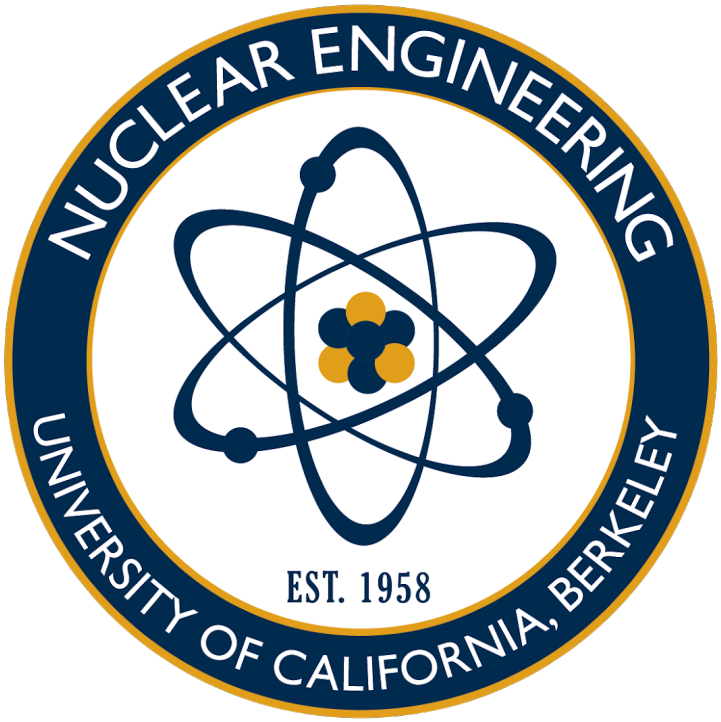
INFORMATION FOR PROSPECTIVE STUDENTS



March 8-9, 2020

Dear prospective students,

Thank you for your interest in our department! The graduate students of the UC Berkeley Department of Nuclear Engineering have compiled this information packet to help you learn more about us—our student societies, our research groups, and our lives outside of school. We've included our contact information in this packet and you are welcome to contact any of us with questions about the department or Berkeley. We look forward to getting to know each one of you. *Fiat lux* and go bears!

-The UC Berkeley Nuclear Engineering Graduate Students

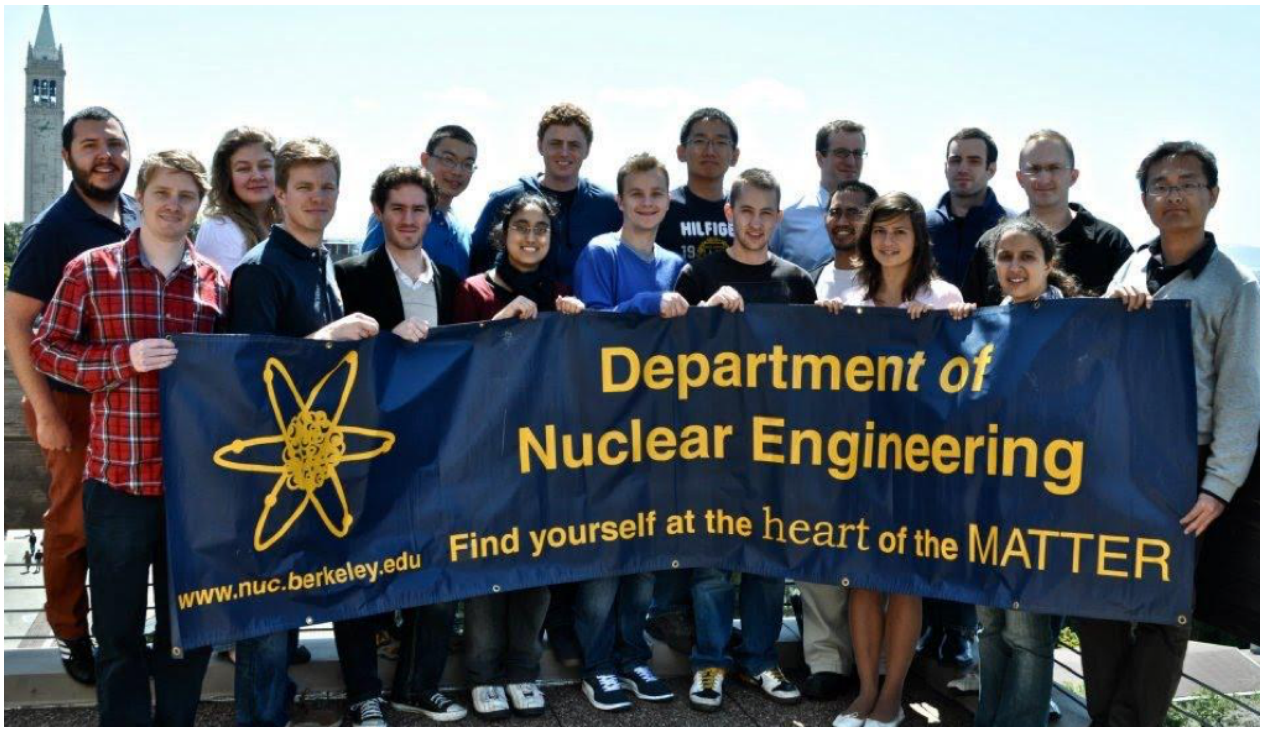
Contents

The University of California, Berkeley

UC Berkeley is the flagship campus of the University of California. It has a total enrollment of more than 42,000 students, almost 12,000 of which are pursuing graduate degrees. Berkeley is noted for the academic distinction of its faculty, the quality and scope of its research activities, and the variety and vitality of its student activities. It is consistently ranked by its academic peers as one of the best graduate institutions in the United States.

The University is located at the base of the Berkeley hills, directly across the bay from San Francisco. The San Francisco Bay Area offers a variety of cultural and entertainment activities. Berkeley students can easily access the lively San Francisco and Oakland city centers, collaborate with top minds from Silicon Valley, explore the Bay's historic monuments like the Golden Gate Bridge and Alcatraz, or hike in the abundant parks and nature preserves. Weather in the Bay is mild year round: summers are foggy and cool, autumn brings a gentle dry heat, and winter hardly ever gets below freezing, though rain is common.

The Nuclear Engineering Department



The Department of Nuclear Engineering was established in 1958. With close to 100 graduate students across several groups, the department offers a large variety of nuclear science and technology research while still feeling like a close community. Courses in the department range from traditional offerings in reactor theory and radiation detection to more unique classes and seminars focusing on nuclear materials and the physics of nuclear reactions. On top of those courses within the department, access to Berkeley's fantastic programs in physics, computer science, and chemistry allows Berkeley nuclear engineers to engage in an unparalleled level of interdisciplinary study and collaboration.

