Ross W. Barnowski, Ph.D

Assistant Research Scientist and Lecturer
UC Berkeley Dept. of Nuclear Engineering

Contact Information

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Research Interests

Nuclear instrumentation, gamma-ray spectroscopy and imaging, nuclear medicine (diagnostic imaging, radiotherapy), robotics, sensor fusion, SLAM

Education

University of California, Berkeley - Berkeley, California 09/2010 - 06/2016
Ph.D, Nuclear Engineering - August 2016 — GPA: 3.98/4.0

- **Dissertation:** *"Development and Evaluation of Real-Time Volumetric Compton Gamma-Ray Imaging"*
- **Advisor:** Kai M. Vetter
- **Coursework:** Advanced Radiation Instrumentation Laboratory, Radiation Transport Simulation and Modelling, Medical Imaging Signals and Systems, Computer Vision, Applications in Parallel Computing, Python for Scientific Computation

University of Michigan - Ann Arbor, Michigan 09/2006 - 04/2010
B.S.E. Nuclear Engineering and Radiological Science - April 2010 — GPA 3.98/4.0

Coursework: Nuclear Reactor Design, Radiation Detection and Measurement, Nuclear Reactor Kinetics, General Radiation Laboratory, Nuclear Physics, Quantum Mechanics, C++ for Sci/Eng

Experience

University of California, Berkeley

Scientific Software Developer — Berkeley Institute for Data Science 11/2019 - Present

Project: NumPy

- Maintainer of the NumPy array computation library.
- Code development, documentation & testing, code review, and project infrastructure.

NetworkX Core Developer

- Joined the core development team for the NetworkX library
- Code development, documentation & testing, code review, and project infrastructure.

BIDS COVID-19 Data Science Consultation Service

- Core team member for planning and implementing web portal for BIDS COVID-19 data science consultation service. The goal of the project is to link data science experts from BIDS with domain-experts conducting research related to COVID-19.

Assistant Research Scientist[1] *— Department of Nuclear Engineering* 08/2018 - 03/2019

Project: Basic Research - Plastic Scintillator for Unmanned Aerial Systems

- Preliminary investigation of the incorporation of plastic scintillation material as structural material in unmanned aerial systems.
- Led acquisition and initial characterization of plastic scintillator material, including development of data acquisition and analysis pipeline for plastic scintillators capable of pulse-shape discrimination for particle identification.

Student Mentorship

- Graduate student mentorship for the development and maintenance of radiation instrumentation systems, including gamma-ray imaging devices based on high-purity germanium and inorganic scintillators.
- Training for graduate students on cryogenics, vacuum systems, and front-end electronics.

[1] The period from 08/2018-12/2018 consisted of a joint role comprising a 60% appointment as assistant research scientist, and a 40% appointment as lecturer.

Data Analysis and Technical Support

- Image reconstruction and data analysis in support of projects related to the mapping of nuclear contamination in Fukushima and Chernobyl.
- Simulation studies in support of gamma-ray imaging for material studies related to uranium enrichment and storage.
- Continued firmware/software development and integration support for the PRISM instrument (see LBNL postdoc description).

Lecturer — Department of Nuclear Engineering 08/2018 - 12/2018

Course: NE 204: Advanced Concepts in Radiation Detection and Measurement

- Graduate-level, 3 credit-hour laboratory course on radiation instrumentation and measurement.
- Lecture component emphasizing digital signal processing, physics and operation of semiconductor and scintillation-based detectors, and spectroscopic and imaging applications of radiation instrumentation.
- Laboratory component emphasizing digital signal processing for radiation spectroscopy and timing applications, and multi-channel radiation detectors for neutron and gamma-ray detection, spectroscopy, and imaging.
- Computational component emphasizing reproducibile and collaborative workflows with git, LaTeX, and the scientific python ecosystem.

