# 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**

- Particle detection for nuclear security
- Monte Carlo particle transport simulation
- Digital data acquisition and pulse processing
- Computational ion beam materials analysis
- Nuclear diagnostic for magnetic fusion
- Production of fundamental nuclear data
- Conceptual designs for magnetic fusion
- Compact superconducting cyclotrons

## Education

**Ph.D. in Nuclear Science**, MIT. September 2013.
- Concentration: Fusion nuclear science
- GPA: 4.7 / 5.0
- Thesis: *An accelerator-based, in-situ diagnostic for plasma-material interactions science on the Alcator C-Mod tokamak*

**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

[1] 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.

[2] Z.S. Hartwig and D.G. Whyte. Simulated plasma facing component measurements for an *in-situ* surface diagnostic on Alcator C-Mod. *Review of Scientific Instruments*, **81** 10E106 (2010).

[3] Z.S Hartwig and Y.A. Podpaly. *The Magnetic Fusion Energy Formulary.* Independently published. Available at: http://www.psfc.mit.edu/ hartwig/formulary.shtml

## Notable Achievements

- *Recipient*, Boston University Alumni Prize for Excellence in Physics. May 2005.
- *Keynote speaker*, MIT Nuclear Science and Engineering Department (NSE) Research Expo. March 2011.
- *Recipient*, MIT International Science and Technology Initative Global Seed Fund Grant. May 2011.
- *Recipient*, MIT Plasma Science and Fusion Center Award, Science Education and Outreach. July 2012.
- *Recipient*, MIT NSE Special Award, Excellence in Science Communication and Policy. May 2012.
- *Invitated talk*, Conference on the Application of Accelerators in Research and Industry. August 2012.
- *USA Cycling National Champion*, Collegiate Track Division II Team Omnium. September 2012.

## Computer expertise

Programming Languages
- C, C++, Java, Python, Unix shell scripting, GNU make, Matlab, IDL, Open MPI, MPICH2

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

Data storage and analysis
- ROOT, MDSplus

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, LaTeX, LibreOffice, GIMP

## Hardware Expertise

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

Particle Detector Construction
- Scintillator crystals, photomultiplier tubes, silicon avalanche photodiodes, silicon photomultiplier, signal preamplifiers, soldering, basic machining, 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.