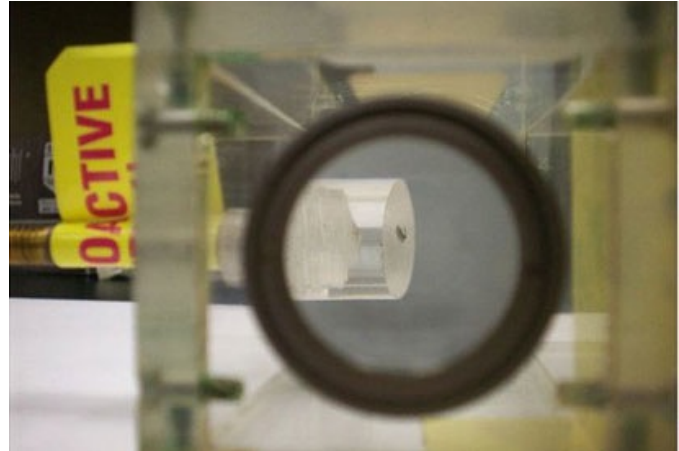
npwg.berkeley.edu | [@ucb_npwg](https://twitter.com/ucb_npwg)

NSSC in the News

Seaborg's Plutonium

NSSC Nuclear Physics Focus Area Lead and Department of Nuclear Engineering faculty member, Eric Norman and his team, NSSC specialists Keenan J. Thomas and Kristina Telhami, led a successful investigation into the verification of a Manhattan project-era plutonium sample found in storage at the UC Berkeley Hazardous Material Facility.

The team published their work in ArXiv, an online repository of scientific papers (arXiv:1412.7590v2 [nucl-ex]). Their work was also featured by Scientific American and various other scientific organizations.



A side view of a speck of plutonium created by a Manhattan Project team led by Nobel-winning chemist Glenn Seaborg. This was the first Pu sample big enough to be measured and weighed. (Photo courtesy of Eric Norman)

“The Watcher in the Water”

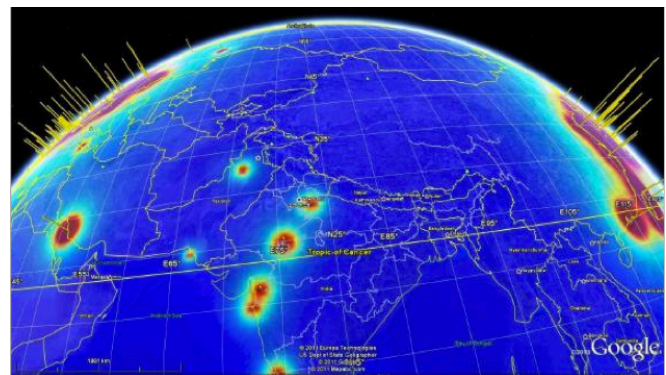


May 16, 2015

WATCHMAN research program featured under nuclear proliferation by The Economist

<http://www.economist.com/news/science-and-technology/21651165-it-may-be-possible-detect-plutonium-factories-distance-watcher>

The WATCHMAN collaboration is led by UC Davis and Lawrence Livermore National Laboratory and includes a number of NSSC students and faculty working with scientists at Lawrence Livermore National Laboratory to demonstrate the feasibility of remote monitoring of nuclear reactors for nonproliferation using only gadolinium-doped water as a target.



Global antineutrino fluxes
(credit: Adam Bernstein, LLNL)

NSSC 2015 Required Summer Schools

Public Policy and Nuclear Threats Boot Camp

June 21 - July 1, 2015 | Institute on Global Conflict and Cooperation, UC San Diego



Ambassador Linton Brooks and Joe Pilat (LANL) at the 2014 PPNT Boot Camp (credit: Bret Silvis, IGCC)

The Public Policy and Nuclear Threats Boot Camp is an established multidisciplinary program offered by the Institute on Global Conflict and Cooperation and designed to provide graduate students and mid-career professionals with the necessary tools to contribute to the debate on nuclear security policy, addressing technical, legal, and policy aspects of nonproliferation.