Beyond coursework, the department also has strong ties with several national laboratories and with industry. Many Berkeley students actually perform their research at the local Lawrence Berkeley National Laboratory, while others work nearby at the Lawrence Livermore National Laboratory or the adjacent Sandia National Laboratory in Livermore, California (about a 40 minute drive). Though a bit further away, some students collaborate closely or have interned with advisors at Los Alamos, Oak Ridge, Argonne, and Idaho National Labs. Finally, local advanced reactor start-ups Kairos and Oklo offer employment opportunities to Berkeley graduates in the Bay Area.

Faculty

Rebecca Abergel
Assistant Professor
abergel@berkeley.edu

Heavy element coordination and biological chemistry; fission product/transuranics/ medical isotopes separation, metabolism, and toxicity; drug development for radionuclide decontamination and radiotherapy.

Lee Bernstein
Adjunct Professor
labernstein@berkeley.edu

Statistical properties of nuclear matter; nuclear physics in high energy density plasmas; neutron-induced reaction cross section measurements; surrogate nuclear reactions.

Max Fratoni
Associate Professor
maxfratoni@berkeley.edu

Nuclear reactor theory, design and analysis, computation, and fuel cycle analysis. Focus resides on advanced fuels for generation IV reactors and designs for future reactors.

Ehud Greenspan
Professor of the Graduate School
gehud@nuc.berkeley.edu

Nuclear reactor theory, design and analysis. Conception, design and analysis of advanced (primarily, Generation-IV) nuclear reactors and advanced nuclear fuel cycles.

Peter Hosemann
Associate Professor and Chair
peterh@berkeley.edu

Experimental material science for nuclear applications, mainly structural materials used for nuclear components (fission, fusion, spallation, etc.). Materials degradation processes in a nuclear environment and resulting consequences to engineering application.

Daniel M. Kammen
Professor of Energy
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Science and technology policy focused on energy, development and environmental management. Technology and policy questions in developing nations. Global environmental change including deep cuts in greenhouse gas emissions and resource consumption. Management of innovation and energy R&D policy.

William Kastenberg
Professor Emeritus

Ethical issues in emerging technologies, risk assessment and risk management for technological and natural complex systems, nuclear reactor safety, environmental risk analysis, environmental conflict resolution.

Ka-Ngo Leung
Professor-in-Residence
knleung@lbl.gov

Ion sources and their application. He has been awarded over 20 patents for the inventions of the ion sources and beam technologies for numerous applications.

Digby Macdonald
Professor-in-Residence
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Aqueous corrosion and its prevention with special attention towards nuclear systems. Aqueous corrosion in extreme environments including high strength localized radiation fields and supercritical systems.

Edward C. Morse
Professor
morse@nuc.berkeley.edu

Fusion reactor design and applied plasma physics, experimental investigation of RF plasma heating. Rotating Target Neutron Source at UC Berkeley. Experimental Studies of Compact Toroids. A Spectral Method for Magnetohydrodynamic Stability

Eric B. Norman

Professor of the Graduate School

ebnorman@lbl.gov

Nuclear physics for homeland security, neutrino physics, and nuclear astrophysics.

Raluca O. Scarlat

Assistant Professor

scarlat@berkeley.edu

Chemical and termophysical characterization of high-temperature molten salts and other inorganic fluids, and heat and mass transport pertaining to energy systems; electrochemistry, corrosion, thermodynamics; nuclear reactor safety analysis, licensing and design, and engineering ethics.

Karl van Bibber

Professor

karl.van.bibber@berkeley.edu

Nuclear physics; particle physics; particle Astrophysics; nuclear instrumentation; accelerator science and technology.

Jasmina Vujic

Professor

vujic@nuc.berkeley.edu

Numerical methods in reactor physics, neutron and photon transport, reactor core design and analysis, shielding and radiation protection, biomedical application of radiation, optimization techniques for vector and parallel computers.

Per Peterson

Professor

peterson@nuc.berkeley.edu

High-temperature fission energy systems, and topics related to the safety and security of nuclear materials and waste management. His research group focuses primarily on heat transfer, fluid mechanics, regulation and licensing for high temperature reactors that use liquid fluoride salts as coolant.

Rachel Slaybaugh

Assistant Professor

slaybaugh@berkeley.edu

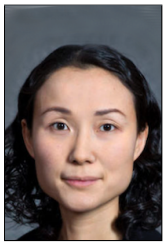
Numerical methods for neutron transport with an emphasis on supercomputing. Applied to reactor design, shielding, and nuclear security and nonproliferation. Software usage and carpentry skills education.

Kai Vetter

Professor

kvetter@nuc.berkeley.edu

Applied nuclear physics and radiation detection applications ranging from fundamental physics to biomedical imaging and homeland security. Development and demonstration of new and/or improved gamma-ray (and neutron) imaging concepts for homeland security, nuclear non-proliferation, and biomedical imaging.



Haruko Wainwright

Adjunct Professor

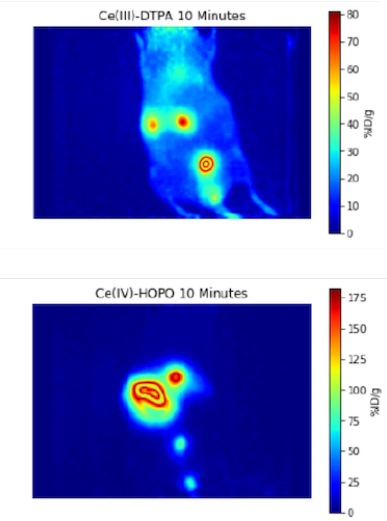
Arctic ecosystem responses to climate change, groundwater contamination, and deep-subsurface CO2 storage. Deputy lead of the site application thrust in the Advanced Simulation Capability for Environmental Management project, leading the site application at the Savannah River Site F-Area.

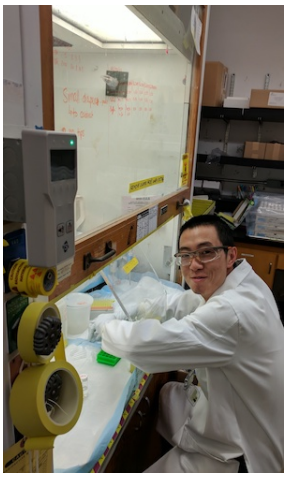
Research Groups

BioActinide Chemistry

Prof. Rebecca Abergel

The multidisciplinary research undergone in the group is at the interface of coordination chemistry, analytical chemistry, photophysics, biological chemistry, health physics, pharmacology, and molecular and cellular biology. We study the effects of heavy element exposure and contamination on different biological systems in addition to the coordination chemistry and metabolic properties of lanthanide and actinide complexes formed with synthetic and biological ligands. Our goals are to gain a better understanding of the biological coordination chemistry and toxicity mechanisms of the f-elements and to develop specific strategies for decontamination, remediation, and separation. Other applications include the development of new antimicrobial strategies that target metal acquisition systems, PET imaging systems, and the design of advanced alpha-immuno therapeutic and diagnostic agents. A new addition to the Nuclear Engineering department as of January 2018, the BioActinide Chemistry group is housed partially on campus and partially at LBNL, where we work closely with the Nuclear Sciences Division. Part of the Nuclear Engineering Department since January 2018, the BioActinide Chemistry group is primarily housed at LBNL, where we work closely with the Chemical and Nuclear Sciences Divisions. As of February 2020, the group includes 6 graduate students, 4 postdocs, 4 undergraduates, 1 postbac, 1 staff scientist, and a partridge in a pear tree.





