

# Daniel Hellfeld, Ph.D.

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CONTACT	Lawrence Berkeley National Laboratory 1 Cyclotron Rd. (B50C - 3315) Berkeley, CA 94720	1.949.680.9345 dhellfeld@lbl.gov   dhellfeld.github.io
EDUCATION	<b>Doctor of Philosophy (Ph.D.)</b> , Nuclear Engineering (4.0/4.0) <i>University of California, Berkeley</i> ◦ Thesis: “Free-moving Omnidirectional 3D Gamma-ray Imaging and Localization”. ◦ Advisor: Prof. Kai Vetter.  <b>Master of Science (M.S.)</b> , Nuclear Engineering (4.0/4.0) <i>Texas A&amp;M University</i> ◦ Thesis: “Feasibility of Remote Nuclear Reactor Antineutrino Directionality via Elastic Electron Scattering in the WATER Cherenkov Monitor of ANTineutrinos (WATCHMAN)”. ◦ Advisor: Prof. Craig Marianno.  <b>Bachelor of Science (B.S.)</b> , Physics (3.89/4.0) <i>University of California, Santa Barbara</i>	<b>Aug 2015 - Jul 2019</b> <i>Berkeley, CA</i>  <b>Aug 2013 - May 2015</b> <i>College Station, TX</i>  <b>Sep 2009 - Jun 2013</b> <i>Santa Barbara, CA</i>
RESEARCH EXPERIENCE	<b>Senior Scientific Engineering Associate</b> <i>Applied Nuclear Physics Group, Lawrence Berkeley National Laboratory</i> ◦ Real-time quantitative 3D gamma-ray imaging and scene data fusion. ◦ 3D object detection and tracking in LiDAR point clouds using sparse convolution networks for improved radiological source detection and attribution.  <b>Research Fellow</b> <i>Nuclear Science and Security Consortium, UC Berkeley</i> ◦ Modeling and imaging algorithm development for free-moving hand-held and UAS-mounted gamma-ray imagers (proximity, coded aperture, Compton). ◦ Experimental demonstration of omnidirectional 3D active coded mask imaging in real-time. ◦ Fusion of contextual sensors (e.g., LiDAR, RGB camera, IMU) and computer vision techniques (e.g., SLAM, photogrammetry) with gamma-ray image reconstruction.  <b>Physics Intern</b> <i>Rare Event Detection Group, Lawrence Livermore National Laboratory</i> ◦ Monte Carlo simulations and data analysis for a water Cherenkov antineutrino detector. ◦ Study on the feasibility of remote clandestine nuclear reactor directionality with antineutrino-electron elastic scattering. ◦ Investigation of potential electron scattering background sources in water and the impact of overburden, fiducial volume, and radon contamination on directionality.  <b>Graduate Research Assistant</b> <i>Department of Nuclear Engineering, Texas A&amp;M University</i>	<b>Aug 2019 - Present</b> <i>Berkeley, CA</i>  <b>Nov 2014 - Jul 2019</b> <i>Berkeley, CA</i>  <b>Jun - Aug 2015/2014</b> <i>Livermore, CA</i>  <b>Sep 2013 - Nov 2014</b> <i>College Station, TX</i>
TEACHING EXPERIENCE	<b>Stand-in Lecturer</b> <i>Department of Nuclear Engineering, UC Berkeley</i> ◦ Multiple lectures for the undergraduate radiation detection and imaging courses (NE 104, 107). ◦ Semiconductor and scintillator detector operation, manufacturing, signal generation, readout techniques, applications and limitations. ◦ X-ray detection, image formation, computed tomography, and phase contrast imaging.	<b>Jan - May / Sep - Nov 2018</b> <i>Berkeley, CA</i>