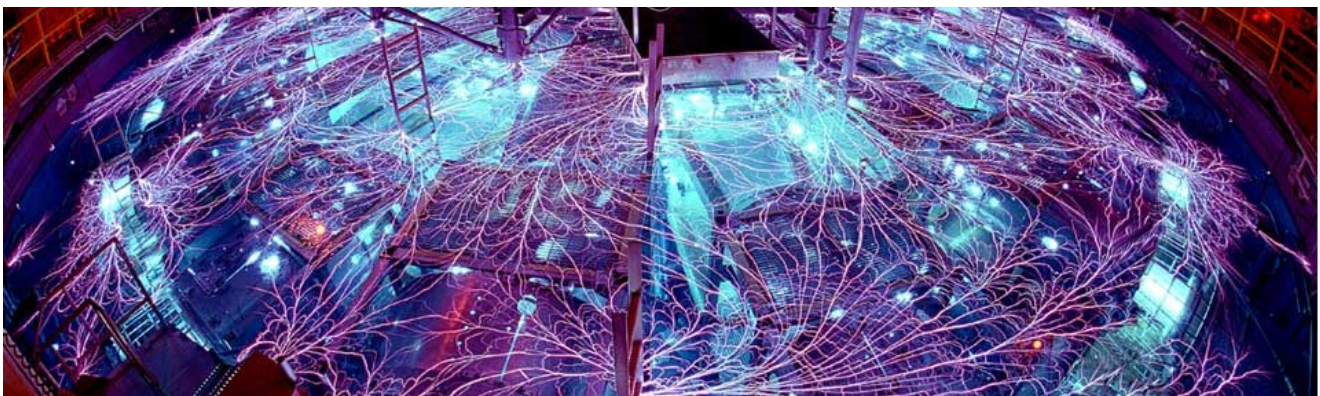
21 NSSC fellows and affiliates from four partner institutions are attending this year's boot camp.

Los Alamos & Sandia National Laboratories Summer School

August 3-12 , 2015 | Los Alamos & Sandia National Laboratories

The NSSC Los Alamos and Sandia National Laboratories Summer School features a five-day module at LANL in Los Alamos, NM, followed by a three-day module at SNL in Albuquerque, NM. The LANL Nuclear Safeguards component provides an introduction to the nondestructive assay (NDA) of uranium and plutonium-bearing materials using gamma-ray and neutron measurement techniques. The SNL Nuclear Science, Security and Safeguards component features activities in nuclear instrumentation and measurement utilizing Sandia's critical assembly (CX), the Annular Core Research Reactor (ACRR), and other facilities.

25 NSSC fellows and affiliates from six partner institutions are participating in this year's program.



Z Pulsed Power Facility at Sandia National Laboratories (credit: SNL)

NSSC-MSI Collaboration Initiative

The NSSC - Minority Serving Institution (MSI) Collaboration Initiative consists of two components: the NSSC-MSI Research Grant Program and the NSSC-MSI Summer Research Fellowship Program. The purpose of the initiative is to encourage the participation of talented researchers and students from Minority Serving Institutions in NNSA mission-relevant science through joint partnerships with NSSC academic institutions.



Hampton University: Paul Gueye, Applied Nuclear Physics for Nuclear Security Applications; collaborating with MSU/NSCL



Fisk University: Arnold Burger, Decreased Electronic Noise in CZT Gamma Spectrometers; collaborating with LLNL



University of Texas, El Paso: Ramana Chintalapalle, Investigation of Tungsten-Yttrium Based Structural Materials for Nuclear Reactor Applications; collaborating with UCD and McClellan Nuclear Research Center

South Carolina State University: Zhang Cheng, On the Separation of Beta-emission Fission Products; collaborating with UNLV



Clark Atlanta University: Conrad Ingram, Metal-Organic Frameworks in Radiation Detection; collaborating with LBNL & SNL

2015 NSSC - MSI Summer Fellows



Quinlan Smith

Graduate Student
University of Nevada, Las Vegas

Lab: Lawrence Livermore

Mentor: Natalia Zaitseva



Athena Gallardo

Graduate Student
University of Nevada, Las Vegas

Lab: Lawrence Livermore

Mentor: David Hickman



Daniel Sneed

Graduate Student
University of Nevada, Las Vegas

Lab: Lawrence Livermore

Mentor: Natalia Zaitseva



Oscar Nunez

Graduate Student
University of Texas, El Paso

Lab: Los Alamos

Mentor: Brett Nadler



nssc.berkeley.edu | nssc_info@berkeley.edu

2150 Shattuck Avenue, Suite 230, Berkeley, CA 94704

Program Manager: Erika Suzuki

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