Lawrence Berkeley National Laboratory, Berkeley, CA

Postdoctoral Researcher — Applied Nuclear Physics 09/2016 - 07/2018

Project: Portable Radiation Imaging Spectroscopy and Mapping (PRISM)

- Development of software for multichannel data acquisition system. Firmware integration and testing; network communication for control and data I/O. Full system integration including front-end design for HW/FW developers (engineering interface) and users. Device applications in source search and gamma-ray mapping — enhanced imaging and localization capabilities.
- Development and implementation of gamma-ray imaging modalities including Compton and proximity-based localization algorithms. Direct application to nuclear contamination remediation in Fukushima, Japan.

Project: Small-Animal Molecular Imaging

- Near-field, high-resolution Compton tomography for molecular imaging with small-animal models. Development and assembly of tomographic system as well as data analysis and image reconstruction algoritms. Proposed applications for radionuclide uptake studies and theranostics for radiophamaceutical development.

Graduate Student Researcher — Applied Nuclear Physics 06/2011 - 05/2016

Project: Volumetric Gamma-Ray Imaging

- Develop and evaluate real-time 3D gamma-ray imaging techniques based on sensor fusion and real-time SLAM algorithms.
- Approach successfully demonstrated with portable high-purity germanium imager as well as hand-portable imager based on room-temperature semiconductor gamma-ray detectors.
- Software contributions include multithreaded application framework written in Python/C for interfacing with commercial DAQ hardware and implementing real-time gamma-ray imaging analysis.

Lawrence Livermore National Laboratory, Livermore, CA

Undergraduate Researcher — Nuclear Data Group 06/2009 - 08/2009 & 06/2010 - 07/2010

Project: Benchmarking of Evaluated Nuclear Data Library (ENDL) with Monte Carlo & deterministic particle transport codes

- Generate simulations using Monte Carlo & deterministic code packages for benchmarking nuclear cross-section data in the (ENDL) libraries.
- Scripting for automation of simulation input and data analysis. Experience with SLURM for

job submission on cluster systems.
- Listed as co-author on release of ENDL2011.

Argonne National Laboratory, Argonne, IL
SULI Summer Intern 05/2008 - 08/2008

Project: Millimeter-wave radar for remote detection of plumes of ionizing radiation from illicit nuclear reprocessing activities.
- Technical report selected for publication in Journal of Undergraduate Science (1 of 18 winners out of 600 applicants).
- Winner of national SULI poster competition at AAAS conference.

Publications

Millman K. J. , Brett M. , **Barnowski R.** , and Poline J.-B. . Teaching computational reproducibility for neuroimaging. *Frontiers in Neuroscience*, 12:727, 2018.

Vetter K. , **Barnowski R.** , Haefner A. , Joshi T. H. , Pavlovsky R. , and Quiter B. J. . Gamma-ray imaging for nuclear security and safety: Towards 3-d gamma-ray vision. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 878:159–168, 2018.

Haefner A. , **Barnowski R.** , Luke P. , Amman M. , and Vetter K. . Handheld real-time volumetric 3-d gamma-ray imaging. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 857:42–49, 2017.

Barnowski R. , Haefner A. , Mihailescu L. , and Vetter K. . Scene data fusion: Real-time standoff volumetric gamma-ray imaging. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 800:65–69, November 2015.

Haefner A. , Gunter D. , **Barnowski R.** , and Vetter K. . A filtered back-projection algorithm for 4π compton camera data. *IEEE Transactions on Nuclear Science*, 62(4):1911–1917, August 2015.

Brown D. , Beck B. , Descalles M. , Escher J. , Hoffman R. , Mattoon C. , Navratil P. , Nobre G. , Ormand W. , Summers N. , and **Barnowski R.** . 2011 release of the evaluated nuclear data library (endl2011. 0). Technical report, Lawrence Livermore National Laboratory (LLNL), Livermore, CA (United States), May 2015.

Barnowski R. . In-sourcing nuclear medicine. *Journal of Science Policy and Governance*, 1, 2011.