	<b>Lab Instructor</b> <i>Department of Nuclear Engineering, Texas A&amp;M University</i> <ul style="list-style-type: none"> <li>◦ Setup and teardown of weekly laboratory experiments for the graduate radiation detection course (NUEN 605).</li> <li>◦ Assisted students with experimental procedures and graded lab reports.</li> </ul>	<b>Sep - Dec 2014</b> <i>College Station, TX</i>
MENTORSHIP EXPERIENCE	<b>Kalie Knecht, graduate</b> <i>Department of Nuclear Engineering, UC Berkeley</i> <ul style="list-style-type: none"> <li>◦ 3D Compton image reconstruction and scene data fusion with a free-moving pixellated CdZnTe detector and auxiliary contextual sensor package.</li> </ul>	<b>Sep 2019 - Present</b>
	<b>David Raji, undergraduate</b> <i>Department of Nuclear Engineering, Georgia Institute of Technology</i> <ul style="list-style-type: none"> <li>◦ Sensitivity-weighted adaptive voxelization for free-moving imaging.</li> <li>◦ Real-time probabilistic tri-state point cloud occupancy with ray-casting.</li> </ul>	<b>Jun - Aug 2018/2017</b>
SCIENTIFIC COMPUTING SKILLS	<b>Languages:</b> <b>Computing Environments:</b> <b>Data/Statistical Analysis:</b> <b>Monte Carlo Transport:</b> <b>Build Systems:</b> <b>Operating Systems:</b> <b>Robotics:</b> <b>Databases:</b> <b>Documentation:</b> <b>Markup:</b> <b>Version Control:</b> <b>Other Software:</b>	Python, C/C++, bash IPython, Mathematica, Matlab ROOT, R Geant4, MCNP5/X, Serpent make, CMake macOS, Linux, Windows ROS HDF5, SQL Doxygen, Sphinx Markdown, XML, HTML git L <sup>A</sup> T <sub>E</sub> X, MS Office
PROFESSIONAL SOCIETY MEMBERSHIPS	IEEE Nuclear and Plasma Sciences Society Institute of Nuclear Materials Management American Nuclear Society National Society of Collegiate Scholars Golden Key International Honor Society	<b>2016 - Present</b> <b>2014 - Present</b> <b>2013 - Present</b> <b>2009 - 2013</b> <b>2009 - 2013</b>
AWARDS	<b>R&amp;D 100 Award Winner (PRISM)</b> , R&D World Magazine, WTWB Media <b>Best Paper - Radiation Detection</b> , UC Berkeley NE Dept. <b>Valentin T. Jordanov Rad. Instrum. Travel Grant</b> , IEEE NSS-MIC <b>Runner-up NSS Student Paper Competition</b> , IEEE NSS-MIC <b>Valentin T. Jordanov Rad. Instrum. Travel Grant</b> , IEEE NSS-MIC <b>Best Oral Presentation</b> , University Program Review Meeting <b>JD Williams Best Poster Award</b> , INMM Annual Meeting <b>Nuclear Science and Security Consortium Fellowship</b> , UC Berkeley <b>Graduate Enhancement Fellowship</b> , Texas A&M University <b>Highest Academic Honor Award</b> , UC Santa Barbara, Physics Dept. <b>Highest Honors</b> , UC Santa Barbara	<b>Nov 2019</b> <b>Dec 2018</b> <b>Aug 2018</b> <b>Oct 2017</b> <b>Aug 2017</b> <b>Jun 2017</b> <b>Jul 2015</b> <b>Nov 2014</b> <b>Aug 2013</b> <b>May 2013</b> <b>May 2013</b>
WORKSHOPS & SEMINARS	<b>Medical Image Reconstruction - Theory and Practice</b> 2018 IEEE NSS-MIC Short Course  <b>Applied Antineutrino Physics Workshop</b> Lawrence Livermore National Laboratory  <b>Machine Learning for Science Workshop</b> Lawrence Berkeley National Laboratory, NERSC	<b>Nov 2018</b> <i>Sydney, Australia</i>  <b>Oct 2018</b> <i>Livermore, CA</i>  <b>Sep 2017</b> <i>Berkeley, CA</i>

<b>Image Quality and Statistical Analysis</b> 2017 IEEE NSS-MIC Short Course	<b>Oct 2017</b> Atlanta, GA
<b>Novel Technologies for Safeguards and Arms Control Verification</b> Institute for Nuclear Materials Management, Sandia National Laboratory	<b>Aug 2017</b> Albuquerque, NM
<b>Fundamentals of Nondestructive Assay Training Course</b> Los Alamos National Laboratory, NSSC	<b>Jun 2017</b> Los Alamos, NM
<b>Fukushima Fieldwork for Radiation Disaster Recovery</b> Phoenix Program, Hiroshima University	<b>Aug 2016</b> Fukushima, Japan
<b>Python Boot Camp</b> UC Berkeley, NSF, Berkeley Institute for Data Science	<b>Aug 2016</b> Berkeley, CA
<b>Nuclear Safeguards Policy and Information Analysis Course</b> Middlebury Institute for International Studies at Monterey	<b>Jun 2016</b> Monterey, CA
<b>Next Generation Fukushima Workshop</b> IRC, LBNL, FREA, Koriyama City	<b>Apr 2016</b> Koriyama, Japan
<b>International Symposium for Resilient Communities</b> IRC, LBNL, FREA, Koriyama City	<b>Apr 2016</b> Koriyama, Japan
<b>Applied Antineutrino Physics Workshop</b> Center for Neutrino Physics, Virginia Tech University	<b>Dec 2015</b> Arlington, VA
<b>Public Policy and Nuclear Threats Summer Boot Camp</b> Institute on Global Conflict and Cooperation, UC San Diego	<b>Jun 2015</b> San Diego, CA
<b>Global Nuclear HR Development for Safety, Security &amp; Safeguards</b> Academy for Global Nuclear Safety and Security, Tokyo Institute of Technology	<b>Feb 2015</b> Tokyo, Japan
<b>NDA Fundamentals for Nuclear Safeguards</b> Next Generation Safeguards Initiative, Oak Ridge National Laboratory	<b>Nov 2014</b> Oak Ridge, TN