Members

Carla McKinley
she/her/hers
carla.d.mckinley@berkeley.edu

Carla is a biologist trying her best at nuclear engineering to use targeted alpha-particle therapy on bacterial infections. She likes food, plants, puzzles, animals, and 2am talks.

Kathy Shield
she/her/hers
kshield@berkeley.edu

Kathy is a 4th year researching solution thermodynamics and column separations of actinium and its associated decay chain, with the goal of identifying better ligands for medical isotope purification and complexation. She is extremely active in science policy on campus and around the country. When not in the lab, you can find her skiing, dancing, reading, or hiking.

Yufei (Albert) Wang
ywang16@berkeley.edu

Yufei is a Ph.D. student working on the aqueous reprocessing of the used nuclear fuel, specifically on the separation of lanthanides from actinides. He used to study at Tsinghua University and the University of Tokyo before he came to the US, so he's trilingual. Other than learning diverse culture through studying/working abroad he is also interested in sports, such as badminton, swimming, and skiing.

Applied Nuclear Physics and Radiation Detection

Prof. Kai Vetter

Our radiation detection and measurement research group at UC-Berkeley comprises two main groups: the BeARING (Berkeley applied Research for the Imaging of Neutrons and Gamma-rays) on campus, and the Applied Nuclear Physics (ANP) group at Lawrence Berkeley National Lab (LBL). Additionally, several members of the BeARING group are involved in graduate research at other facilities, including Lawrence Livermore National Lab (LLNL) and Sandia National Lab. The research undertaken by members of the group span nearly the entire spectrum of radiation detection and measurement (pun intended). On the technology side, the semiconductor fabrication laboratory is involved in projects for the development of novel semiconductor detectors and detector readout methods. The high-energy and spatial resolution of these novel systems are tightly coupled to gamma-ray imaging applications in astrophysics, biomedical imaging, and nuclear safeguards/nonproliferation.

In an effort to demonstrate the breadth of research undertaken by the BeARING group, several active projects are detailed below.

Algorithm development
Developing innovative algorithms and frameworks to enable more robust radiation detection capabilities, such as modeling variable gamma-ray backgrounds, deploying spectroscopic detection algorithms, and attempting real-time, 3-D gamma-ray image reconstruction.

Contextual Sensor and Radiation Data Fusion
Fusing contextual and radiation data enables the visualization of radioactive sources and contamination. This capability has been applied to a variety of platforms (drones, cars, SUVs, helicopters) for applications including

environmental mapping and decommissioning in Fukushima Prefecture.

Data management
Developing web-based platforms for data exploration, retrieval, on/offline analysis, and sharing between DOE labs and contractors. Examples include the Berkeley Data Cloud, which disseminates data for initiatives like the Multiple Informatics for Nuclear Operations Scenarios (MINOS) Venture.

Detector development (Semiconductor Detector Laboratory)
Pushing the limits of ultra-low noise and high-rate Germanium detectors, enabling next generation gamma-ray detection for nuclear structure physics, neutrino and dark matter science, and astrophysics.

Sensor networks
Creating large-scale, ubiquitous, and distributed radiation detection sensor networks to passively detect, localize, and track radiological and/or nuclear threats.

Members

Grey Batie
he/him/his; they/them/theirs
batie@berkeley.edu

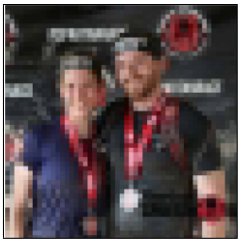
Grey's current research focuses on developing unique methods to design and operate reprocessing facilities and other nuclear material bulk handling facilities, to enable the detection of inadvertent or deliberate hold up of fissionable material. Grey earned a B.S. in both Nuclear Engineering and in Physics from MIT, and a M.S. in Medical Physics from the University of Wisconsin Madison. Their interests include recruitment, retention, and advocacy for minority students in the sciences.

Justin Ellin
jrellin@berkeley.edu

Justin is a Nuclear Engineering graduate student at the University of California, Berkeley and a NSF research fellow. He is interested in the study of high-energy gamma ray imaging systems for high radiation field environments. He has a B.A. in Physics from UC Berkeley and worked for several years in the Physics Research Laboratory at UCSF. His interests include science education for under-represented high school students and public outreach about our radioactive world.

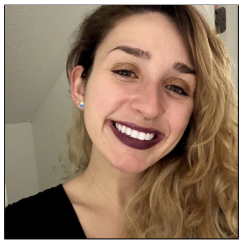
Emily Frame
eaframe@berkeley.edu

Emily's current research is on developing a static detection system that incorporates a 4pi visual camera for tracking of nuclear material. Emily received her B.S. in Nuclear Engineering at UT Knoxville and then spent two years as an English lecturer and researcher in the Department of Nuclear Reactors at the Czech Technical University in Prague. Outside of research, Emily's interests include swimming and playing Hungarian mafia.



Adam Glick
adam_glick@berkeley.edu

Adam is working on neutron imaging using a neutron scatter camera to determine the energy and fluence of neutrons produced during particle cancer therapy. He is also interested in improving the Monte Carlo system, TOPAS, to better model radiation cancer therapy in clinical settings. His outside interests include whiskey distillation to make craft whiskeys, going hiking around the Berkley hills, and running Spartan Races.



Kalie Knecht
she/her/hers
Kalie's research involves 3D image reconstruction and scene data fusion with a free-moving gamma-ray detector and auxiliary contextual sensor package. In her free time, she likes climbing, hiking, and playing board games.

Rebecca Krentz-Wee
rkw@berkeley.edu

Rebecca researches radiation detection using coded aperture imaging and applications in arms control treaty verification. She likes board games, cryptic crosswords, and exploring the Bay Area.

Matt Marshall
mattmar2410@berkeley.edu

Matt is a Ph.D. student focusing on improving detection and localization of radiation on mobile detector systems. Matt enjoys exploring different coffee shops, traveling, reading, and is also in pursuit of finding the best pizza place in the Bay Area!