Barnowski R. , Gopalsami N. , and others . Remote detection of radioactive plumes using millimeter wave technology. *Journal of Undergraduate Research*, 9, 2009.

Conference Presentations

Barnowski R. . High resolution compton tomography for small animal molecular imaging. In *Symposium on Radiation Measurement and Applications (SORMA)*, Ann Arbor, MI, June 2018.

Barnowski R. . 3d gamma-ray imaging with hpge detectors. In *International Germanium Detector Technology Workshop*, Berkeley, CA, December 2017.

Barnowski R. . Scene data fusion: Advances and applications in real-time volumetric gamma-ray imaging. In *University Industry Technical Interchange (UITI)*, Raleigh, NC, June 2016.

Barnowski R. . Evaluation of volumetric imaging systems with scene data fusion. In *IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*, San Diego, CA, November 2015.

Barnowski R. . Scene data fusion: Enabling real-time volumetric gamma-ray imaging. In *University Industry Technical Interchange (UITI)*, Ann Arbor, MI, June 2015.

Barnowski R. and Haefner A. . A python framework for gamma-ray imaging. In *Scipy*, Austin, TX, July 2014.

Barnowski R. . Near real-time fusion of gamma-ray imaging with 3d scene data for volumetric imaging. In *IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*, Seoul, Republic of South Korea, November 2013.

Teaching[2]

Lecturer — UC Berkeley NE 204 Fall 2018
Graduate: Advanced Concepts in Radiation Detection and Measurement

Graduate Student Instructor — UC Berkeley STAT 159/259 Fall 2015
Upper Division[3]/Graduate: Reproducible and Collaborative Statistical Data Science

Graduate Student Instructor — UC Berkeley NE 92 Fall 2014
Lower Division: Introduction to Nuclear Engineering

Graduate Student Instructor — UC Berkeley NE 120 Fall 2012
Upper Division: Nuclear Materials

Graduate Student Instructor — UC Berkeley NE 120 Fall 2011
Upper Division: Nuclear Materials

Graduate Student Instructor — UC Berkeley NE 104 Spring 2011
Upper Division: Nuclear Instrumentation Laboratory

Graduate Student Instructor — UC Berkeley NE 101 Fall 2010
Upper Division: Introduction to Nuclear Physics

Honors and Awards

Best Oral Presentation Award - University Industry Technology Interchange	2016
Nuclear Science and Security Consortium Fellow	2014 - 2016
American Nuclear Society Graduate Scholarship	2014
UC Berkeley Outstanding GSI Award	2012
University of Michigan Joseph M. Geisinger Scholar	2006 - 2010
University of Michigan Class of 1931E Honors Scholar	2007 - 2010
Sustainable Energy Fellowship Program Awardee, Cornell University	2010
NEUP Scholarship Recipient	2009 - 2010
American Nuclear Society National Scholarship Recipient	2007 - 2010

Activities

The Hacker Within, UC Berkeley Chapter 2014-2016
Participant/Contributor

- Contributed presentations/breakout sessions on scientific computing with python, including machine learning (scikit-learn), data visualization, distributed computing, and extending python (cython & the Python C-API).
- www.thehackerwithin.org/berkeley/previous.html

Nuclear Engineering Graduate Student Association — NEGSA 2012-2015
Co-founder & Officer

- Officer position: Secretary/Treasurer 2012-2014
- Organized graduate student visit weekends and intra-departmental educational and social events.

[2] All graduate student instructor (GSI) positions were full 20 hr/week appointments
[3] Upper Division = Juniors/Senior-level, Lower Division = Freshman/Sophomore-level

- Initiated computing seminars for discussion of advanced computing topics relevant for nuclear engineers (merged with The Hacker Within, 2014).

American Nuclear Society (ANS) 2007-2015

University of Michigan & UC Berkeley Student Chapters

Officer Positions

- Social Chair (UCB) 2012-2013
- Vice President (UM) 2009-2010
- Student Conference Volunteer Coordinator (UM) 2010
- Outreach Chair (UM) 2008-2009