Zachary S. Hartwig

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Research Interests

Advancing radiation detection and particle transport simulation to solve complex problems in nuclear science and engineering

- Plasma-material interactions in magnetic fusion
- Conceptual designs for magnetic fusion energy
- Ion beam materials analysis
- Production of fundamental nuclear data
- Radiation detection for nuclear security
- Particle and radiation detectors
- Monte Carlo particle transport simulations
- Digital data acquisition and pulse processing

Education

Ph.D. in Nuclear Science, MIT. February 2014.
- Concentration: Fusion nuclear science
- GPA: 4.7 / 5.0
- Thesis: *An in-situ accelerator-based diagnostic for plasma-material interactions in fusion devices*

B.A. in Physics, Boston University. May 2005.
- Concentration: Experimental particle physics
- GPA: 3.7 / 4.0
- Degree awarded *summa cum laude*
- Dean's List all 8 semesters

Selected Publications

- Z.S. Hartwig *et al. An in-situ accelerator-based diagnostic for plasma-material interactions on magnetic fusion devices.* Rev. Sci. Instr. **84** (2013) 123503.
- Z.S. Hartwig *et. al.* An initial study of demountable, high-temperature superconducting magnets for the Vulcan tokamak conceptual design. *Fusion Engineering and Design*, **87** (2012) 201-214.
- Z.S. Hartwig and P. Gumplinger. *Simulating response functions and pulse shape discrimination for organic scintillation detectors with Geant4.* Nucl. Instr. and Meth. A **737** (2014) 155.
- Z.S Hartwig and Y.A. Podpaly. *The Magnetic Fusion Energy Formulary.* Independently published. Available online at: http://www.psfc.mit.edu/research/MFEFormulary

Selected Achievements

- *Recipient*, U.S. Department of Energy ORISE Postdoctoral Fellowship, Jan 2015.
- *Recipient*, MIT NSE Del Favero Prize in Nuclear Science and Engineering, May 2014.
- *Fellow*, 2013 Kavli Frontiers of Science.
- *USA Cycling National Champion*, Collegiate Track Division II Team Omnium. September 2012.
- *Recipient*, MIT NSE Special Award, Excellence in Science Communication and Policy. May 2012.
- *Recipient*, MIT International Science and Technology Initative Global Seed Fund Grant. May 2011.
- *Recipient*, Boston University Alumni Prize for Excellence in Physics. May 2005.

Computer expertise

Programming Languages
- C, C++, Python, IPython, Open MPI, Unix shell scripting, GNU make, Matlab, IDL

Particle Transport and Nuclear Physics Codes
- Geant4, MCNP5/X, DAGMC CAD-based neutronics, SRIM/TRIM, EASY, NJOY, TALYS, EMPIRE

Data Analysis and Storage Frameworks
- ROOT, MDSplus; lead developer of the ADAQ tool suite

Computer-Aided Design (CAD) and Analysis
- Solid Edge ST5, CUBIT Tool Suite, COMSOL Multiphysics 4

Productivity Software
- Windows OS, Linux OS (Fedora, RHEL, Ubuntu), Emacs, Subversion, Git, GitHub, LaTeX,

Hardware Expertise

Data Acquisition
- CAEN S.p.A. data acquisition systems, Tektronix digital oscilloscopes

Particle Detector Construction
- Scintillator crystals, photomultiplier tubes, silicon avalanche photodiodes, silicon photomultiplier, signal preamplifiers, soldering, basic machining, vacuum hardware, test platforms

Leadership Experience

- *Teaching assistant*: MIT 22.105: Electromagnetic Interactions. Fall 2010.
- *Teaching assistant*: MIT 22.63: Engineering Principles for Fusion Reactors. Spring 2012.
- *Graduate advisor:* MIT Undergraduate Research Opportunities Program (UROP) and student theses.
- *Organizer*: U.S. fusion student advocacy trip to 30 Congressional offices in Washington DC. June 2012.
- *Mediator* in conflict resolution, MIT Resistance for Easing Friction and Stress Program. January 2010.