Yifan Zheng
yifanzheng@berkeley.edu

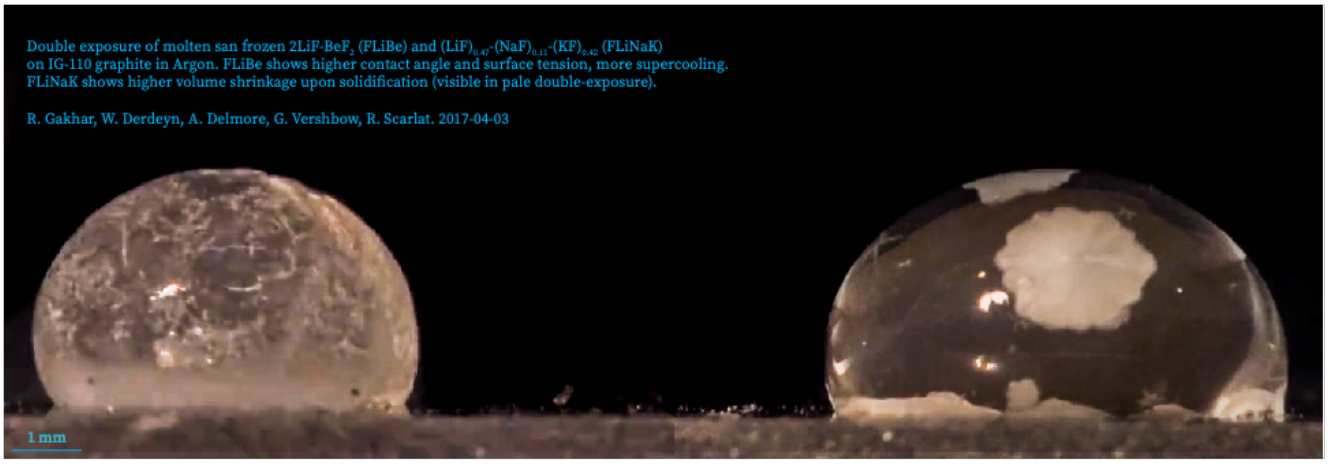
Yifan studies nuclear medicine imaging, in partnership with UCSF.

Chemistry and Nuclear Reactor Safety

Prof. Raluca O. Scarlat

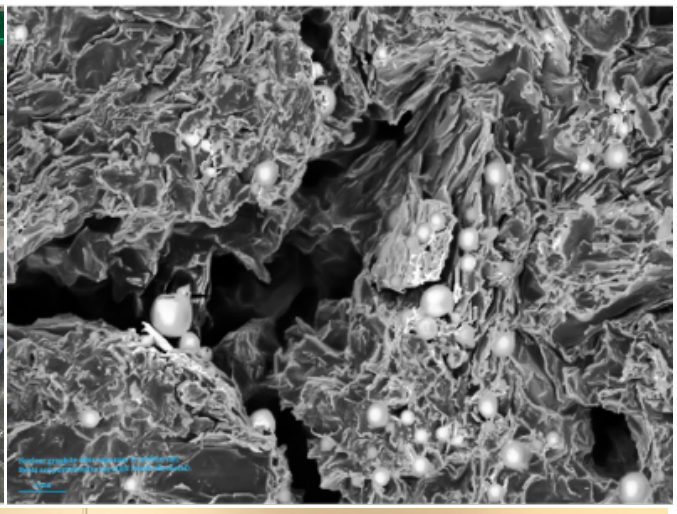
Our group studies the chemistry and electrochemistry of high-temperature inorganic fluids and their application to energy systems. We study molten salt science and the next generation of nuclear reactors to provide options for sustainable energy production. We apply our research to fluoride-salt-cooled high-temperature reactors (FHRs) and Molten Salt Reactors (MSRs), high-temperature gas cooled reactors (HTGRs), and tritium-breeding blankets for fusion systems. Our research includes safety analysis, licensing and design of nuclear reactors, and sometimes extends to engineering ethics.

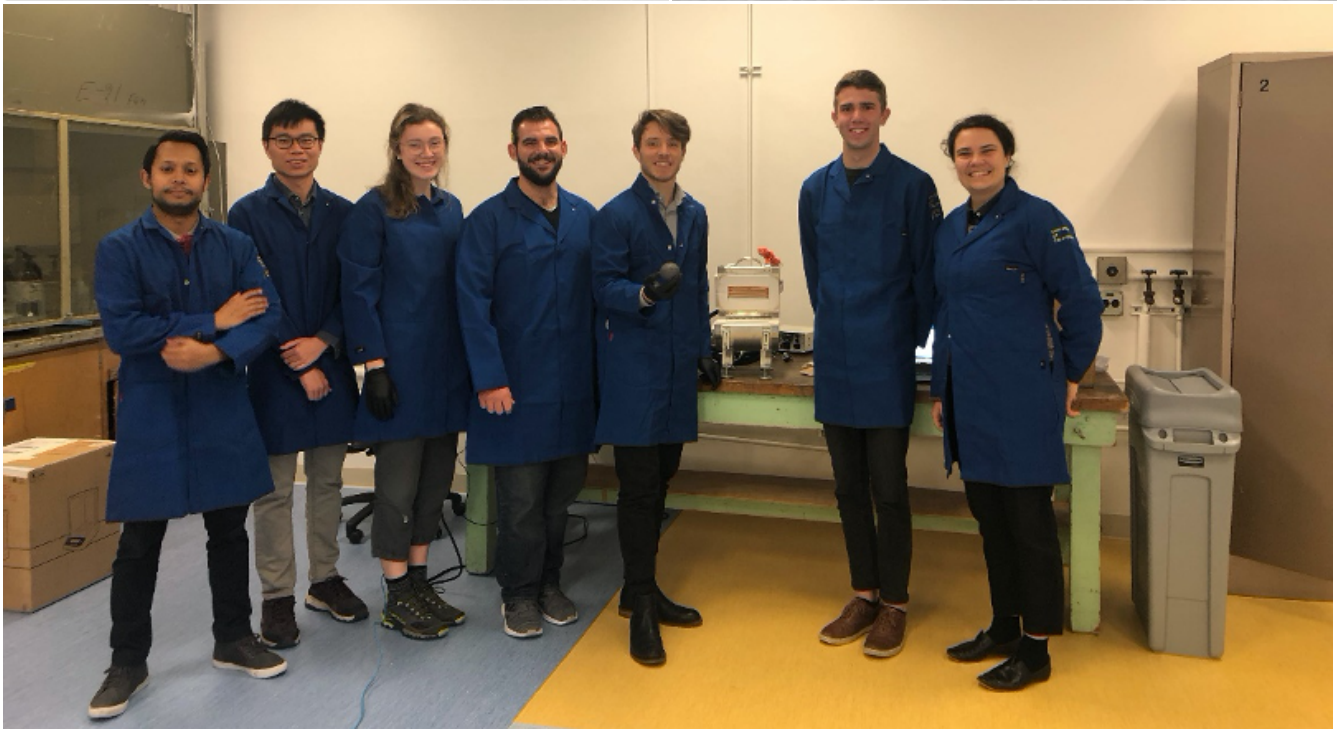
We have a number of burning questions that we seek to answer. How do we capture and manage tritium in molten salt? How does the rheology of molten salt teach us about the molecular structure and lattice structures of these ionic liquids? How does irradiation damage change the chemistry of graphite at high temperature? What is "acidity" in halide salts, and how do we measure it? How much does radiative heat transfer contribute to convective heat transfer, what does this imply for reactor safety and licensing? What is metal fog, and how foggy with it be in a liquid fuel molten salt reactor? What are the phase diagrams for fluoride-salt liquid nuclear fuel? How does corrosion happen in molten salts? How do irradiation and stress change that? How do we best control the redox and other chemical parameters in a FLiBe tritium breeding blanket for a fusion device? Can we predict corrosion problems before they appear in an engineered system, making the learning curve faster and smoother for advanced reactors that utilize molten salts?