PUBLICATIONS,  
PROCEEDINGS  
& PAPERS

- [1] **D. Hellfeld**, P. Barton, A. Haefner, D. Gunter, L. Mihailescu, and K. Vetter, "Real-time Free-moving Active Coded Mask 3D Gamma-ray Imaging," *IEEE Trans. Nucl. Sci.*, vol. 66, no. 10, pp. 2252–2260, Oct. 2019.
- [2] **D. Hellfeld**, T. H. Y. Joshi, M. S. Bandstra, R. J. Cooper, B. J. Quiter, and K. Vetter, "Gamma-Ray Point-Source Localization and Sparse Image Reconstruction using Poisson Likelihood," *IEEE Trans. Nucl. Sci.*, vol. 66, no. 9, pp. 2088–2099, Jul. 2019.
- [3] **D. Hellfeld**, "Free-moving Omnidirectional 3D Gamma-ray Imaging and Localization," Ph.D. dissertation, University of California, Berkeley, Jul. 2019.
- [4] K. Vetter, A. Haefner, R. Barnowski, P. Barton, **D. Hellfeld**, T. H. Y. Joshi, R. Pavlovsky, Y. Sanada, Y. Shikaze, and T. Torii, "3-D Radiation Mapping and Data Fusion for Environmental Remediation and Cleanup," in *Proc. Waste Management Symp.*, Phoenix, AZ, Mar. 2018.
- [5] **D. Hellfeld**, P. Barton, D. Gunter, L. Mihailescu, and K. Vetter, "A Spherical Active Coded Aperture for  $4\pi$  Gamma-ray Imaging," *IEEE Trans. Nucl. Sci.*, vol. 64, no. 11, pp. 2837–2842, Nov. 2017.
- [6] **D. Hellfeld**, P. Barton, A. Haefner, D. Gunter, L. Mihailescu, and K. Vetter, "Omnidirectional 3D Gamma-ray Imaging with a Free-moving Spherical Active Coded Aperture," in *Proc. IEEE NSS-MIC*, Atlanta, GA, Oct. 2017.
- [7] S. Dazeley, A. Bernstein, T. Classen, E. Reedy, **D. Hellfeld**, M. Duvall, and C. Marianno, "Antineutrino Detection based on  $^6\text{Li}$ -doped Pulse Shape Sensitive Plastic Scintillator and Gd-doped Water," in *Proc. Int. Conf. App. Nucl. Tech.*, Crete, Greece, Jun. 2017.

- [8] **D. Hellfeld**, S. Dazeley, A. Bernstein, and C. Marianno, “Reconstructing the Direction of Reactor Antineutrinos via Electron Scattering in Gd-Doped Water Cherenkov Detectors,” *Nucl. Instrum. Meth. A*, vol. 841, pp. 130–138, Jan. 2017.
- [9] **D. Hellfeld**, P. Barton, D. Gunter, L. Mihailescu, and K. Vetter, “Optimization of a Spherical Active Coded Mask Imager,” in *Proc. IEEE NSS-MIC*, Strasbourg, France, Nov. 2016.
- [10] N. S. Bowden, K. M. Heeger, P. Huber, C. Mariani, and R. B. Vogelaar, “Applied Antineutrino Physics - Conference Summary,” *arXiv:1602.04759*, Arlington, VA, Dec. 2015.
- [11] **D. Hellfeld**, A. Bernstein, S. Dazeley, and C. Marianno, “Nuclear Reactor Antineutrino Directionality via Elastic Electron Scattering in a Gd-Doped Water Cherenkov Detector,” in *Proc. INMM Annual Meeting*, Indian Wells, CA, Jul. 2015.
- [12] **D. Hellfeld**, “Feasibility of Nuclear Reactor Antineutrino Directionality via Elastic Electron Scattering in the WATER CHerenkov Monitor of ANTineutrinos (WATCHMAN),” Master’s thesis, Texas A&M University, May 2015.
- [13] A. Bernstein and the WATCHMAN collab., “The Physics and Nuclear Nonproliferation Goals of WATCHMAN: A WATER CHerenkov Monitor for ANTineutrinos,” *arXiv:1502.01132*, Feb. 2015.

#### REFERENCES

*Available upon request.*