Experimental and Computational Tools We design experiments at high temperature using potentiostats, glove-boxes, ovens, chemical and thermo-chemical analysis tools (optical spectroscopy, DSC, ICP-MS, ICP-OES, XRD, XPS, GCMS), material characterization techniques (SEM/EDS, XRD, XPS, Raman, FTIR, ssNMR), rheometers, tribometers, the machine shop and the maker space. We also use and sometimes develop software, such as Systems Analysis Module (SAM), COMSOL, HSC, FactSage.

Professional Development Opportunities We organize and participate in thematic workshops with universities and national laboratories in the US and abroad and with industry and regulatory partners, creating opportunities for interaction with and mentorship by world experts (e.g. 2019 Molten Salt Bootcamp, 2019 NRC Workshop on Non-LWR Materials & Component Integrity Workshop, 2020 Workshop on Sensing and Chemical Sensors for FHRs and MSRs).





Members

Haley Williams

haley_williams@berkeley.edu

Haley studies molten salts using electrochemistry and is currently probing questions about salt properties and composition, corrosion mechanisms, and ion speciation. In addition to her research, Haley enjoys swimming, eating frozen custard, camping, grocery shopping, and reading.

Lorenzo Vergari

lorenzo_vergari@berkeley.edu

Lorenzo has two M.Sc. in Nuclear and Energy engineering from PoliMi and PoliTo and he moved to Berkeley to work on the design of a strategy for management of spent fuel of advanced reactors and on the chemistry of graphite in molten salt reactors. Lorenzo is a mountain lover and an avid skier, enjoys racket sports and psychological thrillers.

Materials

Prof. Peter Hosemann

Our group applies experimental materials science techniques to understanding the effects of extreme environments as they are found in nuclear applications on structural materials. Our main points of research are:

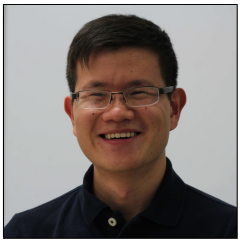
- Corrosion in liquid metals and other extreme corrosive environments.
- Small scale mechanical testing on materials for nuclear applications.
- Investigation and development of new alloying concepts.

Members

Rasheed Auguste

auguste@berkeley.edu

Rasheed is a Ph.D. student studying radiation effects in nuclear materials. He enjoys movies and reading, but not at the same time.



Andrew Dong

2019ad@berkeley.edu

Andrew's research focuses on bridging the length scales of material property evaluation as well as developing and characterizing advanced alloys for next generation nuclear reactors. In his free time, Andrew follows sports and esports and is involved with CalSol, the UC Berkeley Solar Vehicle Team.

Tim Genda

timothy_genda@berkeley.edu

Tim studies nuclear fireball chemistry, and enjoys hiking, skiing, nature, and photography.

Joey Kabel

joey.kabel@berkeley.edu

Joey is currently researching the micromechanical properties of irradiated SiC/SiC composites for advanced reactor applications; applying SEM, FIB, Xray tomography, nano- indentation, and in situ testing techniques for material characterization. Joey graduated from Washington State University in May 2015 with a B.S. in Materials Science and Engineering. Outside of research he spends time participating in nuclear outreach, snowboarding, and happy hours.

Bill Mason

masonw@berkeley.edu

Bill is investigating high temperature geologic samples using femtosecond laser ablation ICP-MS. His interests include mountaineering, motorcycles, sailing, and cave diving.

Franziska Schmidt

franziska_schmidt@berkeley.edu

Franziska is researching the corrosion of materials in a molten salt environment. In her free time, Franziska enjoys happy hours, climbing, traveling, and losing money at the stock market.

Sarah Stevenson

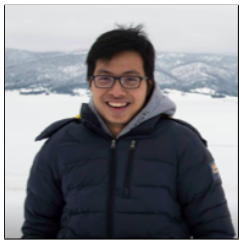
srstevenson@berkeley.edu

Sarah has a B.S. in Mechanical Engineering and previous experience as a Reactor Operator and Senior Reactor Operator, and developing miniature fission chambers with the Idaho National Laboratory (INL) and French Alternative Energies and Atomic Energy Commission (CEA). Currently, she serves as a Physicist/Nuclear Engineer in the U.S. Air Force. For her Ph.D., she's investigating the mechanical properties of deep-ion implanted materials. Sarah is a foodie and enjoys traveling and being active.

Evan Still

evanstill@berkeley.edu

While at Berkeley, Evan partakes in swing dancing, blacksmithing, cooking, data mining, etc. In his free time he looks at different ways to identify precipitates in steel.



Hi Vo

sfhivo@berkeley.edu

Hi researches in metal deformation and constitutive modelling. When he's not in the lab, Hi loves to travel and photograph landscapes.

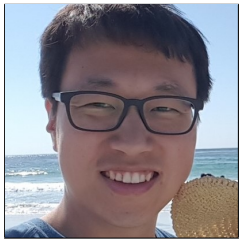
Nuclear Waste Management

Our group develops methods and models to study various aspects of nuclear fuel cycles and waste management. We use these tools to evaluate environmental impacts, management strategies, economics, and proliferation resistance of nuclear fuel cycles. At the moment, we have two ongoing projects:

1. **Evaluation and design of nuclear waste containers for Fukushima fuel debris.** Management and disposal of the fuel debris created in the meltdowns at the Fukushima Daiichi nuclear power plant present unique challenges due to the random size and shape of the fuel particles and the relatively high enrichment of the heavy metal. We develop neutronics models to study the dose rates emitted from different types of waste canisters and evaluate margins protecting against recriticality of the fuel debris.
2. **Methodologies for the evaluation of waste management strategies and applications to advanced nuclear fuel cycles.** Most fuel cycle analyses utilize insufficient metrics, such as waste mass and ra-

diotoxicity, to quantify benefits in waste management. These quantities are intrinsic properties of the waste streams but do not reflect management or disposal performance. To that end, we develop more representative models that can be used to compare fuel cycles based on the management of their wastes. Examples of these models include long-lived fission product inventory, repository footprint, and criticality safety.

Members



Kyoungjin Lee
kyoungjin_lee@berkeley.edu

Kyoungjin researches the retrieval of fuel debris from Fukushima Daiichi nuclear reactor. He focuses on neutronic analysis of radiation dose and criticality safety of damaged nuclear fuels.

Reactor Design and Neutronics

Prof. Max Fratoni, Prof. Ehud Greenspan, Prof. Jasmina Vujic

The thrust of our research efforts into advanced reactor fuel cycles is the conception, design and analysis of advanced (Generation-IV+) nuclear reactors and nuclear fuel cycles. Specifically, the group has researched four innovative nuclear energy systems.

1. Liquid-Salt cooled Advanced High Temperature Reactors (LS-AHTR also referred to as FHR for Fluoride cooled High temperature Reactors);
2. Breed-and-Burn (B&B) liquid metal cooled fast reactors,
3. Fuel-self-sustaining thorium-fueled Boiling Water Reactors (BWR) and
4. Molten-salt breeder and converter reactors (MSBR).

In researching these systems, the role of the neutronics group is to develop both accurate and efficient core simulation software. These tools can then be used to search for optimal core, reflector and control system designs. To validate results, the neutronics group frequently collaborates with others in the department (for example the thermal hydraulics group, the leader in FHR research) and internationally.

Members

Chris Keckler
keckler@berkeley.edu

Chris works on safety and design aspects of sodium-cooled breed-and-burn fast reactors. After moving from the flattest state in the country to California, he now loves biking down hills, but he hates biking up them.

Dan Shen
danshen.echo@berkeley.edu

Dan comes from Tsinghua University in China. Her past research is related to sensitivity and uncertainty analysis for nuclear data. She is now working on the FHR project. She loves dancing and writing novels.

Jun Shi

junshi@berkeley.edu

Jun received a B.S. in nuclear engineering from the University of Michigan and a M.S. in nuclear engineering with a computational science minor from Penn State. He's researched PWR core design/optimization, and he's working on molten salt reactor experiment benchmark evaluations. He loves traveling, taking photos, making friends and watching all types of sports, particularly basketball, soccer and college football!

Computation in Nuclear Engineering

Prof. Rachel Slaybaugh

Our group researches a variety of computational methods designed advance nuclear engineering projects. For many group members, this research focuses devleoping of new methods and enhanced algorithms for solving the Boltzmann neutron transport equation. The main applications of this work are in reactor design, radiation shielding, and nuclear security and nonproliferation. These methods are often inspired by the physics of the problem at hand, developments in computer hardware, or both. Ongoing work involves deterministic solution methods, Monte Carlo methods, and hybrid methods in which deterministic solutions are used to accelerate Monte Carlo (MC) solutions. Current projects include Monte Carlo on advanced architectures such as Graphical Processing Units, angle-informed hybrid methods for MC, beam shaping assembly design for forensics applications, and developing an neutronics framework called BART (the Bay Area Radiation Transport code).

Members

Vanessa Goss

vgoss@berkeley.edu

Vanessa's research involves implementing domain decomposition for an electron/photon Monte Carlo transport code that is designed to run efficiently on next generation computing architectures. Vanessa has a B.S.E. from The University of New Mexico and enjoy playing video games, cooking, and hiking in my free time.

Mitch Negus

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Mitch is studying privacy-preserving computation and its application to nuclear safeguards. Mitch is a competitive runner and his favorite running routes are down to the Berkeley marina and uphill to Claremont Canyon Nature Preserve.

April Novak

novak@berkeley.edu

April researches computational thermal-hydraulics of pebble bed reactors, and in her free time is training for a cross-country bike ride.

Josh Rehak

he/him/his

jsrehak@berkeley.edu

Josh's interests include computational methods applied to advanced and current reactors and nuclear non-proliferation. Josh worked for 7 years in the U.S. Navy as a Nuclear Submarine Officer and holds a B.S. in Physics from the University of Maryland and a Masters in Engineering Management from Old Dominion University. Josh loves hiking, reading, and watching terrible sci-fi movies.

Thermal Hydraulics

Prof. Per Peterson

Our group combines experimental thermal hydraulics with first-principles-based simulations to design and validate a next-generation nuclear reactor that can dispatch more quickly and cleanly than natural gas plants and provide flexible generation anywhere in the United States. We combine separate effects tests that probe the fundamental physical phenomena of heat transfer and fluid dynamics with integral effects tests that facilitate the study of system-level dynamics. The lab's current experiments include the Compact Integral Effects Test (CIET) representing an advanced reactor design, the Advanced Reactor Control and Operations (ARCO) facility connected to CIET for operations support and control room research, an autoclave for heat exchanger design studies, and the Pebble-Bed Heat Transfer Experiment (PB-HTX) to characterize heat transfer between packed pebble fuel beds and molten salt coolants.

The TH Group in front of CIET.

Members

Clara Alivisatos

Clara, a Berkeley native, got her Bachelor's degree in Physics with a minor in Political Science at Vassar College in New York before heading across the pond to get her Master's degree in Sustainable Energy Futures at Imperial College of London. Her passions include skiing, drinking wine, watching Harry Potter, and traveling.

Omar Alzaabi

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Omar is developing methods for quantifying distortions in scaled experiments using frequency response.

Shane Gallagher

shane.gallagher@berkeley.edu

Shane research includes the design and economic feasibility of the power conversion system for fluoride salt cooled high temperature reactors. Shane also enjoys reading, rock climbing, and backpacking.

Ishak Johnson

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Ishak researches the the impact radiative heat transfer plays in misrepresenting heat transfer behavior in scaled-down experiments for fluoride-salt-cooled nuclear reactors. Snowboarding trips to Tahoe dominate his winter hobbies, while weightlifting and concert-going keep him occupied otherwise.

Theodore Kay Chen Ong
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Theodore is interested in implementing neutronics effects in thermal hydraulics integral effects tests. He's from Singapore, and he really loves food; he plays bass in church, plays video games and watches dramas.

Nuclear Physics

Prof. Lee Bernstein

Isotope Production: The isotopes group has performed a number of cross section measurements to assess the viability of several new isotope production pathways, with emphasis on the production of ^{225}Ac, ^{64}Cu, ^{47}Sc, ^{134}Ce, ^{86}Y. Measurments take place at both the 88-inch cyclotron at LBNL and the high-flux neutron generator (HFNG) located in Etcheverry Hall. We collaborate with a number of national labs, where the DOE isotopes program supplies many of the medical isotopes for the U.S. Our primary goals are to fill in essential nuclear data gaps, mostly focusing on charged particle and fast-neutron induced reactions, as well as to improve the nuclear modeling of these reactions. A better understanding of these reactions will enable the next generation of nuclear medicine, in which "personalized" treatments are used to treat cancer.

Neutron Scattering: Inelastic scattering cross sections have been identified as an important source of uncertainty in neutron transport for current nuclear reactors and for the design of Gen IV reactors. Our neutron scattering group is working on measuring, modeling, and validating these cross sections. This includes the GENESIS experiment to measure the energy and angle differential inelastic scattering cross sections for ^{56}Fe and ^{238}U. Scattered neutrons and de-excitation gammas will be measured, allowing us to determine the total inelastic cross section and angular distributions of the outgoing neutrons. Uncertainties in both the experiments and the modeling of the cascade of de-excitation gammas are being characterized so that the cross sections will be reported accurately.

Fission Product Yields: The Fast Loading User Facility for Fission Yields (FLUFFY) is a new experimental capability being developed at the 88-inch cyclotron at LBNL. Once completed, it will feature a pneumatic system to rapidly transport fissionable samples between a high-flux neutron beam line and an HPGe clover array. This will allow for the measurement of independent and cumulative fission yields for products with half-lives down to one second. Initial measurements using FLUFFY seek to improve fission yield measurements on several short-lived products relevant to the reactor antineutrino anomaly including ^{92}Rb, ^{96}Y, and ^{142}Cs.

Members

Amanda Lewis
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Amanda is a 4th year student, working on experimental and modeling uncertainties in nuclear data. Amanda is from upstate New York and enjoys photography, sleeping, and not being sick.

Austin Lo
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Austin researches the effects of heavy ion deposition into noble gases and plasmas for potential application to direct energy conversion schemes (e.g. thermionic energy conversion) and advanced nuclear space propulsion systems. Some of his hobbies include specialty coffee, SF excursions, fitness, and motorcycle riding.

Eric Matthews

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Eric obtained his high school diploma and AS from the Missouri Academy of Science, Mathematics, and Computing and his B.S. from UC Berkeley. Eric is advised by Dr. Lee Bernstein at LBNL where he intends to perform thesis research on nuclear physics and data related topics. Eric also works with Dr. Bethany Goldblum on the development and application of the Fission Induced Electromagnetic Response (FIER) code, a package for the analytical modeling of delayed gamma-ray spectra.

Morgan Fox

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Morgan is a member of the Isotope Production sub-team and focuses on proton-induced reactions relevant to radionuclide generators for oncologic PET imaging. He is from Toronto and hopes to someday see the Maple Leafs win the Stanley Cup.

Dark Matter and Accelerators

Prof. Karl van Bibber

Our group bridges fundamental and applied experimental nuclear physics, utilizing innovative accelerator, ion source, and RF cavity technologies.

One of our primary projects is the Haloscope At Yale Sensitive To Axion Cold dark matter (HAYSTAC). It is a multi-university collaboration searching for axions, a cold dark matter candidate. The collaboration consists of UC Berkeley, Yale, and the University of Colorado. Housed at Yale, HAYSTAC relies on advanced amplifier, magnet, and cavity technology to achieve extremely low-noise conditions. Cooled to hundreds of milliKelvin, the experiment currently operates near the Standard Quantum Limit for noise. UC Berkeley's contribution to the experiment is the microwave cavity. The group here focuses on developing high quality factor/high frequency cavities using novel methods like superconducting thin films and Photonic Band Gap structures.

Members

Al Kenany

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Since joining the team, Al has put together a cryostat for testing microwave cavities designed for HAYSTAC. He is currently working on depositing superconducting thin films onto the inner surfaces of cylinders to improve quality factor of the cavities.

Alex Droster

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Alex is a 2nd year Ph.D. student who studied Physics and Mathematics at UChicago; at UC Berkeley he designs detectors for sensing low-mass dark matter. When not in the lab Alex enjoys playing softball, keyboard, and staying up late at night.

Sami Lewis

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Sami is a 5th year Ph.D. student working on developing electromagnetic devices for accelerator and dark matter search applications. She enjoys musical theater, cooking, and running.

Bay Area Neutron Group (BANG)

The core elements of nuclear physics can be applied to engineer solutions for today's most pressing nuclear security problems. The Bay Area Neutron Group (BANG) combines basic science, algorithm development, radiation detection, and scientific computing to support global nuclear security and nonproliferation. BANG brings an end-to-end approach to this area, with research activities spanning basic nuclear physics to the development of advanced detection technologies. Current research activities include organic scintillator characterization for fast neutron detection, neutron-induced inelastic scattering reaction cross sections (GENESIS project), neutron spectroscopy using pulse integral spectrum unfolding, and design of compact high-efficiency neutron imagers. The group performs experimental physics at a† number of facilities, most notably at the 88-Inch Cyclotron at Lawrence Berkeley National Laboratory. To learn more, visit bang.berkeley.edu.

Members

Christopher Brand
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Christopher Brand earned his B.S. in nuclear engineering at UC Berkeley in 2015. He worked as a safety analyst at Lawrence Livermore National Laboratory prior to returning to Berkeley in 2017 to pursue a doctoral degree where his research is focused on neutron imaging and diagnostic systems.

Kelly Kmak
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Kelly is interested in radiochemistry and its practical applications. She has performed research with the UC Berkeley Nuclear Policy Working Group on the thorium fuel cycle and with LLNL on a project to characterize the homologs of element 114 and 115 to predict the properties of these superheavy elements. She received a B.S. in Chemistry from UC Berkeley in 2016.

Adriana Ureche
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She earned her B.S. in nuclear engineering at UC Berkeley, where her research focused on low energy nuclear properties and nuclear data. Adriana is interested in fundamental nuclear physics, numerical simulations, and nuclear policy.

The Nuclear Science and Security Consortium

The Nuclear Science and Security Consortium (NSSC) was established by the National Nuclear Security Administration in 2011 to create a pipeline of new talent and generate new concepts and technologies in basic and applied nuclear science that can be transferred to the national laboratories. With UC Berkeley as the lead institution, joined by the George Washington University, Michigan State University, Texas A&M University, University of California Davis, University of Nevada Las Vegas, and University of Tennessee Knoxville and five national laboratory partners (LANL, LBNL, LLNL, ORNL and SNL), the NSSC carries out R&D in four technical areas: nuclear and particle physics, radiochemistry and forensics, nuclear engineering, and nuclear instrumentation and radiation detection. Linking these R&D areas are four crosscutting disciplines: nuclear data, modeling and simulation, nuclear security policy, and education and training. Together they provide a framework that yields new ideas, technology development, and personnel with the integrated capabilities required for the nuclear security mission. The NSSC provides education and training opportunities for students at the undergraduate, graduate and postdoctoral levels. To learn more, visit nssc.berkeley.edu.

Members from UC Berkeley

- **Prof. Jasmina Vujic** (*Faculty, NSSC Director*)
- **Dr. Bethany Goldblum** (*NSSC Executive Director*)
- **Prof. Lee Bernstein** (*Faculty, NSSC Director for Laboratories*)
- **Prof. Kai Vetter** (*Faculty, NSSC Liason to NNSA*)
- Prof. Michael Nacht (*Faculty*)
- Prof. John Arnold (*Faculty*)
- **Prof. Peter Hosemann** (*Faculty*)
- **Prof. Max Fratoni** (*Faculty*)
- Prof. Barbara Jacak (*Faculty*)
- **Prof. Rachel Slaybaugh** (*Faculty*)

- **Ethan Boado** (*Grad.*)
- **Emily Frame** (*Grad.*)
- **Alek Keenan Harvis** (*Grad.*)
- **Tyler Jordan** (*Grad.*)
- **Kalie Knecht** (*Grad.*)
- **Rebecca Krentz-Wee** (*Grad.*)
- **Jason Matheny** (*Grad.*)
- **Eric Matthews** (*Grad.*)
- Mark Straub (*Grad.*)
- **Adriana Sweet** (*Grad.*)
- Fernando Torales-Acosta (*Grad.*)
- **Hi Vo** (*Grad.*)
- Ian Chinn (*Undergrad.*)
- Charlie Cummings (*Undergrad.*)
- Gino Gabella (*Undergrad.*)
- Kian Jansepar (*Undergrad.*)
- **Christopher Lamb** (*Undergrad.*)
- **Laura Shi** (*Undergrad.*)
- Thibault Laplace (*Postdoc*)
- Andrew Reddie (*Postdoc*)
- **Janette Ali Hanks** (*Specialist*)
- Aaron Hurst (*Specialist*)

UC Berkeley Nuclear Engineering Department members are denoted by **boldface**.

Student Organizations and Activities

The Nuclear Engineering graduate students are heavily involved in professional and student societies. Three organizations are organized within the department, described below. Additional professional societies include IEEE, INMM, ASME, AAAS, SWE, and numerous others.

The American Nuclear Society (UC Berkeley Student Chapter)

The organization: The American Nuclear Society (ANS) was established by a group of individuals who recognized the need to unify the professional activities within the diverse fields of nuclear science and technology. The core purpose of ANS is to promote the awareness and understanding of the application of nuclear science and technology.

The section's primary goal is to provide a professional and social foundation for all nuclear engineering students (undergraduate and graduate).

Activities: Social events including bowling, scavenger hunts, happy hours, intramural sports teams, and movie nights. Each year a number of students travel to the ANS student conference, hosted by a different ANS student chapter. Members attend local ANS-Northern California meetings in San Francisco. Outreach activities include visiting K-12 schools, inviting students to visit our labs, and participating in campus wide events.

Nuclear Outreach Group

The nuclear outreach group strives to shape public perception of nuclear energy through educational outreach and community involvement. The group celebrates Nuclear Science Week annually, hosting "scoutreach" events to introduce younger students to nuclear energy and setting up a booth at the East Bay Makers Fair. Currently, the group is working to introduce a ballot initiative for the 2018 election to amend Berkeley's "nuclear free zone" designation to "nuclear weapons free."

Nuclear Outreach Group: (*Left*) Chris Keckler teaches a scouting group about Geiger counters. (*Right*) Maria Simanovskaia explains radioactive dose levels at the East Bay Maker Faire.

Nuclear Policy Working Group

The Nuclear Policy Working Group (NPWG) is a research-based educational programming effort that provides opportunities for students from a variety of fields to conduct multidisciplinary research on topics in nonproliferation and nuclear security. The NPWG has a three-fold mission: (1) to educate students on contemporary issues in nuclear security, (2) to foster collaboration across the technical and social science fields, and (3) to generate original policy-relevant publications.

Recreational Sports

Many students in the department stay active by playing intramural sports. UC Berkeley provides numerous options in this regard, with leagues of various degrees of skill and competitiveness. In the past few years, Berkeley Nuclear Engineering graduate students have fielded teams for soccer, futsal, volleyball, and softball.

Sports: (*Left*) The combined Nuclear Engineering/Physics softball team, Tsar Bomba. (*Right*) The Nuclear Engineering intramural volleyball team.

NE Department Happy Hour

The Nuclear Engineering Department has a tradition of enjoying a happy hour every Friday at 5:15 PM in the LaVal's courtyard right near Etcheverry Hall. A great way to end the week, it almost always leads to other Friday night activities.

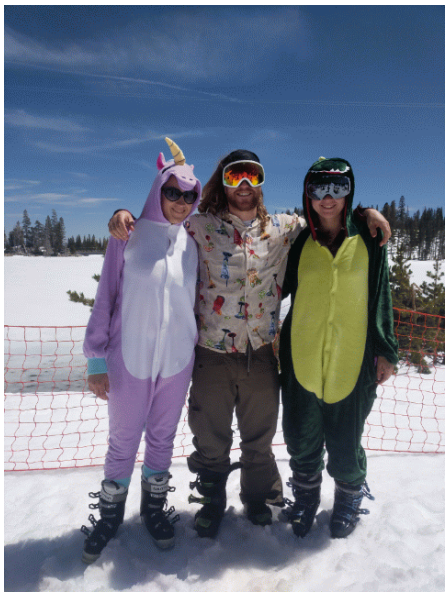
Graduate Life in Berkeley

The grad students in our department like to enjoy the variety of things to do in the area such as skiing in Tahoe, hiking in the Berkeley hills, seeing shows in San Francisco and Oakland, hitting up local farmer's markets, and more. We have a designated social e-mail list and a very active graduate-students-only Slack. There's always something going on!

Hiking

Hikiing: *(Top left)* Chris, April, and fellow grad students from MIT visiting Mayan ruins between presentations at a conference in Mexico. *(Top right)* Berkeley nuclear engineers hiking in the Lake Tahoe region. *(Bottom left)* Emily, Amanda Lewis, Mitch, Franziska, and Franziska's mattress on the rim of the Grand Canyon over spring break. *(Bottom right)* Joey, Sami, and April hiking at Pt. Reyes national seashore.

Skiing



Skiiing: *(Top left)* Kathy Milos, and Maria skiing in style. *(Top right)* Kathy, Mitch, and Joey challenging the rule that there are no friends on a powder day. *(Bottom)* 2016 first year grad students after skiing at Sierra-at-Tahoe.

Spending Time with Friends

Friends: *(Top left)* Jun and Ishak on the field with Cal cornerback Camryn Bynum. *(Top center)* Kathy, Dane, and Emily at the Santa Cruz Beach Boardwalk. *(Top right)* Tracksuit Tuesdays in the TH Lab. *(Bottom left)* The NE soccer team. *(Bottom right)* Berkeley grads at the Oakland Women's March.

Spending Time with Family

Family: *(Left)* Sandra and her daughter, Caroline, at Pt. Reyes visiting the Elephant Seals. *(Right)* Maria collecting White Chanterelle mushrooms with her family in Mendocino County.